

**Living in Liminality:
An Osteoarchaeological Investigation
into the Use of Avian Resources in
North Atlantic Island Environments.**

Julia Bettina Jennifer Best



Thesis submitted for PhD

Cardiff University

Department of Archaeology and Conservation

School of History, Archaeology and Religion

2013

Summary

This thesis explores the use of avian resources within the Scottish and wider North Atlantic Island environment via archaeological bone and eggshell. Birds can provide a range of products including meat, eggs and feathers, however their archaeological investigation has frequently been both overlooked, and limited in its extent and application. By collating pre-existing avian data and combining it with new, in-depth analyses this thesis investigates bird use through time and space; firstly in the Scottish Islands (the primary area of study), and then contextualises this within the wider tradition of fowling archaeologically and historically in Iceland and the Faroe Islands. Mesolithic to Norse Scottish Island bird bone is used to develop our understanding of diet, wild resource exploitation, seasonal fowling activities, habitat use, and movement around the landscape.

South Uist in the Outer Hebrides forms a major case study incorporating substantial primary bone analyses from Late Bronze Age to Early Iron Age Cladh Hallan, Norse Bornais and Norse Cille Pheadair. The full Scottish Island dataset is used to consider trends in bird use by period and location. Species presence, juveniles, medullary bone and SEM analysis of eggshell are used to investigate resource acquisition by season and location.

The material reveals that seabirds played an enduring role, with key birds such as the gannet, auks, shag, cormorant and gulls being repeatedly exploited. Fowling is focused and diverse, often incorporating targeted species and several opportunistically caught taxa. Birds were acquired both locally and in fowling trips further afield. Variations in avian populations are observed; determining the resources available to human fowlers and investigating the impact of such exploitation.

Analysing, integrating and interpreting the archaeological bird remains on this wide temporal and geographical scale has enabled a greater understanding of past bird use and role within North Atlantic Island diet, economy and life.

Acknowledgements

This thesis would have been impossible were it not for a large number of people, who deserve thorough acknowledgement and thanks.

Firstly I would like to very deeply thank my supervisor Jacqui Mulville for her role in this research, from its initial conception and application to its final throws. She has been a constant source of support and encouragement and I owe so much of my academic and personal development to her guidance. The opportunities I have had during this PhD have been exceptional, and without Jacqui's insight, energy and enthusiasm I would not have had such a rounded experience. Her input and skills have helped me to deepen and extend my work. Her hands-on approach has seen me become a confident speaker at conferences (allowing me to gain valuable contacts and acquaintances), whilst also encouraging me to develop my love of outreach and public engagement. Within this thesis she has encouraged and guided whilst providing wide ranging support tailored to fit my needs at a given moment; she has my complete gratitude. I would therefore like to thank Jacqui for her generous giving of time, her unfailing support and many much-needed coffees.

I would also like to very much thank my second supervisor John Hines who in addition to giving support and guidance provided both the valuable opportunity to undertake research in Iceland and the much-welcomed critical eye of editing. His input has been much appreciated.

Dale Serjeantson has been an unrelenting source of guidance, inspiration and insight. Her generosity with time and information has been incredibly valuable to me, and I am eternally grateful to her for taking me under her wing in my novice state when foraying into the world of avian archaeology for the first time. It is a delight to converse and debate with her, and her constructive criticism has been greatly appreciated. I would also like to thank her for helping me arrange initial access to reference material at Southampton University.

I would also like to acknowledge Adrienne Powell who conducted some initial work on the Cladh Hallan material, and was always willing to discuss difficult specimens with me. I would also like to thank Vala Garðarsdóttir and Albína Pálsdóttir for their help and hospitality during my study visit to Iceland.

I am exceedingly thankful to Phil Parkes who trained me in the use of the SEM and was most generous with his time and resources in teaching me and enabling me to use this equipment. I must also thank Eric Nordgren who instructed me on how to use the ultrasonic tank, and to Mr Peter Fisher at the School of Earth and Ocean Sciences at Cardiff University who provided access to their equipment for gold coating the eggshell samples, and provided instruction on its use.

I am also deeply gratefully to the people who so generously provided me with their own data, which in many cases has not yet been published. Miranda Armour-Chelu, Sheila Hamilton Dyer, Dale Serjeantson, and Ingrid Mainland have my sincere thanks. Caroline Grigson is also thanked for her communication and contribution. Without their generosity and contributions I would not have been able to include many significant assemblages.

I very much appreciate and wish to acknowledge the ICAZ Bird Working Group. Having this group of feathery friends and colleagues has been a strong source of encouragement and delight. Whatever the question, there is always a fellow bird-person ready and willing to share their insight and time. The conferences have been a joy and an inspiration and provided the most valuable of contacts. Extending from this I am also exceedingly grateful to John Stewart who very kindly allowed me to include some of his eggshell data in this thesis, which allowed for a fuller interpretation of my key bone assemblages and SEM eggshell analysis. It is always a pleasure to discuss ideas and interpretations with him, and I wish to thank him for his academic input and friendship.

I would like to thoroughly thank the AHRC who funded this PhD, and who provided generous financial contributions for conferences and research trips that allowed me to develop my work. I am also exceedingly grateful to the Postgraduate Quality Committee and the Cyril Fox Fund who have also been a valuable resource, providing additional funding for vital study trips and conferences. Some of these study visits made use of additional research facilities and I wish to thank the English Heritage zooarchaeology lab at Fort Cumberland (Portsmouth), and Southampton University Archaeology Department's reference collection. I would in particular like to thank Polydora Baker and Fay Worley who hosted me at Fort Cumberland for around four weeks over the course of my research and who were very helpful.

To all my friends both in and far away from Cardiff who I have been notoriously bad in contacting and seeing, I am forever grateful that you've stuck by me through thick and thin. To my fellow postgrads I owe you so much. I have been so fortunate to find such wonderful friends within this PhD community who have provided fun, support, encouragement and a wonderful environment. Firstly Jennifer Jones, it has been fantastic to take this journey with you. Whether I need a work related discussion, a laugh, a weep or a pint you were always there. I could not have done without the friendship and support of Alice Forward and Matt Nicholas, Matt Law and Susan Stratton. Richard Madgwick is also owed special thanks for his friendship, encouragement and words of wisdom from beginning to end.

This PhD has also had an impact on my family and my partner Robert May. Thank you to my parents and brother for putting up with my grumpy phone calls, few-and-far-between visits and for providing a voice of normality when academic tunnel vision set in. Also mum, sorry for dissecting the Christmas dinner and then explaining at length its skeletal abnormalities – with hindsight I can see this might have lessened the festive spirit! To Rob, whose life this has affected in many ways, thank you all your patience, proof reading, for taking the brunt of moving house, and for putting up with me living in the lab, scarpering off to study trips and conferences, and trying to calm my general ill-temper and feed me as the end approached.

Finally I wish also to thank my beloved Aunty Helen who saw me start this research journey but sadly did not see its conclusion. She was always proud of what I was doing, even at times when I was doubting myself. Whilst she may have been slightly shocked that anyone could write so much about 'old bird bones' I hope she would have been proud of my work. Her love for life continues to encourage, guide and teach me, and I would like to dedicate this thesis to her.

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Chapter One

INTRODUCTION



1.1 Aims of the Thesis

This thesis explores the zooarchaeological evidence for bird use within the North Atlantic Island environment. It is primarily concerned with identifying, collating and interpreting bone and eggshell data of wild and domestic birds recovered from archaeological sites from the Scottish Islands: the Inner and Outer Hebrides, and the Northern Isles of Orkney and Shetland. This thesis specifically makes a contribution to original knowledge by combining primary analysis of previously unexamined avian assemblages with the wider body of pre-existing bird data from older analyses. Together this material can be examined, compared and contrasted to explore the use of birds through time and location across the Scottish Islands. This thesis also contextualises the Scottish Island dataset within the wider North Atlantic context both archaeologically (through pre-existing and newly analysed material) and as part of the wider tradition of fowling in these locations.

Birds can provide a wide range of products and resources (including meat, feathers, oil, fat, skins and eggs), but their use and role at a site specific level and as part of the wider resource landscape has been frequently overlooked and often simplified within archaeology as a whole, and consequently within Scottish and North Atlantic Islands. This is unfortunate since bird remains have the potential to provide an array of research opportunities, allowing insights into wild resource exploitation, the habitats utilised, seasonality, and movement about the island landscape and seascape. Birds can also inform upon climate and landscape changes, and past faunal distributions; both of which are intrinsic to understanding human subsistence and lifeways in these locations. Under-examination of avian material and limited comparative discussion and interpretation is

detrimental not only to the reconstruction of past bird use, but also to our comprehensive understanding of the diet, resources, society and economy of these Scottish Island sites and locations.

Therefore by conducting analysis of new, large avian assemblages and combining this with a collated body of avian data, this thesis enables investigation of avian resource use by period, location, and by species or taxonomic group on a much wider scale than has previously been attempted; contributing to our understanding of bird use in the Scottish Island environment, and its place within the wider faunal resource base. Archaeological avian material from the Mesolithic to (and including) the Norse period is the primary temporal framework; but where available Medieval and Post-Medieval data are also considered. This facilitates wider contextualisation of the archaeological remains and provides a link to the valuable recent historical documentation of fowling within the North Atlantic environment.

Within this thesis several key research questions are addressed. By identifying the main species used for food through time and space, their economic importance and acquisition can be investigated. The avian remains are also used to establish the character of Scottish Island fowling economies in order to elucidate their focus, examine their diversity and explore their flexibility. This work also contributes significantly to our understanding of the introduction, adoption and expansion of domestic fowl within this location temporally and geographically. The thesis investigates temporal and geographical patterns and variations in Scottish Island bird use on an unprecedented scale, examining variations in the species selected for exploitation and as such the choices and activities of the human fowlers. The collated

material also contributes to our understanding of species-specific trends across the islands, including declines in availability on a local and/or regional scale, or identifying increased levels of exploitation for a particular target species. The holistic approach to avian remains employed in this thesis also provides new information on seasonal resource use and habitat utilisation through combining species based seasonality profiles with aging data and with the identification of nesting females through medullary bone. This enables greater understanding of wild resource use and subsistence activities at different points of the year. From this information comes a greater understanding of the landscapes of capture, and the techniques employed in fowling.

One suite of the assemblages analysed as part of this work come from the island of South Uist in the Outer Hebrides. In-depth examination of these provides a valuable case study which forms part of the wider examination of bird use in the Scottish Islands, whilst also demonstrating the potential that detailed avian analysis has for informing upon the wide range of themes outlined above (such as seasonality and habitat use), both osteoarchaeologically and as part of the wider site and period picture. These analyses have contributed to the wider understanding of bird resource use by filling a temporal and geographical gap in the Western Isles' data.

Whilst the majority of the data considered in this thesis come from bone material, eggshell analysis was also conducted as part of this research and considered alongside available eggshell analyses from the Hebrides and Northern Isles. By examining eggshell in conjunction with the bone data this research is also able to expand our understanding of seasonal avian usage, the habitats under exploitation, and to identify different past avian distributions.

The collation of new and pre-existing avian material in this thesis allows for its comparison and contextualization within the wider North Atlantic context through extension to the Faroe Islands and Iceland. Consideration of this wider North Atlantic environment provides insights into fowling practices during the settlement of new lands, facilitates examination of localized or broad patterns and changes, and also places the Scottish Island data within the wider tradition of fowling documented historically and contemporarily in these locations.

Collating the data into a clear database form facilitated straightforward querying for species presence and frequency at these Scottish Island sites, and allowed examination of (for example) the avian character of a particular site, period or area. Alongside which age, taphonomic, sex and eggshell data could be easily accessed by type, period or locations (etc.).

Islands, and particularly those that are small or marginal, are interesting in that they are neither mainland nor sea. Falling between these two entities they can be said to inhabit a realm of liminality. They provide a context in which avian resources can be far more than a minor dietary addition or a small scale resource, instead birds (and in particular seabirds) can play an important role in people's diets, lives and economies. Through the collation of existing data, and in-depth analysis of new assemblages, the subsistence value of birds can be examined alongside the economic, social and symbolic aspects of avian-human relationships within this archaeological context.

1. 2 Chapter Outline

Chapter Two establishes the geographical and temporal setting of the research, and introduces the area of avian archaeology. The chapter also presents the growth and development of the study of bird remains both in general and within the specific context of the Scottish Islands. The information that can be attained from avian bone is discussed and the types of evidence/material used in this thesis are outlined. This chapter also examines the advantages and limitations of said material and addresses the challenges encountered in the work.

Chapter Three details the methodology used in this thesis from data collection and handling through to the explanation of terminology used within the following chapters. It includes the approach to the work undertaken and the justification of context. The natural and anthropogenic considerations essential to understanding avian bone are outlined; these range from preservation and survival to archaeological recovery and the practicalities of analysis. It also presents the specific methodology followed for the bone and eggshell analyses conducted for this thesis, the collation of the existing data, and how the combined dataset was handled.

Chapter Four is the first results chapter and presents the results of a case study focused on the island of South Uist in the Outer Hebrides. This case study includes the primary large novel analyses from Late Bronze Age/Early Iron Age Cladh Hallan, Late Iron Age/Norse Bornais, and Norse Cille Pheadair, which are combined with the pre-existing data for the area for a full in depth study. This chapter considers the data as part of the wider faunal assemblage prior to their independent examination. The bird remains are

explored by broad taxonomic grouping and at species level. Seasonal bird use is investigated and then extended through the examination of juvenile birds and medullary bone. This chapter also details the processing and wider use of bird resources via butchery, burning and gnawing data, and by dietary input calculations.

Chapter Five follows a similar format to that used for the South Uist case study, but in this instance the avian resources from Orkney, Shetland, the Outer Hebrides and the Inner Hebrides are considered through time and by geographical location. This chapter therefore presents the results from the collation of a wide range of pre-existing data with that of newly analysed assemblages from Scottish Island locations outside of South Uist. Key avian species repetitively selected for exploitation are explored in greater individual detail, and unusual or vagrant birds are also documented, as are changing patterns in bird use, and location dependant variation. Bird capture in a range of seasons and periods is outlined.

Chapter Six focuses on avian material from the wider North Atlantic environment, predominantly from the Faroe Islands and Iceland. The chapter presents the results of an analysis conducted for this thesis which is directly comparable to the new Scottish Island material in terms of analysis methodology and level of identification. It also presents collated data from other sites in the Faeroes and Iceland in order to contextualise the Scottish Island data within the wider landscape of avian resource use.

Chapter Seven details the results from analysis of archaeological eggshell material from the Late Iron Age, Pre-Norse/Pictish and Norse site of Bornais. The scanning electron microscope results (conducted for this thesis) are then compared with other

eggshell data from the Scottish Island sites including material identified through a new mass spectrometry technique.

Chapter Eight draws together, discusses, and develops the key points identified in the results chapters, and then extends them via focused interpretation and investigation. Avian use across time and space is explored; investigating period profiles, key species, the character of fowling, opportunistic capture and changed availability of bird species. The landscapes of capture and associated fowling techniques are outlined, followed by discussion of avian product provision and wider symbolic roles. This chapter also contextualises the archaeological material within the wider historical tradition of fowling in the North Atlantic environment.

Chapter Nine concludes the research contained within this thesis and discusses how the findings outlined within this work contribute to and develop our understanding of bird use in the North Atlantic Islands. Directions for future developments of this work are also outlined.

CHAPTER TWO

AN INTRODUCTION TO THE ARCHAEOLOGY
OF BIRDS AND THEIR PLACE IN SCOTTISH AND
NORTH ATLANTIC ISLAND SITES



2.0: Introduction

This chapter introduces the ways in which birds are represented in the archaeological record and the different lines of evidence that can be explored in order to understand human interaction with avian species. The chapter starts by introducing the potential for avian-human interactions, and the situations in which this relationship may be pronounced. This leads to an introduction of the geographical setting considered in this research, followed by a general overview of Scottish Island archaeology to contextualise the work and outline key sites. Next, the chapter outlines and discusses the development of avian archaeology itself as a field within zooarchaeology and its implementation in the research area (the North Atlantic Islands). This includes a consideration of the types of material used within this thesis, the advantages and limitations of existing work and its continuing advancement. The problems encountered within this body of research are also addressed and discussed, including accessing data, handling older reports and issues of compatibility and comparability. The methods by which these were dealt with and overcome are then explored in the next chapter: Methodology.

2.1: Birds and Archaeology: Relating the Past and Present

Birds are an extremely diverse form of life. With over 10,000 species existing today they form an integral part of ecosystems across the world (Clements 2007; Gill and Donsker 2013). It is therefore no surprise that birds occur in a variety of archaeological contexts, encompassing the practical to the ritual. Evidence for past avian-human relationships is visible archaeologically in a variety of forms, ranging from bone material with indications of human consumption and wider use, to the rich

representation of birds in mythology and symbolism depicted in formats such as manuscripts or metalwork. As with mammals, both domestic and wild bird species have played important roles in the past and need to be considered.

Today there are substantial resources devoted to protecting, watching, mapping and understanding our current bird life. Many people enjoy bird watching or are interested in ornithology, and birds can make much loved pets. However, for a large number of people birds play little role in modern everyday lives. We may consume large amounts of chicken meat and eggs and use their feathers as bedding or fashionable dress accessories, but beyond that people today are frequently unobservant of the avian world (Serjeantson 2009, 1-4). This does not appear to have always been the case, with evidence pointing to a greater overall avian awareness in the past. Observation of wild birds may inform on the changing seasons or be used for weather prediction (with early sources including Pliny the Elder [*Naturalis Historia* 10] and Aristotle [*Historia Animālium* 8, 12] referring to the seasonal movement of species), whilst avian data from place-names can document bird presence within a landscape (Boisseau and Yalden 1998, 482-500; Eastham 1997, 233-239). This in itself suggests that archaeological avian research will be informative and of value. However, avian archaeology does not always receive the amount of attention or resources that it appears to deserve, an issue which is explored below. Often in Britain when people consider birds in the archaeological past they commonly think only of special cases of bird use (such as falconry), or the familiar consumption of domestic fowl, geese, ducks and their eggs.

It is apparent that fowling rarely reached the level of dietary contribution achieved by hunting and fishing, and that in terms of subsistence, animal husbandry mammals were

generally of far greater importance (Cartledge and Serjeanston 2012, 342; Maltby 1997; Masson 2004, 97-110; O'Connor 2003, 156; von den Driesch and Pollath 2000, 145-162). However, importance is a relative term, and should not be confused with frequency. The presence of sites in the archaeological record which have a greater or unique relationship with avian resources is both interesting and also important for understanding the sets of circumstances which create these deviations, and the role that birds can then play. This is not to say that at these irregular sites birds have to outweigh all other dietary contributions. Rather that they appear in a quantity or as a percentage of the overall faunal assemblage that is unusual or above what would be considered normal. Also notable are sites at which certain species may be exploited in a specific manner or with a particular intensity. It must be stressed that birds are not only valuable as a food source, but can provide commodities such as eggs, feathers, oil and fat, which again may influence their exploitation by humans in certain situations. Their abstract and ideological status is also intrinsic to understanding their past use.

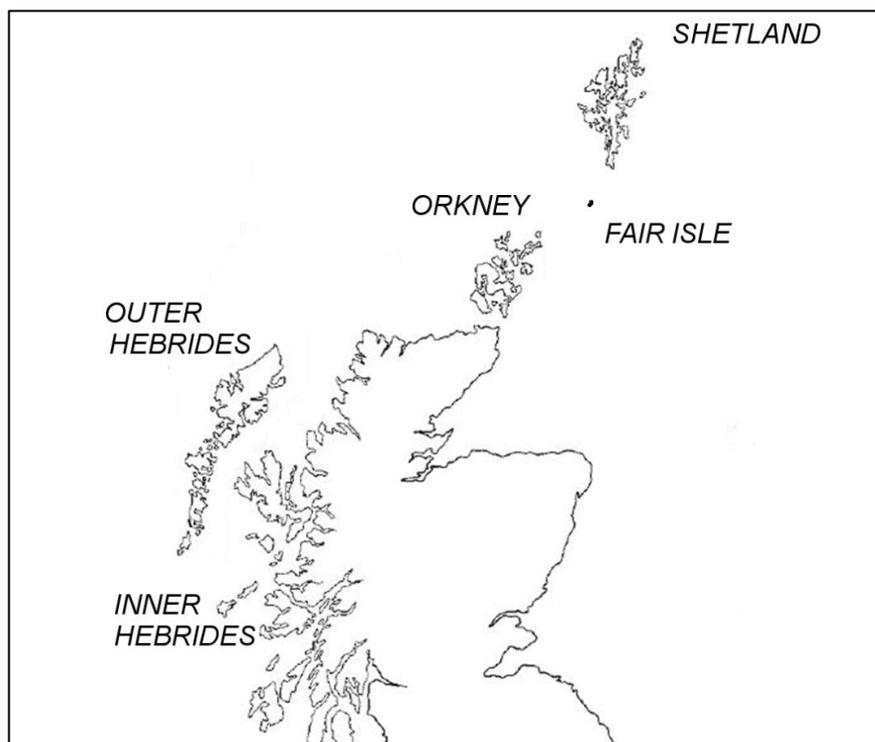
2.1.1 The Setting: Islands and Avian-Human Relationships

One context where unusual avian-human relations can be found is in specific island locations within which birds can be far more than a minor dietary addition, or an insignificant resource. Small, discrete or marginal islands are in some ways liminal since they occupy a position that is neither mainland nor sea. These island locations are one of the very few places in which we see a continued and often very necessary relationship with wild resources extending beyond prehistory and even up until the last century (Fleming 2005, 61-83). In these situations where (for example) terrestrial resources may be limited, birds, and particularly sea birds, can play a significant role in people's diets, lives and economies. Island locations provide access to faunal resources

in the air, the sea and on the land allowing for a diverse range of human-animal interactions. Such islands often also hold concentrated avian resources, such as gregarious breeding seabirds. Coastal locations can also provide access to the multitude of resources offered by a range of ecotonal environments, but being part of a less delineated area impacts upon use of the available fauna.

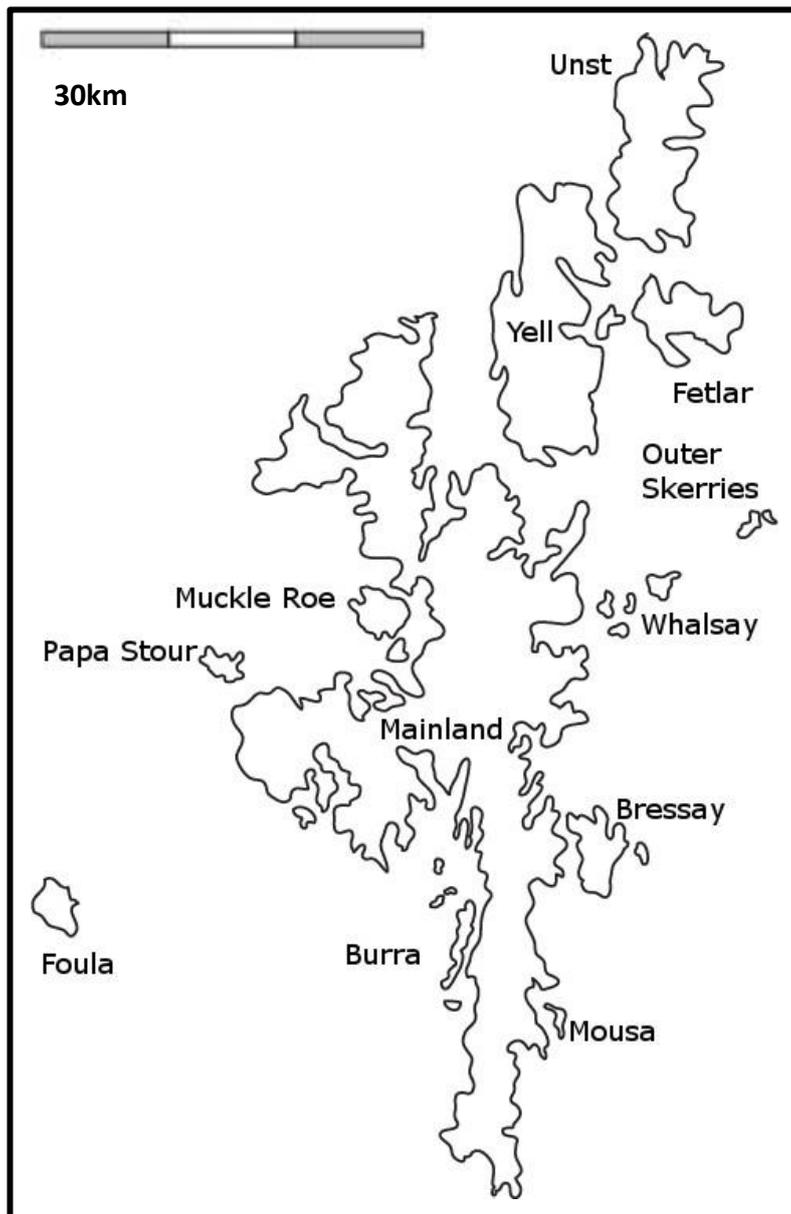
The varied and valuable nature of avian exploitation can be seen in the archaeology of Scottish and other North Atlantic islands. It is the avian remains from these locations that will be focused upon and considered in this thesis. Material from the Scottish Islands is the main body under study, but it will be contextualised within the wider North Atlantic comparative framework (see methodology 3.1.1). The Scottish Islands addressed here consist of the Northern Isles of Orkney and Shetland, and the Inner and Outer Hebrides (the latter of which is also known as the Western Isles) (see Figure 2.1). The small Northern Isles of Fair Isle and Foula fall within the Shetland Island group.

Figure 2.1: Map showing Scottish Island groups (Base Map by Ian Dennis)



These islands, whilst similar in many respects, have unique characteristics that inevitably will have an effect on the human and animal populations inhabiting them. Shetland is the most northerly of the Scottish Islands and as such it experiences nearly continuous sunlight in the summer with long expanses of darkness in the winter (like the Faeroes and Iceland).

Figure 2.2: Map of Shetland and its constituent islands (by author based on WWW1)

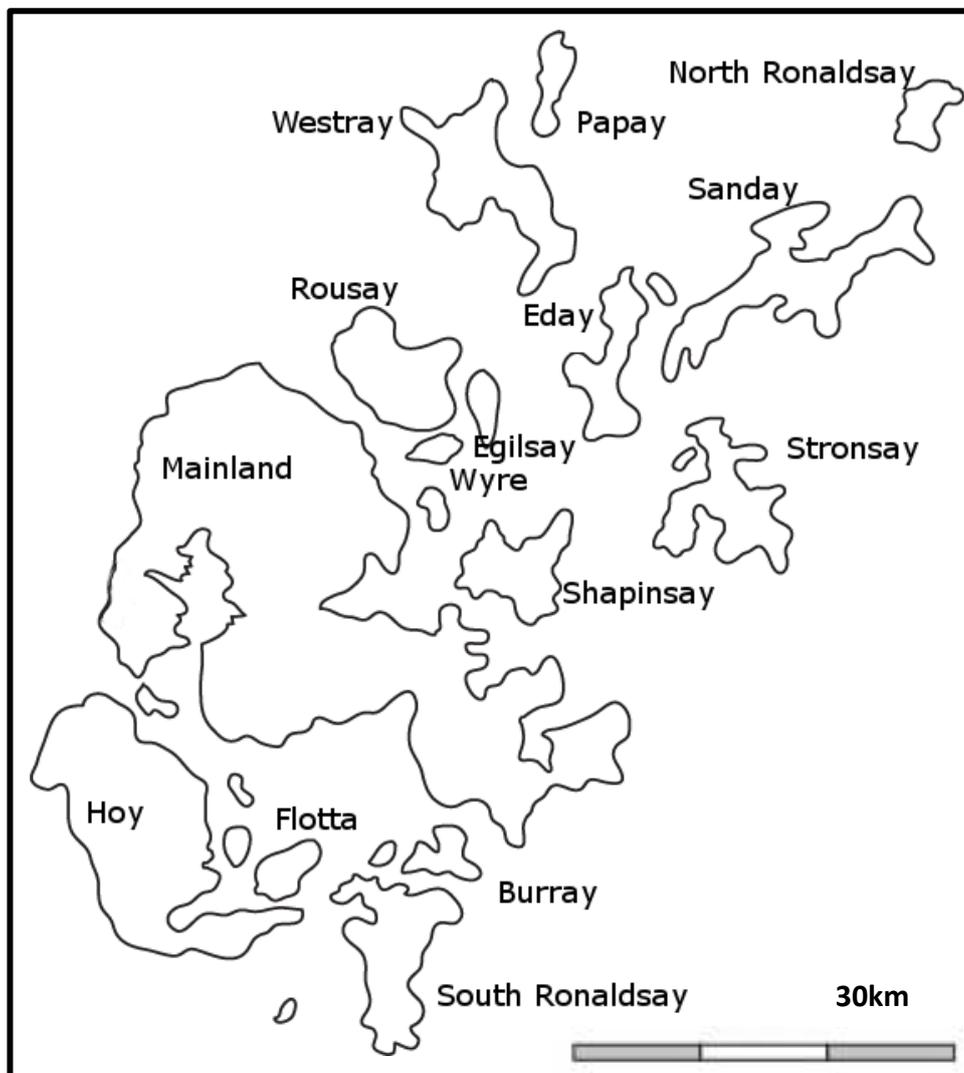


Shetland's landscape is complex; it has a rugged coast, with many rocky shorelines and sea cliffs with small pockets of machair (a fertile coastal plain of sandy, grassy

duneland formed of alkaline shell sand) (Ballantyne and Dawson 2003, 23-44; Parker Pearson *et al.* 2004). Inland are found low hills and freshwater lochs. Shetland is formed of a large ‘Mainland’ island, with Yell and Unst being the next largest, and a handful of smaller islands.

Orkney today consists of around 70 islands, of which the Mainland is the largest. The Orcadian landscape is mainly low lying (with the exception of some dramatic hills on Hoy). A rise in sea level has had a dramatic impact on the island landscape.

Figure 2.3: Map of Orkney and its constituent islands (by author based on WWW2)



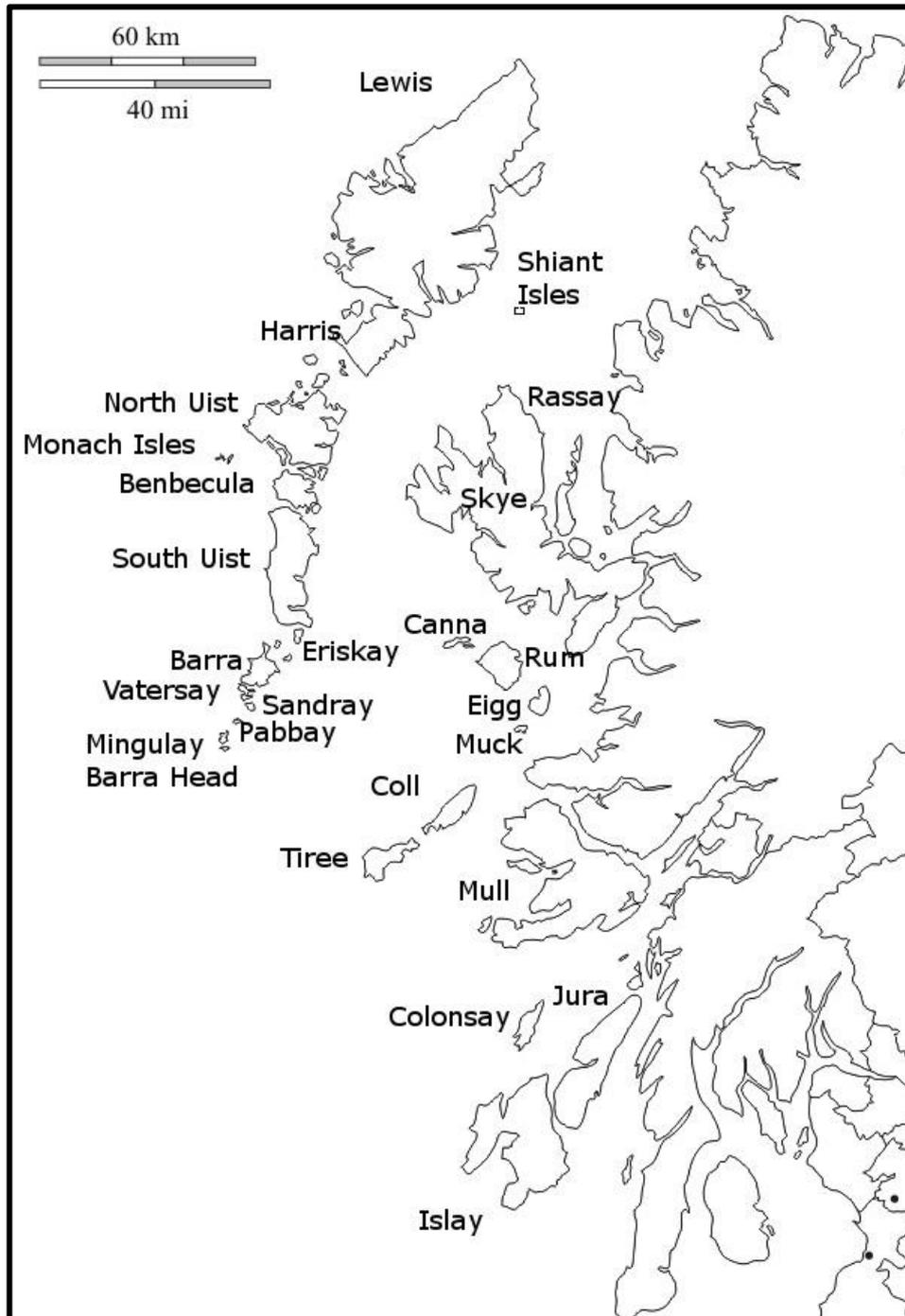
Around 8000 BC these Orkney Islands mostly formed a single landmass, large areas of which are now submerged (Bates *et al.* 2013, 24-30; Dawson and Wickham-Jones 2007, 1; Dawson and Wickham-Jones 2009, 1-3). Inland can be found fertile farmland, freshwater lochs and moorlands. The coast has a large number of sandy beaches, rocky shores and some machair (although much less than is found in the Hebrides). The western coasts have some sea cliffs and rugged shorelines (Angus 2001, 178; Ballantyne and Dawson 2003, 23-44; Maddock 2011, 40-41; Ritchie 1979, 445-451). Orkney also experiences long daylight in summer and long darkness in winter, but to a lesser degree than Shetland.

The Inner Hebrides' landscape is varied, with some islands being low lying (such as Tiree and Oronsay) and others being dramatically mountainous (like Mull, Jura or Skye) (Ballantyne and Dawson 2003, 23-44; Bell and Harris 1986, 119; Emeleus and Bell 2005, 60). The Inner Hebrides contain a large machair coastal environment, with around 4,000 hectares on Tiree and Coll alone (Angus 2001, 178-180; Maddock 2011, 40-41).

Within the Outer Hebrides there is again a range of landscapes, but overall there are a large number of freshwater lochs, machair, moors and bogs. The Western Isles have the largest and most developed machair system in Scotland, with the Uists holding a large proportion of this (Angus 2001, 178-189; Ballantyne and Dawson 2003, 23-44; Maddock 2011, 40-41). This is important archaeologically, since the alkaline nature of the shell-sand provides excellent preservation for bone remains. Lewis is the largest Outer Hebridean island and has a gentle western coastal shore with beach and duneland, inland peat and a rugged eastern coast. Whereas Lewis is fairly flat (with some

exceptional pockets), Harris is full of hills and peaks, with a mountainous band which separates it from Lewis (Ballantyne and McCarroll 2006, 211-223).

Figure 2.4: Inner and Outer Hebrides and constituent islands (by author based on WWW3)



Within this thesis the island of South Uist forms a large case study. This island's landscape is varied and dramatic with mountains, hills and sea lochs to the east, a band

of acidic peat soil ('blacklands') dominating the middle of the island, whilst to the west lies the machair; the fertile coastal plain, which slopes gently to the sea (see Figure 2.5) (Parker Pearson *et al.* 2004). North Uist displays similar makeup. Barra is rugged, with extensive beaches and machair. Some of the more southerly islands in the Outer Hebrides such as Berneray and Mingulay have dramatic sea cliffs (Edwards and Ralston 2003, 1-11; Edwards and Ralston 2003a, 255-265; Thompson 2008).

St Kilda is the most remote Hebridean island group, made up of several small islands and stacs¹ which lie 64km west of the Outer Hebrides and is the most remote archaeologically inhabited part of Britain, remaining almost untouched by the modern world until the 19th century (Figure 2.8) (Fleming 2005, 10-21; Maclean 1992, 51-56 and 84).

These Scottish Island landscapes provide a wide range of avian habitats. Today much of coastal and island Scotland is well known for its bird life, with a diverse range of species being present on the mainland, and the islands and offshore stacs and skerries holding exceptional populations. The avian diversity within the Scottish Islands is not just at species level, but supplemented by the important presence of rare or vulnerable birds and regular migrants. The JNCC (Joint Nature Conservation Committee) has established a large number of SPAs (Special Protected Areas) in the Scottish Islands (see Figure 2.6). These sites are selected in accordance with the 1979 EC Birds Directive, which ordered special protection for rare and vulnerable birds alongside the 'maintenance of the populations of all wild bird species across their natural range' and

¹ The Gaelic spelling is used rather than the English 'Stacks' to be consistent with place names referred to in the thesis such as Stac Armin.

the implementation of general protection schemes for all wild birds (Pollock *et al.* 2000, 2-16; Stroud *et al.* 2001, 3-7).

These SPAs signify that a site is used regularly by a certain number of birds in any season (e.g. 20,000 waterfowl), or has a high breeding success rate, or a long history of occupation by a given species (Stroud *et al.* 2001, 7). The Scottish Islands contain important breeding sites for many species such as the northern gannet, of which the majority of the British population nests on the cliffs of Scottish islands and coastlines. The significance of these Scottish landscapes is highlighted when it is considered that Britain holds 60 to 70 percent of the world's breeding gannet population (Stroud *et al.* 2001a, 44; Pollock *et al.* 2000, 15-18).

Figure 2.5: (Left) Map showing different landscapes on South Uist (WWW4)

Figure 2.6: (Right) Map showing SPAs in the UK (Stroud *et al.* 2001, 2)



The Scottish Islands have also been home to some famous fowling communities in the recent past, which in some cases continued to exist into the last century. For the human inhabitants of the aforementioned St Kilda fowling of seabirds was an essential food source and also formed an important part of the island's trade and exports. In particular cliff nesting seabirds were exploited for adults, eggs, and young birds (Figure 2.7). St Kilda had a very targeted fowling regime which in early modern periods was heavily focused on gannet although fulmar became the main quarry from the mid 18th century. Puffins were also extensively and repeatedly harvested in huge numbers (Harman 1997, 206-207; Maclean 1992, 92). St Kilda houses the largest breeding populations of gannets, fulmar and puffins, showing that the inhabitants were making maximum use of the wild resources offered in this challenging and remote setting (Stroud *et al.* 2001a, 32-33, 47, 397). When contact with the outside world began to increase, self sufficiency declined. Reliance on outside supplies, combined with the emigration of able-bodied young people brought about by external contact, initiated a breakdown of what was a very physically demanding economy and way of life. This eventually led to the evacuation of the remaining population in 1930 which at this point consisted of only 36 people (Harman 1995, 19; Henriksen *et al.* 2006; Maclean 1992, 156-158).

Fowling communities such as this demonstrate the many ways in which birds may have potentially been valuable for past populations within these islands. This may be as part of a general programme of subsistence (both in pre-agricultural and farming societies), as a valuable initial resource on entering an area, as an occasional supplement or even as emergency resources.

Figure 2.7: Faroese fowler taking a gannet on a cliff 1954 (By Bodo Ulrich WWW5)



Figure 2.8: Map showing location and form of St Kilda (WWW6)



2.2: An Introduction to Scottish Island Archaeology

Archaeological Interest

The Scottish Islands have long been a subject of academic or scholarly interest and curiosity due to their unique location and special character. Whilst this ranged from the ecological to the geological, it included historical and archaeological investigation. The often spectacular archaeology of the Scottish Islands attracted several early analysts such as Martin Martin who recorded the Callanish stones around AD 1700 or Dr Samuel Johnston who was inspired to tour the Hebrides and spent some time contemplating the form of Dun Beag broch in 1773 (Armit 2006, 7; Martin 1716, 9). However, the developing archaeological interest in the Scottish Islands of the 19th century was largely focused on Orkney to the neglect of the Western islands and to a large extent of Shetland. This initial avoidance may have saved the archaeology of these islands from an antiquarian approach. In the early 20th century study and surveys of the archaeological sites in the Scottish Islands was conducted by individuals such as Erskine Beveridge, who published work on the Inner and Outer Hebrides including Coll and Tiree in 1903, and North Uist in 1911. Works such as these have provided a basis for subsequent excavations and also supply a valuable record in understanding which sites have been lost to forces such as coastal erosion.

The Scottish Islands as a whole have recently benefited from increased archaeological attention (Fleming 2005, 93; Parker Pearson *et al.* 2004, 11-13; Sharples 2005, 3-6). This attention comes both in the form of more extensive and thorough archaeological investigation of the Scottish Island sites, increased post-excavation analysis, and through the development of island archaeology as a valuable research area in itself. The hundreds of offshore Scottish Islands contain numerous important archaeological sites,

some of which are of international significance (Sharples 2005, 1). It is particularly these Scottish Islands that have benefited from recent excavation at a variety of sites. This has resulted from both archaeological activity targeted at answering research questions, and the need for practical intervention to conserve data from sites at risk.

The threats faced by these island sites are manifold, and include both natural and anthropogenic events such as coastal erosion, wind erosion, sea inundation or new building plans. The mid 20th century saw increased excavation of a range of sites in the Western Isles alongside continued work in the Northern Isles. For instance, in the 1950s several sites on South Uist were threatened by the proposed development of a rocket range. The excavations that followed formed the largest archaeological project in Scotland to that date (Parker Pearson *et al.* 2004, 18). These sites included two wheelhouses (A'Cheardach Bheag and A'Cheardach Mhor), a Viking long house at Drimore and a further two wheelhouses on North Uist at Sollas. As a result these sites were excavated, but at the insistence of the Ministry of Defence all standing structures were to be demolished. After some sites had complied with this demand the Ministry of Defence then changed their plans and prepared to build elsewhere, making the rescue archaeology project a part of the sites' destruction (Finlay 1984, 1-22; Hunter and Carruthers 2012, 6; Parker Pearson *et al.* 2004, 18).

In the 1960s excavation in the Outer Hebrides continued with Iain Crawford's large project at Udal on North Uist, which was ahead of its time in sieving and sampling, and which uncovered Neolithic to Post-Medieval material. Work at the site continued until the late 1980s / early 1990s, but unfortunately there was a lack of publication and a general hiatus in the provision of data and information. However, this is in the process

of being rectified and the site is being written up by Beverly Ballin-Smith. Whilst publication at a date closer to the original excavations is preferential, this presents a significant development and body of work in the Outer Hebrides.

More recently in the 1980s and 1990s sand quarrying endangered the existence of Cladh Hallan on South Uist, a site which was revealed to be of international importance and that was thrust into the public spotlight after mummified human foundation burials were discovered beneath a terrace of Late Bronze Age to Early Iron Age roundhouses (Parker Pearson *et al.* 2004, 19; Parker Pearson *et al.* Forthcoming). Cladh Hallan was partially destroyed by this sand quarrying which ceased when the remains of a 10-year-old child and a prehistoric house were exposed (Mulville and Parker Pearson 1995, 2). However after the cessation of quarrying the partially revealed structure was subject to deleterious wind erosion until archaeological excavation by SEARCH (Sheffield Environmental and Archaeological Research Campaign in the Hebrides) intervened (Mulville and Parker Pearson 1995, 2). Excavation therefore has in some cases been determined through the need to prioritise sites at risk from human actions (Sharples 2005, 3-10).

However rescue archaeology and research conducted excavations should not be considered as separate from each other. Rescue archaeology has provided some of the most important and informative sites in the Scottish Islands. The preservation offered by certain (and often fragile) island locations and environments such as the machair can provide exceptional preservation of remains and as such be vital to archaeological research and the understanding of these landscapes. For instance, the mummified remains found at Cladh Hallan demonstrated to the world that beneath the excellent preservation conditions afforded by the machair sand lay prehistoric (and historic)

archaeology of a magnitude and quality rarely seen elsewhere in Britain (Parker Pearson *et al.* 2004, 19; Parker Pearson *et al.* 2005, 543; Parker Pearson *et al.* 2007). Such factors may encourage research excavation but they also help to at least ensure rescue excavation by emphasising the quality and quantity of what will be lost. Today much of the excavation archaeological research occurring in the Western and Northern Isles is in response to at risk sites, such as the aforementioned Cladh Hallan excavations, and projects such as Shorewatch: Recording the Eroding Archaeology of Scotland's Coasts, managed by SCAPE (Scottish Coastal Archaeology and the Problem of Erosion).

Human actions are one of the few threats to these island archaeological sites that can be controlled to a degree. Whilst protective policies, common sense and interest in the past can prevent the destruction of archaeological sites by human hands, nature is indiscriminate. As mentioned, many areas of the Scottish Islands are low-lying. Sites, structures and material are being lost at a rapid rate to erosion, displacement and damage by wind, sea and rain. These natural threats can be sudden dramatic short events, such as a storm, or gradual processes. Or one can lead to the other. The tidal island of Baile Sear is located half a kilometre to the west of North Uist and is just one area along the western Scottish seaboard that is being affected by sea encroachment and adverse weather conditions. The prehistoric settlement site of Sloc Sabhaid on Baile Sear was exposed by the dreadful storms that battered the Hebridean coast in January 2005. In some locations a single storm caused the Outer Hebridean coastline to move inland by five metres overnight. The initial storm opened up the site of Sloc Sabhaid to subsequent further destabilisation and damage by sea and wind (Dawson pers.comm.). By 2008 in some areas of the site the coast had moved six metres inland, destroying one wheelhouse and laying much of another open upon the beach (Figures 2.9 to 2.11). This

eroding site was excavated by the SCAPE Shorewatch Project, and the bird bone was analysed within this thesis providing comparative material for the analogous site of Mid-Late Iron Age Ceardach Ruadh also on Baile Sear (Figure 2.9).

Figure 2.9: Plan of erosion at Sloc Sabhaidh. Green indicates erosion of the site between August and September 2005, blue shows erosion between September and December 2005, and black shows the coast edge and surviving archaeological structure in early December 2005 (WWW7).

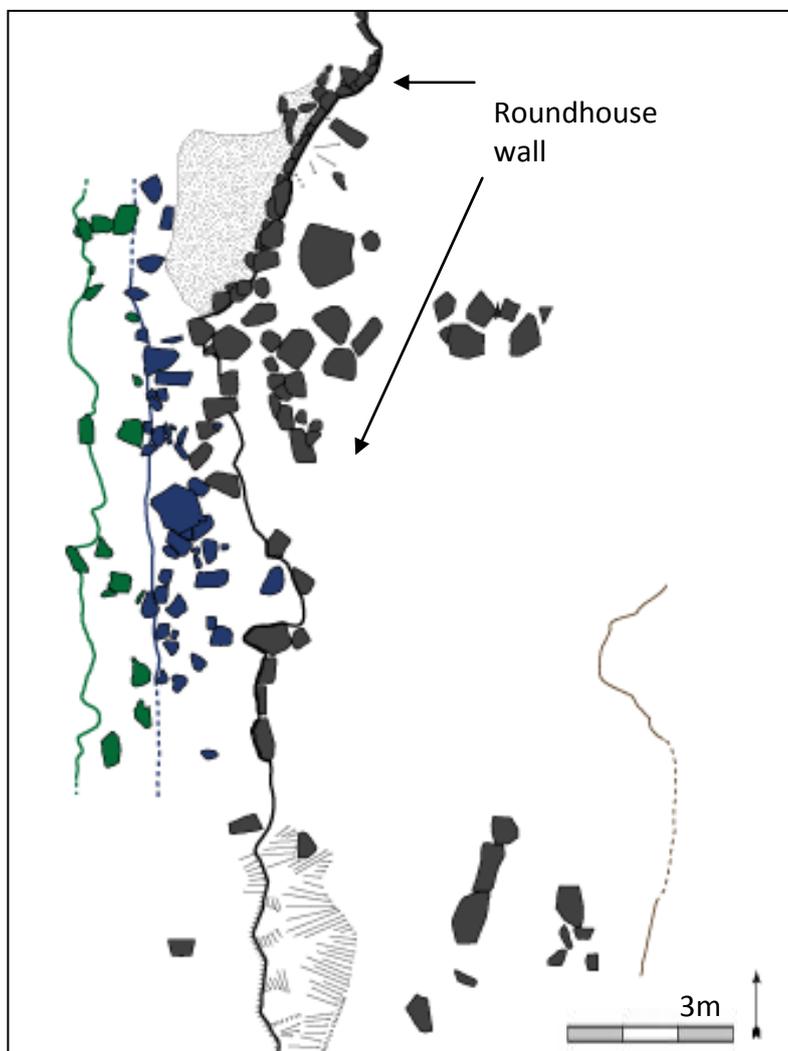


Figure 2.10: Erosion of Sloc Sabhaidh between May 2005 and July 2007 (WWW7)

May 2005	August 2005	October 2006
Settlement with red hearth site exposed by 2005 storms.	Most of red peat ash hearth deposits washed away.	Very high tide battering at the end of a season.



August 2006



July 2007

Retreating coastline and loss of archaeological structures in less than a year. NB. In the August 2006 image the sea has deposited pebbles on the site, but these were quickly swept away again leaving the soft sediments open to erosion.

The loss of sites such as this reduces understanding of the past in these locations, both on an individual site basis, and in terms of reconstructing density of occupation, local chronological sequences and refining our understanding of the dynamic and complex settlements and temporal periods within the islands. Excavation in these locations is therefore crucial to prevent data being lost irrevocably and to allow us to form a more accurate and detailed understanding of the Scottish Islands' past from prehistory to the

present day. Even though the islands are rich in archaeological sites (and so to some people the loss of the occasional roundhouse may not seem detrimental), there are many individualities and idiosyncrasies. For example the Late Bronze Age or the Iron Age of the Northern Isles is not identical with, and thus not directly comparable to, that of the Western Isles. As such each individual site has the ability to further inform on its specific and wider context both in general, and in terms of its zooarchaeological data.

Periods and Chronology

As outlined in the introduction the primary focus of this research extends from the Mesolithic to the end of the Norse Period. This covers an extensive period of time which encompasses both prehistoric and historic archaeology in order to examine temporal trends in avian resource use. The data collated in this thesis also come from excavations and analyses conducted over a wide period of time (extending from 1881 to the present day) and as such some sites and bone assemblages have more dating information available than others. The chronology of the Scottish Islands is complex and sometimes inconsistent geographically. The commencing and ending of periods is constantly being debated and refined and as such there is no one universally accepted chronology, particularly within periods such as the long Iron Age and Early Historic Period. Comparing data from various sites is therefore challenging and coarse period analysis is in many instances necessary, although the author has tried to use as detailed a temporal resolution as possible (for example the division of the Iron Age into Early, Middle and Late phases). The understanding of the chronological sequence of events in Scotland has naturally developed since some of the earlier excavation, site and faunal reports were written through continued research and also via advances in dating techniques. Where direct dating evidence is accessible, reclassification or adjustment is often possible. The archaeology of the Scottish Islands is outlined here by period.

Mesolithic

The Mesolithic is the earliest period considered in this research. In Britain it is seen to start at the beginning of the Holocene warming c.8000 BC and ends c.4300 BC with the introduction of farming and the Neolithic. It is associated with dramatic changes in environment (including deglaciation and fast afforestation) and sees the colonisation of the Scottish landscape by hunter-gatherer-fishers (Finlayson and Edwards 2003, 112). (Pre-Mesolithic evidence for occupation is sparse and contested, with only a handful of recognised Late Upper Palaeolithic sites) (Saville and Wickham-Jones 2012, 9-21).

The Inner Hebrides were relatively well occupied during the Mesolithic with the large shell middens of Tiree, Oronsay and Skye bearing witness to this temporal episode (Gregory *et al.* 2005, 944-950; Jardine and Jardine 1984, 22-34). However, in comparison, evidence for Mesolithic activity is very scarce in the Western Isles and Orkney (Saville and Wickham-Jones 2012, 21-40). The Mesolithic on the case study island of South Uist is noticeable by its absence. The startling lack of Mesolithic archaeology on this island (and at other locations in the Western/Scottish Isles) is in part due to the changing land surfaces and a rise of sea level created by the melting of glacial ice which simultaneously unburdened the land (causing lift in some areas) and created a rise in sea level, which covered low lying areas (Ballantyne and Dawson 2003, 32-34; Parker Pearson *et al.* 2004, 21-25; Saville and Wickham-Jones 2012, 39-41). This means that what Mesolithic archaeology could have been on South Uist is now some distance out to sea; making detection via survey and excavation problematic (Parker Pearson *et al.* 2004, 21-25). Marine foods were an important part of Mesolithic subsistence, and many Mesolithic sites could have been situated on the coast to exploit such resources, which would place them at most at risk of becoming submerged

(Finlayson and Edwards 2003, 116; Saville and Wickham-Jones 2012, 39-41; Schulting and Richards 2002, 148). Predictions have suggested that the Mesolithic shorelines of Orkney and the Outer Hebrides could be as far as 20-30 metres below the present sea level (Saville and Wickham-Jones 2012, 40).

Ten years ago no strong evidence for Mesolithic occupation could be provided for any location in the Outer Hebrides, with possible sites of activity being inferred via changes in the pollen profile or through patches of burning in the floral record. However, recently three Mesolithic sites have been discovered in the more northerly islands of Harris and Lewis (excavated in 2010/11). On Harris the sites of Northton and Bagh an Teampuill are Late Mesolithic while Traigh na Beirgh (Lewis) dates to the terminal end of the Mesolithic (Church *et al.* 2011; Church *et al.* 2011a; Gregory *et al.* 2005, 944-950). These discoveries give weight to the educated assumption that the Outer Hebrides were settled in the Mesolithic but that the evidence for this period is somewhat less tangible than in other periods; and particularly in certain locations. If the Minch could be crossed to reach Lewis and Harris in the Mesolithic then there is little reason to doubt that South Uist would have also seen Mesolithic activity in some form. A similar situation is present in Shetland where recent work at sites such as West Voe has again demonstrated a Mesolithic presence in an area which had previously been reliant on less substantial data from pollen records (Edwards *et al.* 2009, 113-123; Melton 2005, 127; Melton 2008, 23-36; Melton and Nicholson 2007, 94-100; Saville and Wickham-Jones 2012, 34). Consequently, the extent of Mesolithic activity in the Scottish Islands is starting to be more fully understood.

Sea level change was not purely restricted to the Mesolithic, with current levels reached c.4000 years ago in the Orkney region, with estimates of 5000-4000 years ago for the Outer Hebrides and localised areas of the Inner Hebrides (Jordan *et al.* 2010, 115-134; Saville and Wickham-Jones 2012, 41). On the Uists there is evidence of continued submergence through Neolithic monuments that are now partially underwater or regularly inundated by the sea, including Geirisclett (North Uist) and Sig More (South Uist) (Ballantyne and Dawson 2003, 40; Beveridge 1999, 255-256; Callander 1929, 318-319; Parker Pearson *et al.* 2004, 25). In the Northern Isles work by Wickham-Jones *et al.* (2009, 26-30) around Orkney has identified probable Neolithic structures underwater, whilst submerged Shetland peat indicates that sea level in this location has risen by c.8 metres since 4350 cal BC (Ballantyne and Dawson 2003, 40). This again strengthens the argument that much of the earlier Mesolithic archaeology will also be in such locations, which although problematic for excavation and survey, has the potential to offer excellent preservation.

Neolithic

The Neolithic (c.4500-2500 BC) saw the arrival of domestic animals and plants on the Scottish Islands and the development of farming which created new patterns of subsistence and relationships with the landscape and wild resources (Barclay 2003, 127-140; Parker Pearson *et al.* 2004, 29). The period is characterised by the development of more permanent settlements, house construction, monument building and the use of domestic animals and crops. Such activities formed new ideas of space and place, and also changed practices of burial and the treatment of the dead, which reveal alterations in worldviews. This is combined with technological developments in material culture (such as the implementation of pottery usage, and changes in lithic technology) and in

resource use (the secondary products revolution). In the Scottish Isles aspects of the Neolithic appear to have been adopted selectively and with a degree of variability, rather than as an entire package (Barclay 2003, 129; Brophy and Sheridan 2012, 17).

Bronze Age

The Bronze Age sees the first arrival of metalwork on the Scottish mainland and Islands along with its associated technology and, to an extent, cultural package and extends from c.2500-700 BC. The end of the Neolithic and the commencement of the Bronze Age is open to discussion, with the transitional period being flexible and complex. This period begins with the introduction of copper (and probably gold) which arrives in Britain with Beaker style pottery, which first occurs in Scotland during the 25th century BC, and is declining by 2200-2100 BC (Brophy and Sheridan 2012, 17; Downes 2012, 1-5 and 12). This period can be referred to as the Chalcolithic and marks the transitional episode from the end of the Neolithic to the adoption of full-blown Bronze metallurgy (Cowie and Shepherd 2003, 151). The Beaker period culture within the Chalcolithic is more pronounced in the Western Isles than in Orkney and Shetland where uptake was not as strong; in Orkney and steatite urns were persistent (Brophy and Sheridan 2012, 35). The Bronze Age is characterised by the development of metal working and use, roundhouse living, and a more individual based approach to funerary archaeology with a shift to cremation. This period can be divided into the Early Bronze Age (2500-1500/1200 BC) and Later Bronze Age (1500/1200-700 BC). This period can be further divided to include a Middle Bronze Age phase which extends from c. 1600-1200 BC (Downes *et al.* 2012, 28-30; Roberts 2007, 1-4).

Iron Age

The Iron Age (unsurprisingly) sees the uptake of iron working and use, but the name is overarching and encompasses a wide series of changes (Armit and Ralston 2003, 169-170). The Iron Age in Scotland covers a far longer period of time than in England and Wales, with the Roman presence in Scotland being restricted in location and limited in impact. This is particularly true for the islands. The Atlantic Iron Age can be divided into three periods: Early Iron Age (c.700-200 BC), Middle Iron Age (c. 200 BC- AD 400) and Late Iron Age (c.AD 400-800). The dates for the Iron Age as a whole and for the subdivisions are complex, constantly being redefined and not consistently agreed upon. The categories of Early, Middle and Late are based on the presence of certain cultural, architectural, material and technological characteristics, and as such exact date ranges are not always possible or appropriate. For example, the start of the Early Iron Age has variously been given as 800 BC, 700 BC or even as late as AD 600/500, whilst the late Late Iron Age has been repeatedly referenced as starting c.300 or AD 400 and ending in AD 800 and AD 900 (Downes and Ritchie 2003; Harding 2004, 3; Hunter and Carruthers 2012, 9; Needham 2007, 39-50; Parker Pearson *et al.* 2004, 84; Parker Pearson and Sharples 1999, 15 and 359; Sharples 2012, 16). Architecturally the Early Atlantic Iron Age is characterised in Scotland by living in roundhouses (Sharples 2012, 16-17). The existence of roundhouses in the Late Bronze Age of the Western Isles has recently been demonstrated by the transitional site of Cladh Hallan (Parker Pearson *et al.* 2004, 19; Parker Pearson *et al.* Forthcoming; Sharples 2012, 16-17). On Shetland the appearance of roundhouses is novel, being preceded by cellular structures such as those at Jarlshof, whilst on Orkney the situation is unclear but suggests that circular structures may have been present in the Late Bronze Age (Hamilton 1956, 212-215; Sharples 2012, 16-17).

The Middle Iron Age is noted for the appearance of complex roundhouses, such as the iconic brochs, and pottery with elaborate decoration (Parker Pearson *et al.* 2004, 83-86; Sharples 2012, 17-21). Wheelhouses are also a very visible form of Middle Iron Age building and are present in the Western Isles and Shetland, but as of yet none have been found on Orkney (Dockrill *et al.* 2005 52-65; Sharples 2012, 18).

The Late Iron Age sees a decline in the construction of the complex and monumental roundhouses so visible in the Middle Iron Age, and the development of a wider range of structural types, including the emergence (or in the case of Shetland re-emergence) of cellular or 'Jellybaby' houses (Hunter and Carruthers 2012, 62; Sharples 2012, 18-20). Pottery becomes less decorated, but there is an increased presence of individual items such as pins and brooches (often associated with personal adornment) and a developed integration of the Scottish Islands into the wider context of Western Europe (Hunter 2007, 289-90; Parker Pearson *et al.* 2004, 105-117; Sharples 2012, 18-20).

Pre-Norse/Pictish

This period falls within the Late Iron Age and is often referred to as the Pictish Later Iron Age. In the Western Isles Pictish influences and characteristics are not particularly visible until the seventh century AD, whereas in the Northern Isles and mainland Scotland the Pictish period can also encompass the fifth and sixth centuries AD (Parker Pearson *et al.* 2004, 105-106). Since Pictish archaeology/culture is not universally applicable and not apparent at every Late Iron Age site, material in this thesis will not be classified as Pictish unless explicitly identified as being of Pictish nature by the excavator/reporting archaeologist, rather than just being attributed on date alone. Interpreting the extent and nature of the Pictish evidence is complex, and knowledge has developed since the publication of some of the works considered in this thesis; as such even in these cases the material will be referred to as Pre-Norse/Pictish (Lane 2007, 14).

Norse

The Norse period in Scotland commenced by the early 9th century AD, with the slightly earlier date of the 793 raid on Lindisfarne heralding its arrival. Soon after Iona was attacked in 795, and plundering is recorded in the Hebrides from 798. The Norse period therefore runs from c.AD 800 up until AD 1400 (Graham-Campbell and Batey 1998, 24 and 155; Hunter 2003, 241-254). Although the Viking/Norse Period can technically be said to start c.800, the Late Iron Age or Pictish culture may in some instances continue past this, since this period's commencement in different locations is directly related to the arrival of Norsemen. However, this is difficult to precisely identify archaeologically. In this thesis the Norse period is considered to start at AD 800 and is broken down into the Early (c.800-1100), Middle (c.1100-1200) and Late (c. 1200-1400)². The Viking period refers exclusively to the early settlement period where incomers from Scandinavia were arriving in Britain; it falls within the Early Norse dates from the 9th to 11th centuries (Graham-Campbell and Batey 1998, 155). The term 'Viking' has been somewhat misused in the past, so it will be used with caution within this thesis for early primary arrival contexts, but considered as part of the Early Norse period.

The continuation of the Norse period differs between the Northern and Western Isles. In the Western Isles the focus of trade shifted away from the Northern Isles and Scandinavia in the 13th century (with the islands politically coming under control of the Scots in AD 1266), whereas in Orkney and Shetland this power transfer did not occur until the later 15th century (AD 1468). However, political connections with Scotland had been growing during the 14th and 15th centuries. Therefore, in some instance the Later

² The Norse period may also be divided into: Viking AD800-1050 and Later Norse AD 1050-1350 and beyond (*cf* Graham-Campbell and Batey 1998, 155). However the Early, Middle, Late system outlined above was selected to maximise the detailed chronology of Bornais in particular, since this is a major case study within the thesis (Sharples, 2005, 2012 and pers. comm.).

Norse Period (c.AD 1200-1400) could also be considered the Later Medieval Period (Hall and Price 2012, 18; Parker Pearson 2012, 418; Parker Pearson *et al.* 2004, 125; Sharples 2005).

Medieval and Post-Medieval

This is a diverse period in terms of its classification and extent. Whilst the major research focus terminates at the end of the Norse period, Medieval and Post-Medieval assemblages have been incorporated where possible to explore continuing bird usage in the Scottish Islands and in order to help contextualise the historical and ethnographic sources that document fowling practices. However, these periods are often not the targeted material within an excavation (but encountered en-route) and as such post-excavation analysis is rarely focused on them due to financial and time constraints. The Medieval period in this thesis refers to the Late Medieval Period (post AD 1400).

Key Sites Analysed

Bornais

Bornais is an Iron Age and Norse period site on the machair of South Uist. It is comprised of several mounds which represent different settlement areas within the site and different occupation periods (Sharples 2012). Mound 1 consists of a Late Iron Age wheelhouse and related features that became a sub-rectangular building. This appears to have been abandoned by the start of the 6th century AD before the area was reoccupied by a 9th century Norse settlement, which continued into the Middle Norse Period (Sharples 2012, 49, 102 and 137). Mounds 2 and 2A are occupied through the Early to

Late Norse period, with Mound 2 also producing some Pre-Norse/‘Pictish’³ features; the Norse occupation of Mound 2 is comparatively high status (Sharples 2012, 4-5; Sharples pers.comm.). Mound 3 also houses Middle and Late Norse occupation, but is of lower status than Mound 2, being more of akin to Mound 2A (Sharples 2005).

Cille Pheadair

Cille Pheadair is also situated on South Uist’s machair. This Early to Late Norse farmstead settlement was exposed by storms in the 1990s. It is smaller in scale than Bornais, and appears to be formed of a main longhouse surrounded by associated structures. The principle house was replaced three times over the course of four hundred years (Sharples and Parker Pearson 1999, 50). Unlike Bornais there is no Late Iron Age occupation directly underlying, however there are Iron Age mounds nearby (including a wheelhouse), and others have been destroyed by the sea. Combined with Bornais, Cille Pheadair suggests that Norse settlement on South Uist followed a similar placement pattern to that of the Late Iron Age (Parker Pearson *et al.* 2004, 137-142; Parker Pearson *et al.* 2004a, 235-254; Sharples and Parker Pearson 1999, 50).

Cladh Hallan

Cladh Hallan is again on the machair of South Uist and consists of a series of Late Bronze Age to Early Iron Age roundhouses (Parker Pearson *et al.* 2004, 19; Parker Pearson *et al.* 2005, 530). Prior to this the area had contained an Early Bronze Age ploughsoil and a cremation cemetery dated to 1940-1540 cal BC, above which a Middle Bronze Age house was built c.1380-1185 cal BC (Marshall *et al.* 2010, 10; Parker Pearson *et al.* 2004, 63). After the abandonment of this house, a series of structures

³ In the Outer Hebrides only Bornais produced any ‘Pictish’ material (the term used by Sharples). From here on in this 7th and 8th century AD material from Bornais will be referred to and considered as Pre-Norse/Pictish (Sharples pers.comm.).

were erected followed by a period of pit digging and filling (Parker Pearson *et al.* 2004, 64-65). Next a series of human foundation deposits were placed before roundhouse construction began again c.1135-1035 cal BC (Marshall *et al.* 2010, 12). At least four of these houses were part of a terrace with each being an individual structure but sharing party walls. Then, as the roundhouse terrace was nearing the end of its occupation, around 635-535 cal BC two double roundhouses were constructed (Marshall *et al.* 2010, 13; Parker Pearson *et al.* 2000, 2001, 2002, 2007; Parker Pearson *et al.* 2004, 66-86).

The Long Picture

The long time expanse covered in this work (and explored above) provides an exciting opportunity to examine avian resource use within and across these periods. It is therefore important that all the faunal remains from these sites are analysed and compared not only to aid overall understanding of resource use and subsistence on the islands, but also to provide a basis for further work resulting from an increased program of excavation and better resolution of the archaeological sequence in the Scottish Islands. However, before contemplating birds in the archaeology of the Scottish (and wider North Atlantic) Islands, it is important to consider avian archaeology independently. In this way the methods through which we can investigate past interactions between birds and humans and the questions that we can ask of the avian remains can be outlined.

2.3: Investigating Birds in Archaeology

This section explores the occurrence of birds in the archaeological record and how they are archaeologically investigated. The information that can be attained from avian

remains is also discussed and the ways in which this can inform upon a wide range of areas and themes.

The Form and Formation of Avian Data and the Information it can Provide

Physical bone remains form the main body of evidence for investigating archaeological birds and understanding their interaction with human populations. The bones are recovered from archaeological sites through excavation and are then analysed zooarchaeologically. Archaeological eggshell is another direct source of avian evidence which can be recovered from sites. Excavated sites may also yield gizzard stones and even feathers, droppings or bird skins dependent on the preservation conditions of particular environments. The study of osseous material (and other direct sources of evidence) provides primary data for understanding and interpreting avian-human interactions within their own specific archaeological context. For bones this is achieved through identifying them to species/family, anatomical element and establishing the relative abundance of different birds. In addition study of the bone material also involves establishing the age of animals at death (through the fusion and porosity of bones), noting any evidence of sex characteristics, and identifying taphonomic features such as butchery, burning and gnawing.

Bone analysis therefore forms the basis for a large part of archaeo-avian research, with eggshell playing a much smaller (but important) role. However, it is by no means the only way in which birds can be examined. Artifacts and structures associated with human-avian relationships should also be considered. These may include traps, nets, nooses, bird cages, falconry equipment, false cock-fighting spurs and structures such as dovecotes or bothies and cleiteans (the latter two of which are storage huts used to dry

and preserve [among other things] birds, eggs, and other resources) (Harman 1997, 217). These all help us to understand the multitude of ways in which birds have been utilised by humans, how they were caught or handled, and the various social and ideological associations that this may have created. To take just a few examples, the English Medieval lord often exercised a monopoly over the dove and its meat, squabs and eggs. As such dovecotes are often found in manorial complexes and are frequently interpreted as expressing status, wealth and an element of resource control (Jones and Page 2006). Cock fighting, on the other hand, may be seen to signify prowess and strength in a visual, adrenaline filled, animalistic display. Meanwhile, capture tools such as snareboards, nets or the noose and rod provide an insight into interactions with wild, untamed resources and the manner in which they were taken.

In addition to these, other indirect lines of information should also be considered. These incorporate a range of literary sources and also illustrations or depictions of birds occurring both on paper/manuscript sources, but also in other media such as stone or pottery. Written sources provided a personal insight and snapshot into avian-human relationships to contextualise the archaeological data. Meanwhile visual sources (in all their forms) are valuable for supplementing physical bird remains in prehistoric contexts, or those in which literary accounts are limited. For instance at Norse Jarlshof, one of the sites included in this study, a hen was illustrated on a piece of slate (Hamilton 1956, Plate 21; Platt 1956, 212-215). A geographically distant example (Figure 2.11) comes from a wall in Blackler's Cave, near Pleasant Point, South Canterbury in New Zealand, where Maori are actually depicted in the process of hunting the moa (a giant flightless bird), using a beater and possibly driving it into unfavourable locations such as swamps (Buick 1937, 167-176). These provide a valuable insight into how birds were taken, and social hunting practices.

Further examples of these avenues of research include linguistic and place name evidence. It has been established that about 300 place names in Britain contain an element deriving from or meaning crane (Boisseau and Yalden 1998, 482-500), whilst literary evidence also indicates that crane was a high-status game bird in Medieval England (Albarella and Thomas 2002, 34). Combining such evidence with the osseous evidence expands our understanding of the former distribution of species such as crane, which at one point was extinct within Britain, and today is still a rare visitor (Boisseau and Yalden 1998, 482-500; Serjeantson 2010, 148-149; Stroud *et al.* 2001a, 436).

Figure 2.11: Maori hunting Moa in New Zealand (from Buick 1937, 167-176)



As outlined in Chapter One, the majority of the material analysed and collated in this thesis is avian bones recovered from archaeological sites. Eggshell evidence was also collated and a sample of archaeological eggshell from the site of Bornais on South Uist was analysed using microscopy. The historical sources, imagery and fowling equipment are considered in order to interpret, contextualise and discuss the bone and eggshell data but these sources are not the primary focus of this work. The bird bones are used to investigate human resource use and diet, movement around the landscape and habitat exploitation, collection of resources from non-local locations and processing of the food resources to provide a variety of products from meat to oils and feathers. By identifying

human exploitation of birds in particular habitats, capture tools, fowling techniques and associated technology can also be explored. The bird remains may also inform upon changes in the past distribution of avian species (such as the great auk), which in turn provides information on the range of species being available for human exploitation and anthropogenic interaction with the avian resources. Changes in avian populations can also reveal variations in climate, habitat and landscape (resulting from natural and anthropogenic stimuli), and identify human influenced factors such as over-exploitation. Bird bones from archaeological sites can also help to investigate seasonal activities (and the associated landscape use) by the presence of juvenile birds, eggshell and through identifying breeding females via medullary bone (discussed later in this chapter). Furthermore the various uses to which these birds and their remains were put (ranging from food to clothes and tools) can also inform upon material culture and symbolic and ideological relationships and associations. The introduction and use of domestic birds such as chicken, domestic goose and domestic duck has the capacity to inform upon husbandry practices and resource management.

In handling and studying archaeological bird bone, several questions must be asked about its origin and its state/condition on archaeological recovery and the way in which it has been analysed. Topics including recovery, quantification and interclass comparison are outlined fully in Chapter Three and their implications considered. However, the archaeological recovery of avian bones, and the material retrieved from them is partially determined by the date in which they were excavated and studied. As such some key points will be considered here that are essential for understanding the development of avian archaeology and for exploring the avian research previously conducted on material from the Scottish Islands (and further afield).

2.4 Birds in the Archaeology of Scottish Island Sites

The Development of Avian Archaeology

It is apparent from ethnographic studies and historical sources (such as those outlined in 2.1.1) and the current avifauna in the area that birds may have played an important role in the lives and economies of past communities in the Scottish and North Atlantic Islands. Thus these locations are an appropriate place in which to consider the archaeoavian record. The historical and avifaunal examples emphasise the need to analyse archaeological bird remains and determine their role in provisioning populations in island locations where other resources may have been limited, which then allows avian-human relationships to be considered in the wider faunal, site and social context. However despite the likelihood of avian exploitation in the past being high and even though the archaeological sites on these islands themselves have demonstrated the need for avian analysis, the development of avian archaeology overall has been a fairly recent occurrence.

Avian archaeology today is a growing discipline. Novel techniques of identification are being developed for bone and eggshell, interdisciplinary projects are increasing, and several international conferences have been held by the ICAZ Bird Working Group, with subsequent publication in prominent journals such as *The International Journal of Osteoarchaeology*. However, this is a relatively recent occurrence, and this research area has come a long way from the dearth of interest or understanding present 50 years ago. To open this section, a worrying statement by M. Platt (published in 1956 regarding Jarlshof, Shetland) exemplifies the general opinion of archaeological avian material that is faced for some of the most prominent Scottish Island sites: “Fragments of bird bones were quite numerous, occurring at all levels. Apart from the age of the deposits, they are

not of further interest, since all are recorded from Shetland today”. This site produced significant multi-period deposits of Bronze Age, Iron Age and Norse bird bone (and a large quantity of remains from the other classes) in a location which often does not have favourable bone preservation due to acidic soil conditions (Dry and Robertson 1982). Such valuable material has often been lost irrecoverably, and the only observations that can be made for this site are based on the few species named in passing, but with no real idea of frequency or quantification. The development of avian archaeology (both in Scotland and worldwide) is therefore still hindered by problems of the recent past, with sizable amounts of data being incomplete, overlooked, ignorantly presented or completely missing.

The Ecological Start

The origins of studying ancient bird bone are found not in archaeology but with scientists and ecologists researching bird anatomy in the 18th century. In the actual identification of bone to species there is no difference between the avian ecologists and an avian zooarchaeologist, and it was through ecological study that the fundamental mechanics and forms of the avian skeleton by species was often explored. However it was not really until the 19th century that these avian palaeontologists focused on all elements of the avian skeleton (Serjeantson 2009, 5). Before this point attention was directed at the skins and feathers, beaks and claws (Serjeantson 2009, 5). At this early point in its history the study of archaeological and palaeontological bird material was mainly conducted by avian palaeontologists (Olson 2003 26-34; Serjeantson 2009, 5). The differences occurred when the study of avian bone was taken into the field and applied to archaeological material. As a result, early studies of archaeological bird bone in the 18th and 19th centuries tended to have little or no focus on avian-human

relationships. Avian palaeontologists examining the fossil and osseous bird remains were naturally more concerned with examining the past of the birds themselves, focusing on, for example, avian extinctions, the distribution of species and (later) the evolution of birds. While there are a few early instances in which human modification of and interaction with the birds was noted or reported on, these are rare and not developed fully.

In 1857/8 Japetus Steenstrup showed great insight when using the bird bones found in Jutlandic shell mounds to investigate climate, vegetation and capture techniques, but even here discussion of this in relation to humans is limited (Brothwell *et al.* 1981, 195; Steenstrup 1857). Steenstrup (like many writing at this time) focuses on the great auk or, as he aptly put it the ‘aldeles udelig Alkefugl’: utterly inept auk (Steenstrup 1857, 2). In 1879 J.A. Smith also wrote a detailed paper on the great auk, stemming from the discovery of its bones in Caithness, but which was mainly concerned with describing the bones and examining historical sources. Whilst Smith’s collation and investigation of many historical sources relating to the great auk is exceedingly valuable, the archaeological remains are not linked to this, or interpreted in light of the information. This paper again shows distinct focus on one species, and (although concerned with archaeological finds) also appears to have a strong biological and ecological interest in the great auk which, at the time that Smith was writing, was coming to be considered as “in all probability altogether extinct” (Smith 1897, 96). As such the focus is on the bird rather than avian archaeology: “In the comparatively few museums where this bird has been preserved, its remains are now, therefore, cared for as among their most prized, because among the rarest, of their natural history treasures” (Smith 1897, 96).

It was not really until the 20th century that the birds were properly considered as a resource for raising and answering archaeological questions. Even then, the manner in which avian remains were approached limited the information that could be obtained from them. Identification to species is labour intensive and time consuming, and needs to be conducted using a reference collection (Armour-Chelu 1985, 1; Bocheński 2008, 1247-1250; Cohen and Serjeantson 1996, 1-4). The number of avian reference collections which are accessible is limited even today, and it can be difficult and expensive to build up a skeletal reference body that is broad enough for full comparison, and to acquire rarer species such as the great auk, crane and certain raptors (Corke *et al.* 1998, 67-69). This is particularly difficult when ideally more than one of each species should be available for comparison to ensure that the archaeological specimens are not being compared with an atypical individual (Bocheński 2008, 1247-1250). The restricted availability of reference material has inevitably hampered avian identification, both in the recent and distant past. Before the 1960s reference material was rare outside of museums (in particular natural history museums) (Serjeantson 2009, 6). Even writing in 1985, Armour-Chelu states that the small number of reference collections within Britain has hindered thorough investigation of many assemblages (1985, 1), and as such delayed both the progression of this discipline and enlargement of the data body. It is at this point that we again turn our attention to the Scottish and North Atlantic Islands and the development of avian archaeology in this particular context.

Scottish Islands: Existing Avian Work and its Development

In common with the general development of avian archaeology outlined above, the earliest examinations of bird bones from Scottish Island (and mainland) sites were mainly focused on the birds themselves and not their role in relation to the human

inhabitants. This approach can affect and bias the bird data recovered and/or studied. One of the earliest archaeological investigations to incorporate birds in a notable way was the 19th century excavations of Caisteal nan Gillean on Oronsay, Inner Hebrides. The excavations on the Mesolithic shell midden commenced in 1881 and were jointly conducted by William Galloway and Symington Grieve (Grieve 1883; Grieve 1885; Mellars 1987). The pair hoped that the lower parts of the mound would contain Bronze Age burials, and were not particularly interested in the archaeology of shell middens. It appears that these excavations would have been abandoned quite early on had it not been for the discovery of bones from the great auk (*Pinguinus impennis*).

Grieve, a biologist by origin, was fascinated by the recent extinction of the great auk and its presence in archaeology, and resultantly he devoted much time to its study and publication of his findings. From his publications on the great auk and his accounts of the excavations it is evident that the great auk was the major stimulus to return for additional sessions of excavation (Grieve 1883; Grieve 1885). Admirably, Grieve wrote much upon the excavation and the great auk, albeit with a much greater focus on the great auk, the faunal remains and the other artefacts before the archaeology of the site itself. His 1885 work 'The Great Auk or Garefowl: Its history, archaeology and remains' deserves particular note. Although still devoid of the type of avian assessment and the forms of information we would today hope to draw from the remains (such as species frequency, taphonomy, habitat use, or seasonality), he does devote one small chapter of the book to discussion of "The Uses to which the Great Auk was put by Man" which was a promising step towards developing the interpretation of avian remains. It is also full of valuable ethnographic and historical accounts of great auk use,

and if nothing else this work perhaps brought attention to the presence of birds in the archaeology of the Scottish and North Atlantic islands.

However, despite the many merits of the work considering its date, there are substantial problems, which shall be discussed due to their all too common occurrence in many later analyses. The most obvious is clear when we compare Grieve's avian data from the 19th century fieldwork with that from later excavations of other Mesolithic mounds around 1913 at neighbouring Cnoc Sligeach, and at nearby Cnoc Coig in the 1970s (Bishop 1913, 52-55; Mellars 1987; Mellars and Payne 1971, 397-398; Nolan 1986, 1-2). It appears that many of the smaller avian (and mammalian species) were not recovered from the earliest excavations, or were ignored during analysis since a much wider range of small species is represented in assemblages from the later excavations. Although this should be partially expected considering the age of the excavations and the developments in excavation and sampling methods since that date, failure to collect smaller species/elements is a persistent problem in the avian assemblages from the area and elsewhere. To achieve a good degree of avian bone recovery sieving of some description needs to be employed, and ideally wet sieving would be practised. Obviously whilst this cannot be physically rectified for the older excavated assemblages, by identifying these possible failings in retrieval they can be accounted for in analysis to prevent forming inaccurate interpretations based on incomplete data (i.e., rather than assuming no small species were present, one can suggest that they may have been lost due to recovery).

The avian remains from the 1880s excavations on Oronsay also suggest that species which were not of interest may have been ignored and not analysed or identified at this

early stage of avian archaeology. It is suspicious that (except for swan) the only species recorded from the 19th century excavations are all large auks, namely great auk, razorbill and guillemot. The skeletal structure of these large auks is rather distinctive, particularly the wing bones which are flat and angular. The later excavations (even those in 1913) recovered several other species of a similar and larger size including gannet, shag, cormorant and goose. When considered alongside Greive's fascination with the great auk, it appears that only those bird bones which could have belonged to the extinct auk were collected, or at any rate analysed and reported upon. This is one example of the way in which the 'cherry picking' of archaeological material can affect the resultant data, both at site level (i.e. which sites were selected for excavation) but also in the faunal remains.

Whilst analyses and reports of the early 20th century approached the bird remains in a more logical and thorough manner, attention was mainly focused on ascertaining what species were present, without any formal attempt at quantification or elemental discussion, and only very rarely were taphonomic modifications observed (with the notable exception of worked bone, which in some instances are the only bird remains documented/examined). Interpretation and exploration of the meaning of such finds were barely considered (Bishop 1913, 52-108; Callander and Grant 1933, 44-516; Callander and Grant 1934, 320-350; Graeme 1914, 31-51). However, occasional comparisons are made to the St Kilda fowling community for the birds from the Knowe of Ramsay and the Calf of Eday (Platt 1936, 418; Platt 1937a, 153-154). For example, in discussing the cormorant dominated Iron Age faunal assemblage from the Calf of Eday, Platt suggested that inhabitants may have been: "using the flesh of the cormorant as an article of diet, in the same way that St Kildans and other inhabitants of the

Western Islands have been known to subsist comparatively recently on the solan goose as their staple food” (Platt 1937a, 154). Much of the work containing any avian data is again focused on the Orkney Isles, and much of this focuses on monumental structures such as the cairns of Rousay (Platt 1934 348-350; Platt 1935, 341-343; Platt 1936, 415-419; Platt 1937, 306-308; Platt 1937a, 152-154).

By the mid 20th century the potential of bird remains was more widely understood, and discussion of avian use was being published; such as Grahame Clark’s (1948) synthesis paper on fowling in Prehistoric Europe. This provides an exploration of the range of uses to which birds were employed in the archaeological past and supplements it with some later archaeological examples and ethnographic accounts (Armour-Chelu 1985, 1). However, the implementation of approaches such as this was limited, as evidenced by the aforementioned Jarlfshof papers (Platt 1956). Although Ms Platt passed away before completing the later analyses from this site, her earlier publications followed the same form (for example: Platt 1933, 135; Platt 1934 348-350; Platt 1934a, 318; Platt 1935, 341-343; Platt 1937, 306-308). It was 100 years from Steenstrup’s aforementioned work to Clark’s synthesis; a depressing indication of the slow development and application of avian zooarchaeology (Brothwell *et al.* 1981, 195; Clark 1948). Still very little consideration was being given to quantification beyond identifying that such-and-such a species was present. However, the mid 20th century saw the emergence of some important works which examined changes in the distribution of avian species and their relation to human activities, such as Fisher and Waterson’s 1941 work on the fulmar which examined the impacts of hunting, climate change, and the increase of commercial fishing on the growing fulmar population compared to its past distribution.

As mentioned above, from the 1960s onwards there has been an increase in access to reference collections (Serjeantson 2009, 5-6). This period also saw the development of important studies into skeletal morphology and methodology for major species and families, particularly within Germany with significant work being conducted by Angela von den Driesch and Joachim Boessneck at the Institut für Paläoanatomie, Domestikationsforschung und Geschichte der Tiermedizin in Munich, which also produced a series of key theses on avian remains (Bacher 1967; Erbersdobler 1968; Woelfle 1967).

The wider and fuller implementation of avian archaeology gained a strong impetus in the 1970s and particularly from the 1980s. Many important works and studies were conducted, both on archaeological remains and in research into avian biology and modern distributions. The 1970s saw von den Driesch's significant work on the measurement of archaeological animal bones, including birds (von den Driesch 1976). In 1981, in Brothwell and Dimbleby's *Environmental Aspects of Coasts and Islands*, Don Brothwell *et al.* discussed the relevance of bird remains for understanding these sites, but mention how limited their application has been (supporting the point made above). Thirty years on from this publication, avian archaeology has thankfully become much less marginalised and its great potential to inform upon human resource exploitation, seasonality, habitat use and movements around the landscape has been realised and implemented to a greater (if still limited) degree.

Other work has explored how to approach complex avian assemblages, including Miranda Armour-Chelu's work on the Neolithic assemblages from the Links of Noltland on Orkney (1985 and 1988). Armour-Chelu's work was significant for

addressing the importance of distinguishing between anthropogenic and non-anthropogenically assimilated material occurring at archaeological sites. Identifying natural deposits is important to prevent them being mistakenly interpreted as e.g. human food remains and having associated significance attached. Furthermore, Armour-Chelu also explores what information is available from 'natural' assemblages when they are identified alongside cultural deposits, rather than just identifying non-anthropogenic material in order to exclude it. For example, material deposited by non-human agents can inform upon the depositional sequence of a site and help to identify species living in the vicinity, such as the short-eared owl which was proposed as an avian predator responsible for part of the Links of Noltland assemblage (Armour-Chelu 1985, 3-5; Armour-Chelu 1988, 74-5). A more thorough approach to quantification and recording was developed, and birds started to become more frequently integrated into wider site discussion and interpretation. The 1980s also saw developments in the identification of avian eggshell with Keepax's 1981 publication 'Avian Eggshell from Archaeological Sites' (Keepax 1981, 315-335). This was then developed and further implemented by researchers such as Eastham and ap Gwynn (1997, 85-94) for material from Neolithic Skara Brae, Orkney, and later by Jane Sidell whose work encompasses methodological developments and their application on Scottish to Icelandic material such as that from Freswick Links, Caithness, Scotland and Mývatn, Iceland (McGovern *et al.* 2006; Sidell 1993, 211-213; Sidell 1995).

The 1990s not only saw the creation of the ICAZ Bird Working Group, but also the publication of vital identification guides such as Cohen and Serjeantson's 1996 'A manual for the identification of bird bones from archaeological sites'. This proved a key resource for aiding identification, and perhaps most significantly introducing zoning to

the study of avian bone (which Serjeantson employed in many of her Scottish Island analyses). Not only does the use of zoned bones provide a more detailed and scientific manner of recording, assessing and interpreting avian material, it also provides a much more comparable framework for integrating the avian data with mammalian bone material. Other publications focused on the creation of suitable avian reference collections (Corke *et al.* 1998, 67-69) highlighting this need to a wider readership, which was important for work in the Scottish Islands and further afield.

However, whilst some of the reports from the 1980s were detailed and exemplary, there are still many problems encountered when extracting usable data from both them and later examples (this is explored further below). No doubt in 20 or 30 years time advances in technique and technology may mean that our modern work is considered lacking. However, these improvements should be striven for and welcomed since they will help the field develop further and increase the information that can be obtained from archaeological bird remains.

The development and application of avian archaeology in the Scottish and North Atlantic islands has varied by geographical setting. Naturally the study of avian remains from these locations is determined by the nature of excavation in these areas. As already mentioned, Scottish Island excavation was initially heavily focused on Orkney and despite extensive surveys and archaeological fieldwork in the other islands from the late 19th century onwards, in the assessment of avian remains, there is still a distinct focus on Orkney. This appears to have arisen from several sources.

Firstly, the early focus on the many rich, visible Orcadian archaeological sites made the

avian material accessible for analysis. Secondly, the presence of monuments such as Isbister: The Tomb of the Eagles, or the chambered cairn on the Point of Cott Westray, which have a clear relationship with the white tailed-eagle would also have provided an incentive for avian analysis, to aid interpretation of these intriguing sites (Bramwell 1993a, 159-170; Harman 1997a, 49-51; Pitts 2006, 86). Thirdly, many of the Orkney avian assemblages had the good fortune to be analysed by thorough and foresighted professionals, such as Don Bramwell, who produced detailed data and interpretative reports (particularly in the 1970s and 1980s) that tackled issues such as seasonality, resource use and species purpose. These provided a sound basis for works such as Dale Serjeantson's 'Archaeological and ethnographic evidence for seabird exploitation in Scotland', which included comparative analysis of bird remains from six sites (Serjeantson 1988, 209-224). Unfortunately the availability of comparative material preserves the geographical imbalance to an extent, with this particular study only containing one non-Orcadian site – that of Udal on North Uist, Outer Hebrides, which Serjeantson herself analysed. And fourthly, the archaeological assemblages from the Western Isles experienced an unfortunate hiatus in analysis due to the death of Judith Cartledge who had been analysing many of the Hebridean avian assemblages, in particular several from South Uist.

The new analyses conducted as part of this thesis have sought to rectify this hole in the zooarchaeological record of the Western Isles. Judith Cartledge had partially analysed some of the material from sites such as Cladh Hallan and Cille Pheadair, however these needed recommencing, partially because it was often unclear which material had been analysed, and most importantly to ensure compatibility between all the new assemblages in the form and level of analysis (e.g. use of zones to calculate the

Minimum Number of Elements [MNE] and Minimum Number of Individuals [MNI]). Other material including the large assemblages from Bornais Mounds 2 and 2A, had not yet been started, but sorting of the material appeared to have begun. In addition to these assemblages material was also analysed from Askernish, Frobost and Sligeanach on South Uist, from the newly excavated site Sloc Sabhaid on Baile Sear, and (re-analysed) for Northton on Harris. The author has also previously analysed the remains from multiple sites on the Shiant Isles in the Outer Hebrides (Best and Mulville 2010).

This has helped to provide a much larger dataset for the Western Isles across several periods, which starts to balance the geographical discrepancy in avian data and therefore allows greater comparison of avian resources between island groups, in order to explore geographical and temporal traits in fowling and species use. However, assemblages which have not yet been analysed are just one problem facing avian research in the Scottish Islands.

2.5 The Avian Material and Past Analyses

Size and Survival: Birds as a Material

The form and size of avian bone determined its survival and recovery and can hinder its presence in the archaeological record. As a generalisation, the majority of birds are significantly smaller than most of the domestic and wild mammal species commonly utilised by past human populations. As a result, one of the first issues to be considered is the recovery of bird bone from archaeological sites, particularly when handling older data. The small size of many bird bones inevitably means that their presence can be affected by human failure to see them during hand collection, even on the most diligent

of excavations. Sieving, flotation and/or sampling are therefore important for ensuring that the avian assemblage collected is representative of past exploitation rather than reflecting the easier recovery of larger species (Armour-Chelu 1985, 1-6; Serjeantson 2009, 100-104). Inadequate soil processing practices can radically alter the make-up of an avian (and fish) assemblage to a far greater extent than is normally seen with mammals. Size and recovery are therefore issues considered when collating some of the older reports and data considered in this work. As discussed above, avian archaeology has developed significantly since its origins, and with this increased awareness came a greater understanding of the need for detailed soil processing programmes to recover faunal and floral remains. While avian assemblages from non-extensively sieved/sampled sites are still of value, one must understand sieving's importance in order to assess what might be missing, and what may have been present. For example if an assemblage includes no small species but contains comparably small elements from larger birds (i.e. phalanges) it would be reasonable to suggest that the assemblage is not biased and that this pattern may have arisen through the targeted hunting of certain larger species. However if an assemblage contains only larger bones from medium or large birds it may be that the small elements were not retrieved during excavation, in which case caution should be taken to mention that smaller species might be underrepresented. In this scenario it is also important to remember that preservation may have also biased the assemblage. This is another point in which the development of a deeper analysis of avian bone incorporating quantification and elemental recording is vital for understanding the processes that have created the assemblage under study.

Size is also a contributing factor when it comes to the preservation of avian bone. As mentioned above this may result in the loss of small elements or species, which could

then be misconstrued as past patterns of preferential exploitation. This is particularly problematic in reports where elements are not recorded, making the true size bias hard to determine (for example Bishop 1913, 52-55, Grieve 1881 *or* Harman 1997a, 49-51).

In common with mammalian bone, juvenile birds are also less likely to survive in the archaeological record. Immature birds are often very fragile, crumbly and can be hard to identify in excavation. Very juvenile birds are usually not identifiable to species or family but those approaching skeletal maturity may be accurately assigned and provide valuable answers for questions regarding seasonality and age-related exploitation. However here it should be noted that (unfortunately for the zooarchaeologist) a bird's skeletal maturity does not necessarily correlate with its plumage or its fledging (Cohen and Serjeantson 1996, 7). Thus a juvenile bird may have a completely fused skeleton and archaeologically appear mature, when ornithologically speaking the bird may still be in immature plumage and not of breeding age (Cohen and Serjeantson 1996, 7; Serjeantson 2009, 10). It is therefore vital that even the slightest signs of juvenile porosity are carefully looked for during analysis, and that this is used in conjunction with other indicators of young birds, for example eggshell, and summer-focused exploitation. In this way, even in an assemblage which appears to consist of solely adult birds, the possibility of juveniles can be more accurately explored. Unfortunately juvenility information was only presented for a third of the assemblages used in this thesis, and about half of these only gave limited information on the juveniles.

Problems of Analysis

More avian bone has been recovered and analysed from some periods than from others. Due to issues of preservation and accessibility (discussed above in section 3.2) less concentrated occupation periods of prehistory such as the Mesolithic are under-

represented in the faunal data both the Northern and Western Isles, with sites such as the shell middens of Oronsay and the site of Sand (Inner Sound) being vital exceptions for facilitating study of this period in the Scottish Island landscape, albeit focused on a specific area: the Inner Hebrides. Substantially more Orcadian Neolithic sites have been excavated and the faunal data analysed, published and made available than in the Hebrides (and Shetland). This again means that comparison of faunal assemblages between the Northern and Western Isles in this period is biased by sample size. There is a more balanced number of Bronze Age sites from the Northern Isles and the Hebrides. Proportionally more sites have been excavated in the Scottish Islands from the Iron Age onwards. Naturally this provides more faunal and avian assemblages for examination from these periods and a greater resolution, which determined the extent of interpretation in this thesis.

However, even where avian analyses exist they are often fraught with problems, particularly when endeavouring to compare and contrast them. Although the vast majority of pre-existing analyses are valuable sources of information, care is often needed to extract data without unintentional bias and bring them together into a coherent and workable body. This can then form the basis for interpretation and the identification of geographical and temporal avian patterns and allow examination of resource use, habitat, climate, preference, dietary contribution and symbolic aspects of avian-human relationships across time and space.

Regrettably, in many instances the avian remains have been seen as a very insignificant part of the archaeological material due in large part to biased preconceptions and a lack of understanding. For example, even as recently as the 1960s Clarke writing of the birds

from A'Cheardach Mhor on North Uist states that they were 'mainly inedible' (Clarke 1961, 169; Serjeantson 1988, 209). The species to which he refers include gannet, swan, shag, puffin and gull all of which are well known to have been consumed in the Scottish Islands from documented fowling communities, historical sources and archaeological evidence. This site also highlights some of the other problems hindering avian analysis. Between Clarke's 1960s report and a report based on this material by Judith Finlay in the 1980s some of these bird bones had become lost or were missed, with only four bird bones being recorded as identified from A'Cheardach Mhor. Although two further bones were recorded as unidentifiable it could suggest that information and material may have been misplaced in the intervening time.

As a result of these kinds of mindsets many of the avian analyses are woefully incomplete both in terms of the zooarchaeological data presented and in the lack of interpretation that this material receives. Perhaps the most depressing are publications where the majority of the faunal assemblage has been identified to species even for unusual mammals, fish, and shells but the avian remains are simply recorded as 'bird' as though this is a species and a sufficient identification. For example the remains from Room 5 Brough of Birsay were recorded in such a fashion:

“The animal remains from Room 5 have been assumed to be kitchen refuse.
The species represented by the samples include cattle, sheep/goat, pig,
rabbit, otter, rat, vole, bird, cod, mackerel and ray.”
(Sellar 1982, 132)

Without any identification having taken place the report then goes on to speculate that:

“The bird bones may represent occasional trappings of wild species
or domesticated chickens and geese.”

(Sellar 1982, 133)

So while it is apparent that birds were present, for assemblages such as this no other information on their species can be gained without locating the remains and reanalysis, which is beyond the scope of both this and many other works seeking to make comparisons. Unfortunately a number of zooarchaeological assemblages have been disposed of or lost, hindering any future rectification for all classes. For example, Bu on Orkney produced one of the largest collections of bones (including birds) from an Early Iron Age Orcadian site. However, "It is unfortunate and irredeemable that the bones were identified (by the late Barbara Noddle) without reference to a context and were then destroyed" (MacKie 2002, 89). Fortunately the birds were analysed by Don Bramwell, providing at least detailed species frequencies. However, it is unclear if the avian material in this instance was also destroyed, or just not located at the present time. In another example, Caroline Grigson is writing up a paper on the birds from the aforementioned Oronsay middens based on the edge-punched cards from an analysis conducted by Don Bramwell which was never published or made accessible. However, she has been unable to locate the original bones to aid this work (Grigson pers. comm.).

It is also often the case that even where a seemingly thorough analysis of the bird bone has taken place it is frequently recorded and published in such a way that very little information can be retrieved from it. For example, the stalled cairn at the Point of Cott on Westray, Orkney produced a varied and potentially very informative assemblage. However, in its publication the number of fragments identified for each species is not presented in the single table detailing the results for all species (Harman 1997a, 49-51).

The only attempt at explaining frequency of occurrence is recorded thus:

‘P’ = present

‘A’ = more than 5 bones represented

This means that 'A' could represent from five fragments to infinity. While it is obviously valuable to know which species were present, it detracts greatly from the overall interpretation since variations over time cannot be accurately assessed, and it cannot be ascertained which species were most commonly exploited. This information is only elaborated upon for one species, the white-tailed eagle, which had at least 139 fragments present from several layers and deposits (Harman 1997a, 49-51). However from the aforementioned results table it could only be said that there are at least 25 white-tailed sea eagle fragments present, with 'A' (greater than 5) recorded in five different features. This highlights how uninformative and potentially misleading data presentation can be, masking the frequency of the other 24 species and two categories (Corvus sp. and Wader). While not intent on singling out this particular work for unique criticism (particularly considering Harman's excellent work on St Kilda) it is important to highlight some of most common failures in the study, interpretation and presentation of avian remains in order that they may be addressed for future works and the limitations of existing studies made clear.

Following on from the above, another persistent problem is the inconsistent level to which avian analyses are conducted and the level to which the data are published/made available. In contrast with the mammalian data from these island sites many of the published avian reports do not include any usable element data (around four-fifths), MNI (minimum number of individuals) and only a few analyses include any information on juvenility or any mention of butchery (around a third), burning (just over a quarter), or gnawing (less than a third). These inconsistent approaches are damaging in several ways. Firstly the data are not widely accessible or incorporated into the overall analysis of faunal assemblages conducted by other archaeologists. Secondly the reader is left not knowing whether merely the publication or the analysis itself was

lacking. And thirdly it makes any form of comparison between sites, periods or islands difficult without extensive work, which is often beyond the scope of a site publication, or short report. Even within this thesis it has been challenging.

Unfortunately many of the older (and some newer) avian analyses were more concerned with identification to species than in identifying any of the other information such as element, butchery or juvenility. For example at Iron Age Scalloway the bird bone analyst records that ‘Very few if any butchery marks of any kind were evident on the Scalloway bird bones’ (O’Sullivan 1998a, 119). Firstly, it is impossible to determine from this if any butchery was actually identified; presumably some possible examples were noted but were not in good enough condition to be confidently identified. Secondly, even tentative butchery marks should ideally be noted since it would have provided useful evidence for investigating the assimilation of material in the mixed broch destruction layers, which could help exclude intrusive species.

Early avian analyses rarely refer to element, in some instances an attempt is made but lacks scientific vigour, such as Platt 1937 (306-308) where the gannet is described as having ‘two pieces of the wing-bone’ present. Unfortunately there are several wing-bones this could be! Other assessments (such as the Howe) record elements but only for the birds as a whole, and not for individual species, thus making cross species analysis of processing and deposition difficult (Bramwell 1994, 153-157). The sites for which there is no elemental evidence dictate two responses. Either: consider avian trends using NISP, the level of quantification most commonly present, or undertake reanalysis of the avian data to achieve a level of analysis more akin to mammalian bone and the newly analysed (‘novel’) avian assemblages. Due to the impossible scale of reassessing and

reanalysing all avian bone from Scottish Island sites within the scope of one PhD, NISP will be heavily used (see Chapter Three: Methodology).

Fortunately the bird remains from some archaeological sites in the Scottish and North Atlantic islands have received some thorough and detailed attention. This is primarily due to the work of a handful of individuals who have combined a more thorough approach to analysis and publication of avian zooarchaeology with attention to the interpretation of the data and consideration of the birds in their contextual situation. These include Don Bramwell, Judith Cartledge (with C. Grimbley), Sheila Hamilton-Dyer and Dale Serjeantson. As an example, the relatively short avian report for Dun Vulcan on South Uist manages to present species frequency and elemental representation before considering worked bone, seasonality, the main species exploited, the historical accounts of gannet as food, and capture methods (Cartledge and Grimbley, 1999, 282-288). The report then goes on to explore the symbolic role birds may have held, the differential loss of avian and mammalian bone, birds as a proportion of the food, and the problems in these calculations, before assessing the avian remains from different areas of the site and comparing Dun Vulcan to other sites. But even this valuable report does not present all the taphonomic information, for example only mentioning one example of butchery but alluding to more. Unfortunately exploring the taphonomic character of the avian assemblages is often beyond the remit of the reports. This probably was partially a result of practical considerations such as time constraints and financial limitations, but also arose from the unfortunate tendency which emerged for only exploring avian remains on a basic level (i.e. species present) rather than as part of wider interpretation of processing, animal husbandry and to the same level as mammalian and fish research.

However, another difficulty of some past analyses (even by the aforementioned Bramwell) concerns the introduction and use of domestic birds on the Scottish Islands, which has proved to be an intriguing and yet sometimes overlooked research question in the alteration of avian-human relations. Within the Scottish Islands there has been a strange initial reluctance to accept that Iron Age (including Pictish) populations had domestic birds. For example, in the avian report for Pre-Norse/Pictish and Norse Buckquoy Bramwell was keen to identify the single Pre-Norse/Pictish domestic fowl bone as intrusive material from rabbit burrowing. Whilst possibly correct, no evidence of intrusion is given before stating that this ‘suggests very strongly that Pictish people did not have any domestic birds at all’ (Bramwell 1976, 209). Although Bramwell largely rectifies this Buckquoy statement in the later Howe publication (1994), showing that the importance of these early specimens for investigating introduction was becoming recognised, it does suggest that other early examples may have been dismissed or misidentified.

Achieving a detailed temporal resolution within the collation and comparison of avian data is often challenging and problematic; this also affects and limits the extent to which it can be examined alongside other classes (e.g. mammalian remains). The often small size of avian assemblages can render splitting it into small groupings problematic and unproductive for overall analysis. In many cases, the diverse species makeup and the small quantity of each species present can make breakdown by phase/small period unsuitable for presentation in final reports; although often the zooarchaeologist will have conducted this as part of the analysis. As such, this information is not easily accessible to the general zooarchaeologist who may wish to perform comparative analysis with a site that he or she is working on, and who may not have the luxury of

time/finances to research thoroughly and find such data. To use the (in general excellent) report from Dun Vulcan as an example again, birds are not presented in the publication to the same temporal resolution as the mammalian remains, which meant that this Middle-Late Iron Age assemblage could not be examined by more detailed phasing division (Cartledge and Grimbley, 1999, 282-288). Phasing for the bird remains can only be inferred from in-text references (e.g. domestic fowl only appear in the Late Iron Age levels) and areas which had specific temporal activity (Cartledge and Grimbley, 1999, 282-288). In other cases, where avian remains may have been regarded as less informative this level of analysis was not deemed necessary. This can limit the exploration of the data for temporal patterns and variations.

Previous Comparisons

Some comparative analyses of avian bone from Scottish sites have taken place, but to date these have usually been very period and/or place specific and conducted in order to complete a wider faunal or environmental analysis. These are well researched and informative, such as Jennifer Harland's 2006 thesis 'Zooarchaeology in the Viking Age to Medieval Northern Isles, Scotland: An investigation of spatial and temporal patterning', and Dale Serjeantson's aforementioned fowling paper (Serjeantson 1988, 209-224). However their application is limited to their specific spheres (geographically, temporally and conceptually) with very little wider interpretation of the avian data in terms of human activities, hunting skills, resource use, environmental reconstructions, habitat or seasonality etc. As a result a wider collation of data which reached beyond one period, location and or purpose is a crucial part of this thesis.

Sex and Season

Another point of concern and regret is the lack of data for avian sexual profiles. Sexual data in any form was only recorded at a fifth of the sites/period subdivisions considered here. Bird bones offer fewer opportunities for accurate sex identification than mammalian remains with only a small number of sexual characteristics in skeletal morphology. As with mammals, measurements can be used for sexual identification but wide variation in intra-species size for many birds limits their application, as does fragmentation and assemblage condition. The presence of a spur on the tarsometatarsus of the cock bird in many Galliform species is a useful sexually diagnostic characteristic. However it is not always present and hens can occasionally grow spurs, preventing this from being a definite identification of sex (Baker and Brothwell 1980; Serjeantson 2009, 48). Furthermore, building sexual profiles based on one element is notoriously problematic, since natural preservation and human modification may have affected the elemental distribution.

Medullary bone is the most definite sexual attribute for identifying sex in female birds, and its importance should therefore not be underestimated (Armour-Chelu 1985, 20). Medullary bone is a deposit of calcium which forms in the long bones of female birds just before and during the egg-laying period (Dacke *et al.* 1993, 63). It then disappears at some point soon after the lay, however the timings concerning its deposition and disappearance are not only poorly investigated, but also appear to be highly variable. Unlike spurs it occurs in multiple bones of the body providing a greater opportunity for observation. However, whereas spurs are permanent, medullary bone is a temporary feature with a small window of opportunity in which the bird could be killed with it present. Also, since it forms within the bones it can only be observed in broken

fragments unless intrusive sampling or x-ray analysis is employed (such as that conducted by Amour-Chelu (1985, 19-21) for the Links of Noltland Material). Birds that are repetitive layers (e.g. domestic fowl) will contain medullary bone for a greater proportion of their lives compared to other species which lay once annually. This is very useful for investigating animal husbandry, resource management and egg production. The quantity of domesticates with sexual characteristics is therefore likely to be higher than that of their wild counterparts. This should be remembered in order to prevent seasonal wild fowling from being underestimated.

Whilst sexual profiles are valuable in their own right, the very small proportion of an assemblage which can be assigned a sex limits application and interpretation. However, perhaps most importantly for wild species medullary bone is an indicator of the season in which they were captured. It provides evidence that females were being taken in their breeding season, and indicates this was occurring near to their nesting sites. Sex along with species and juvenility can therefore show seasonal resource use and provide a fuller picture of avian-human interactions.

The lack of sexual data in the bird bone reports for the Scottish Islands is problematic. If medullary bone is actually absent rather than just not recorded, it can inform upon seasonal resource use, or the birds selected for capture (e.g. avoidance of laying females). One sentence such as 'no sexual characteristics were noted' would facilitate fuller analysis. However in many cases it is impossible to distinguish between lack of sexual presence and that of incomplete analysis, lack of recording or limited reporting. For example, in some instances a faunal analyst who was not specialised in avian remains may not have observed and identified certain sexual characteristics. It is

probable that medullary bone may not have been checked for in every possible specimen and only noticed when present in full profile rather than just as a thin trace.

Cautions in Calculating the Relative Importance of Species in an Assemblage

Developments in avian archaeology as a whole have resulted in a greater number of identification guides being available to those studying bird bones. Many of these recent works focus on distinguishing between ecologically and skeletally similar species, such as Zbigniew Bocheński's "Identification of skeletal remains of closely related species: the pitfalls and solutions" (Bocheński 2008, 1247-1250). Identification accurately to species is essential for calculating species abundance and MNIs and for informing upon specific archaeohabitats or environmental and climatic conditions (Gál 2006). However, with older analyses we must be aware that without the benefits of these modern studies, birds may have been assigned to a species which we now know to be indistinguishable from another on certain points of the skeleton. For example, many bone parts from the herring gull are impossible to differentiate from the lesser black-backed gull. In modern bird reports this caution will often be expressed by identifying bones to i.e. 'Herring/Lesser Black-Backed Gull'. Although this may look as though identification skill has decreased over time, this caution is necessary to prevent inaccurate reconstructions of the past and is based on our increased understanding of which skeletal features are reliable indicators of species. One should therefore consider the extent to which overconfident identification may have affected species frequency in past analyses.

One other point should be mentioned in relation to this. It is important to remember that just because a zooarchaeologist with all the benefits of modern research, resources and

reference materials will be able to distinguish a lesser black-backed gull from a greater black-backed gull or different goose species, it does not mean that people in the past did. Even the population of St Kilda in the early 20th century, who at this time still relied in large part on seabirds for subsistence and trade, did not distinguish between the shag and the cormorant (Serjeantson 2009, 5; Maclean 1992, 90-109). These two important species (which are year round residents to the islands) were all simply referred to as cormorants.

Birds being captured in the past may therefore have been classed and described according to different criteria to that which we use today. For example, categories or naming may be based on those birds that behave in a similar way, have similar breeding patterns, arrive on the islands at the same times, or produce certain products. Were, for instance, birds such as the Manx shearwater and the puffin considered together due to their ground nesting habits? Did past peoples exploiting a multitude of gull species regard them all as just 'gull' based on their ecological attributes, and is it possible that even birds such as terns or the fulmar could have been included in this? While these are essentially archaeologically intangible questions, anyone examining archaeological bird bone would do well to consider these possibilities. This means that when an assemblage is analysed, the bones identified to species and then quantified, the patterns that emerged can be interpreted in more ways. We must for example in certain cases not try too hard to understand why say more herring gulls were killed than common gulls, when the people exploiting them may not have made this distinction.

This means that our caution in identifying between species such as herring and lesser black-backed gull need not be detrimental to the overall information we can attain from

an assemblage since these may be purely modern distinctions. For this reason some reports, in addition to examining individual species, will also consider them in wider groupings such as gulls, geese, and swans in order to see what overall contribution these may have made to the fowling economy.

The increased access to paper and digital identification guides mentioned above can have a surprising negative side effect. These guides are designed to aid identification and not to replace the use of a proper reference collection of osseous material. Of course, they are very useful for in-the-field initial identification where such collections are not available, but overconfident identification based on limited material and (in some instances) knowledge can be damaging. Even to the trained eye one bird bone can look very much like another, and just because it may look like a specific illustration or image in a reference book, there could equally be another 20 species that also look very similar! This leads us to consider the species identifications present in the existing reports being collated.

Establishing a Control

While it was essential to make use of a wide range of previously conducted avian analyses to complete this work, the validity of these identifications and reports were tested in several ways to facilitate their inclusion in a way that reflected the actual bone data most accurately and to try to eliminate errors that could bias the work. Firstly the avian dataset itself was examined to identify identifications that (with modern knowledge) we know to be untrue or exceedingly problematic; these were then investigated further (i.e. who made the identification, the date of the work, and the skeletal element). This helped to ensure that accurate but unusual identifications were

not excluded or lowered in classification (e.g. from lesser-black backed gull to herring/lesser black-back gull) while rogue identifications were highlighted. The analyst who conducted the bone work was considered. If it was, for example, a student engaging in early avian material work then more care was sometimes necessary to counteract overambitious levels of identification (e.g. small passerines). Others such as Don Bramwell are very well renowned in the field of avian research but were working at a time when certain research on speciation had not yet occurred, and changes reflecting such developments can be observed between his early and later works (Bramwell 1976, 199-200 to Bramwell 1994, 153-157). Collating this material created familiarity with the skills and identification styles of several of these zooarchaeologists, allowing understanding of what data may be trusted and which may require care. For example, Judith Cartledge conducted several important Outer Hebridean analyses and passed away while still working on material from multiple sites including Cladh Hallan, Cille Pheadair and Bornais. As aforementioned in the case of Cille Pheadair analysis had been well started, and she had begun to sort material from some of the other assemblages, bagging it by species or 'taxonomic group'⁴. However, even within the short period between her death and the start of this thesis some of her paper records had become lost.

The case in point here is that by working with this partially pre-handled material (which was completely restarted by the author of this thesis) it was noted that Cartledge (who was a skilled avian archaeologist) had a repeated tendency to assign small waders to species that were by no means identifiable to such a level and as such was being over confident in this specific taxonomic area. This knowledge ensures that this over

⁴ However, the majority of the bone from the largest assemblages of Bornais Mound 2 and 2A had not been touched.

confident identification could be identified and rectified in her other work, which allowed its accurate inclusion in the collation under broader taxonomic titles such as ‘Small wader *cf.* phalarope’. After drawing this conclusion it was established in conversation with Dale Serjeantson (who had written up Judith’s work on Bornais Mound 1), that she had also been concerned with the level of small wader identification, and adjusted the material accordingly (Serjeantson pers. comm.). Although this concern over distinguishing between such similar species may seem pedantic, it is important. Even species within a group such as ‘plover’ inhabit different regions at different points of the year. Overconfident identification of say a plover to grey plover could suggest a past distribution and availability of resources that did not in fact occur, since the grey plover only winters in Britain whereas the golden plover breeds and has wintering populations (Davidson *et al.* 1991 422; Moser 1988, 473; Stroud *et al.* 2001a, 260; Tubbs 1991). Cartledge was also rather prone to over identify subadults when there was no evidence of such on their bones. The author suggests that she was misinterpreting certain taphonomic features as potential late juvenility.

Caution has also been employed in handling some of the domestic bird identifications in the collected material. Whilst the chicken is a non-native introduction to Britain which can (in general) be reliably distinguished from wild members of the Galliform family in Britain, the situation is more complicated for geese and ducks. Both of these have many wild relatives in the locality which are often very difficult to distinguish between. As such where the published material has claimed an identification but not specified the criteria used, the specimen is treated with a degree of caution to ensure reliability of the identification (using e.g. knowledge of the zooarchaeologist’s work to aid the decision). Identifications can then be classed as e.g. ‘probable domestic goose’, ‘possible domestic goose’ or ‘greylag/domestic’. (See section 3.4.1 for criteria used in new analyses).

It has also been unfortunate that even in very modern reports ambiguous assignment to species is sometimes present. For example the faunal report for the Mesolithic site of An Corran (Bartosiewicz, 2012) is in many ways very good; the elements for birds are presented and metric data are also contained within the faunal report (although the MNEs are not presented and there is no mention of sex or taphonomy for birds). However, the analyst creates confusion by referring to a group of bones as both ‘*cf. shag*’ and as decisively ‘Cormorant *Phalacrocorax carbo*’. Only once later in the discussion is it mentioned that some of the bones recorded as *Phalacrocorax carbo* could actually be *Phalacrocorax aristotelis* (Table 2.1). While it is perfectly correct to classify the shag as part of the cormorant family ‘*Phalacrocoracidae*’ they should not be referred to as ‘*Phalacrocorax carbo*’ which refers exclusively to the great cormorant. This means that even where the actual zooarchaeological identification is sound, the reporting of data can contain surprising and potentially misleading errors. It is important that data are presented clearly, particularly for species such as these where there is some interchangeability in terminology, both in past and present contexts.

“Bones from the other species in this order, cormorant (*Phalacrocorax carbo* L. 1758), are more common and occur in two size groups. The two gracile carpometacarpalia bones found in C36 may be shag (*Phalacrocorax cf. aristotelis* L. 1758).”
 (Bartosiewicz 2012, 57)

Table 2.1: Species frequencies from An Corran (Bartosiewicz 2012, 48)

Vernacular name	Latin name	Mesolithic		Post-Mesolithic	
		NISP	Weight, g	NISP	Weight, g
great auk	<i>Alca impennis</i> L. 1758	17	50.8		
gannet	<i>Sula bassana</i> L. 1758	1	6.1	1	1.4
cormorant	<i>Phalacrocorax carbo</i> L. 1758	7	16.9		
white-tailed eagle	<i>Haliaeetus albicilla</i> L. 1758	2	5.5		
pomarine skua	<i>Stercorarius pomarinus</i> L. 1758	2	1.6		
gull	<i>Larus argentatus seu marinus</i>	2	1.0		
guillemot	<i>Uria aalge</i> L. 1758	1	1.1		
puffin	<i>Fratercula arctica</i> L. 1758	81	44.7		
willow tit	<i>Parus atricapillus</i> L. 1758	3	0.1		
thrush	<i>Turdus cf. merula</i> L. 1758	1	0.1		
perching bird indet.	Passeriformes	7	0.0		

Other authors had analysed bones from several sites in (often period specific) comparative work. One of these included Finlay's 1984 thesis 'Faunal evidence for prehistoric economy and settlement in the Outer Hebrides to c.400 AD'. Finlay did not have much avian identification knowledge prior to this work, and since many important sites were analysed by her, the decision was made to reanalyse one of these assemblages as a control for the other work she had conducted and to explore what commonly made mistakes may be present in other analyses. The site of Northton was selected for re-analysis since this was a multi-period site with rare Neolithic remains in addition to Bronze and Iron Age birds (Finlay 1984, 46-55). This reassessment showed that while Finlay had made good identification with the main species some basic mistakes had been made when confronted with unusual specimens or uncommon elements. This is likely to have arisen from limited reference material and less experience in ascertaining which other species may need to be consulted for a particular bone. For example, Finlay had identified a proximal, well preserved white-tailed eagle humerus as a stork. This is quite a serious mistake considering the implication of interpretation that these rarer species may have, particularly since it is published and people will access and refer to it (Finlay 2006, 174). It is likely that if not having encountered any birds like these before the analyst was at a loss as to how to proceed with the identification and therefore upon finding a similarly sized and (to some extent) structured bird bone assumed a correct match had been made. In Finlay's analysis no raptors were recorded, when in fact a tarsometatarsus of a peregrine falcon was also present and was notable in that it had strong deep cuts midshaft.

Finlay is by no means the only analyst to have encountered identification problems for unusual specimens. The bird remains from Fishbourne Roman Palace in Chichester

were initially reported to contain seven fragments from the great bustard (Allen 2009, 184; Eastham 1971, 389). The identification of any bones from this species is particularly significant and interesting since they are extinct from Britain today, and archaeological evidence for their presence in Britain is limited to a handful of sites such as Late Pleistocene/Early Holocene Port Eynon (Harrison 1987, 60-64) or Gough's Old Cave (Harrison 1989, 410; Tyrberg 1998, 468) to Late Medieval Baynard's Castle (Allen 2009, 184; Bramwell 1975, 16-19; Yalden and Albarella 2009, 163-167). However, the original Fishbourne identifications (by Eastham) were challenged by Allen who reanalysed the assemblage and re-identified them as crane (Allen 2009, 184, 188-189).

Unusual species were not the only challenges faced by analysts such as Finlay; less commonly encountered elements were also misidentified. For example a cranium that Finlay had identified as a red throated diver was in fact a guillemot. While these species do share some cranial similarities (see Figure 2.12) it shows that the analyst was not fully aware of the characteristics shared between certain species and perhaps not examining the morphology of each bone to the correct degree to assess the characteristic features. It could also suggest that in some cases the specialist is looking at a bone and then deciding based on overall superficial visual analysis that since it looks like a certain species it must be that one, without further comparative analysis or metric data. A bone may well look like a particular species, but there could be another 20 or so species which it also looks like, and which it may not be possible to distinguish between, or which need in-depth analysis of repeatedly identifiable characteristic features. Not only do incorrect identifications such as this imply that a species was present when in fact it was absent; but it also detracts from the range of elements by

which an important seabird (the guillemot) is represented, which could bias interpretations of resource processing. Perhaps more concerning is one seal bone (apparently recorded) as ‘unidentifiable bird’ – although in this instance there is a chance that someone else may have wrongly bagged the specimen.

Like Cartledge, Finlay was also overconfident in identifying some bones to exact species, including small passerines, small waders and one duck. However these are common mistakes to have made and can easily be rectified in the collation of the data by assigning them to broader categories e.g. ‘wader *cf.* redshank’.

Figure 2.12: Skull of red throated diver (top) and guillemot (bottom) (WWW8-9)



Other examiners, such as A.S. Clarke (Pierowall Quarry), again conduct exceedingly specific (and probably inaccurate) identifications of small passerines to species, but then make some disconcerting comments regarding a gannet coracoid and ulna, which he says are ‘*cf.* gannet’ but ‘rather small for a gannet’ (Clarke 1984, 111-112). These bones

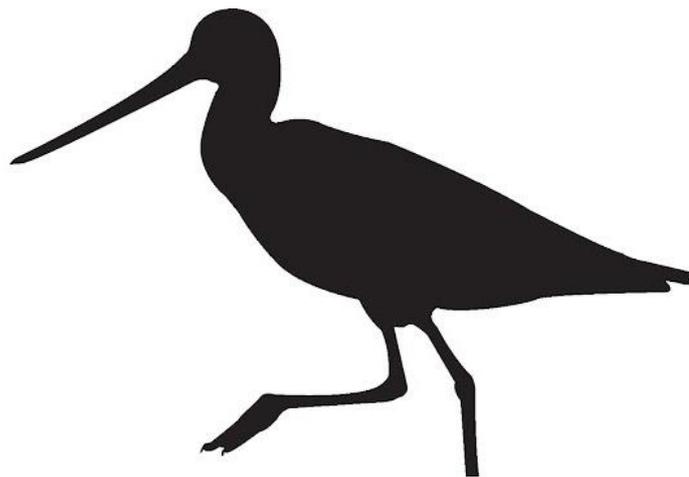
are very distinctive and (although zoning is not applied) the specimens here do not appear to have been particularly fragmentary.

Examples such as this serve to demonstrate that identifying and analysing avian bone is (like any archaeological or zooarchaeological area) a specialism in which it takes time and resources to develop skill. They also emphasise the importance of a sound knowledge of avian ecology to aid and ground identifications (i.e. of similar families, subspecies and their biological make up, shared morphological features through to the introduction of domesticates etc). Unfortunately (due to several constraining factors such as money and availability of reference material) it is sometimes the case that a very good zooarchaeologist is expected to identify all the bone material from a site, even when certain groups fall outside of their particular skill set, which can result in limited analyses. For example the author of this thesis, while having had basic training and grounding in fish identification, would desire much further practise before confidently handling a fish assemblage to a high level of data recovery.

The methods used to handle the collated data (and to control the potential limitations and problems highlighted here) are explained in the following chapter.

CHAPTER THREE

METHODOLOGY FOR COLLATED AND NOVEL ASSEMBLAGES



3.0 Introduction

This chapter presents the methodology of the work within this thesis. The methodology incorporates several main areas:

1. The approach to the work addressed within this thesis, its context, and how the research was conducted.
2. The criteria, restrictions, and protocols that govern and determine the zooarchaeological study of avian bone.
3. The analysis of new bone and eggshell assemblages.
4. The collation of existing data.
5. The manipulation of the entire dataset.

To ensure clear understanding of the avian material contained within this thesis these items (and in particular points two and three) will be outlined separately in this chapter. This will allow the data to be considered and addressed in a more holistic way throughout the study.

This chapter rationalises the area chosen for study and the manner in which the work was approached (including terminology). It then explores the natural and anthropogenic factors determining archaeoavian survival and recovery, including those processes which are outside the control of the archaeologist and those which are the product of archaeological activities, such as restrictive decision making during excavation and analysis (Gál 2007, 11). Also outlined within this chapter are problems encountered in the quantification of avian remains and its comparison to other osseous material, the effect of sample size, and the impact methods of recovery have upon avian bone and eggshell from Scottish and other North-East Atlantic island sites. Developing this point,

the methods by which pre-existing analyses have identified, assessed and presented the avian material will be explored to show how they have been collated and made comparable. This chapter also details the methods used to identify, record, quantify and interpret the novel assemblages analysed during this PhD. This includes both bone and eggshell material.

3.1 The Research Framework

3.1.1 Geographical Mobility and the Avian Area

Space and Place

Birds are a highly mobile class of animals which are in many instances less restricted than the other classes in terms of movement. Wild avian resources present a different challenge of consideration, as (to some extent) do their controlled domestic counterparts. It can, for example, in general be assumed that domestic mammalian livestock are not going to drift off to Africa for the winter. While mammals and fish may move around large areas, it is only within the avian class that a single species can inhabit the land, the sea and sky. Even with domestic birds their flight ability would have had to have been controlled. This directly impinges upon the selection of the Scottish Island avi-zooarchaeological study area and the justification of the wider area and body of evidence used to contextualise the Scottish data.

The geographical area considered in this thesis for the data collection was the Scottish Islands. However, in response to the challenges just listed, the comparative bone data and ethnographical material were selected from a wider area, in order to shed further light upon the use of avian resources within this primary area of study. Therefore the

research in this thesis extends to incorporate archaeological sites, modern avian data and historical sources from other North Atlantic environments such as Iceland and the Faroe Islands (see Figure 3.1 which shows the situation of the Scottish Islands in the Atlantic context and the extended study area indicated by the red circled zone). This allows the thesis to develop a fuller, more inclusive and accurate understanding of the use of avian resources in the Scottish Island landscape. This approach in turn enables flexible, reactive identification and interpretation of trends and patterns in the archaeoavian data since these may not be constrained to one island group but could have affected and been affected by the wider network or landscape. Since live birds are not restricted to one geographical area examining archaeological birds from single area in isolation (in this case Scotland) risks limiting our understanding of the data and prevents developed interpretation.

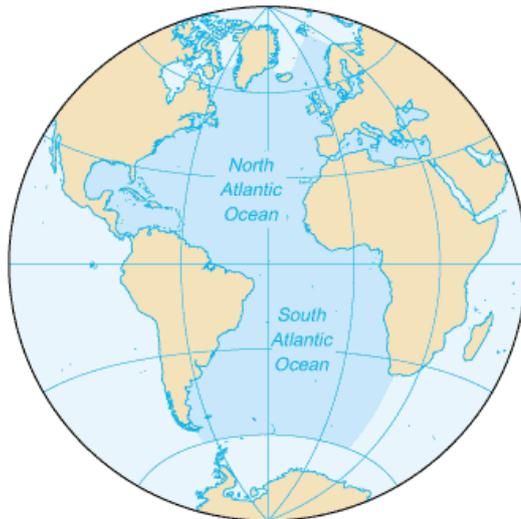
In particular many of the key species exploited archaeologically in the Scottish Islands are migratory, emphasising the importance of wider scale contextualisation for avian analyses. Migration can take several forms; some birds may migrate large distances while others only make short migrations within the local seascape, or inland at different points of the year.

While it is far beyond the scope of this PhD to consider all of the geographical areas to which birds from the Scottish Islands travel, by considering comparable archaeological sites from other areas of the North-East North Atlantic area, a range of relevant themes can be addressed. For example, the now extinct great auk foraged and fed widely in the North Atlantic waters, covering fairly large ranges (Grieve 1885, 66). Thus it is pertinent to establish if there is any comparable evidence to suggest that the great auk

populations decline in Iceland and Faroes at the same time as in Scotland. This in turn would (for example) facilitate study of shared characteristics or factors that contributed to the trend (in this instance the decline and extinction of a flightless bird).

Figure 3.1: Map (top) shows North and South Atlantic Oceans (WWW10 and 11).

Map (Bottom) study area location in proximity to Arctic Circle (WWW12)



Arctic circle map courtesy of Hugo Ahlenius, UNEP/GRID-Arendal

Several of the key species targeted for hunting by human populations move around the North Atlantic region at different points of the year. This includes long-distance

movement of birds between island groups (i.e. Scotland to Iceland and vice versa) and smaller movements from land based breeding sites to wintering grounds in open sea. Consider, for example, the greylag goose. In Britain today this species contains true wild populations and reintroduced feral groups (Bowler *et al.* 2005, 61). Within the wild greylag geese populations there are native resident birds (including breeding birds) and winter visitors to Britain from Iceland that swell the local populations (Owen and Salmon 1988, 37-38; Stroud *et al.* 2001, 88-89). By comparing and recording modern movements of birds between these locations we can more accurately reconstruct the size, structure, and seasonal variation of past avian populations within the Scottish Islands in order to correctly understand the resources available to the human populations at particular times of the year. Thus whilst resident greylags may have been captured during the breeding season, an influx of birds from Iceland could have made them a key target for winter fowling.

The mobility of birds also means that human or naturally enforced change (e.g. decline) in one area could have a direct impact on another. For example, prior to the settlement of Iceland, migratory birds entering Britain (and the Scottish Isles) from Iceland were not exploited as part of an Icelandic fowling economy. Post-settlement over-exploitation in Iceland of (e.g.) gulls could theoretically damage the numbers wintering in Britain.

For some species with concentrated distributions such as the gannet, changes in human exploitation or natural factors in one key area can affect numbers, distribution and have a significant impact in the different locations that this particular group of birds may visit. Today between 60 and 70 percent of the world's gannet population breeds around the British coast, with the majority of these nesting on the cliffs of Scottish islands and

coastlines (Stroud *et al.* 2001a, 44). When they are not nesting gannets are highly pelagic (spending most of their lives at sea), and while they can still be seen around the coast they also migrate further out to sea and some move to the more southern areas of the North Atlantic, even extending to Africa (Serjeantson 2001, 44; Stone *et al.* 1995, 148-152; Stroud *et al.* 2001a, 44). Over exploitation in one location could therefore deplete the numbers arriving in a second location, affecting the population there (through food, animal predation, breeding, targeted capture) which may in turn affect other species and human agents, and the birds returning to Britain the next year, and so the cycle continues.

The decision to extend this study to incorporate comparative material from Iceland and the Faroe Islands was also made in part due to the shared history of these locations with the Scottish Islands and their interlinked relationship within the physical and perceived world at certain points of the past. Although the Scottish Islands had interconnectivity with each other and further afield in much earlier periods, they, Iceland and the Faroe Islands were all part of Norse seafaring and expansion, when these islands became part of an increased maritime highway with networks of seafaring playing an important role in their existence. Viking exploration, Landnám, and the subsequent Norse settlements within the North Atlantic Island landscape saw increased activity in this area with dramatic impact on the existing and novel environments⁵. Mainland Scandinavian Europe (Norway, Sweden, and Denmark), although referred to, is not elaborated upon in this thesis as, although linked to the Scottish Islands they differ in many relevant points (Bratrein 2005, 181-193). In this context the primary comparative interest lies in the

⁵ New evidence from the site of Á Sondum suggests that the Faroe Isles were visited prior to the Norse settlement, but the extent and duration of this activity is unclear (Church *et al.* 2013, 231-232). It has also been suggested that monks may have colonised Faroe and Iceland from the 7th and 8th century (Dugmore and Church 2005, 25-26).

animal exploitation by Scandinavian people after they had left their homelands and moved into new areas. Consequently, while Scandinavian fowling and economy prior to this point are relevant for background contextualisation, they will not be developed for further inclusion in this work. The Norse people that left Scandinavia and settled in the islands of Scotland, Iceland, Faroe and Greenland were all encountering new locations (whether they had previously been settled or not), and their interaction with the wild resources at this potentially uncertain time is an important part of the animal-human relationship.

3.1.2: Classification and Terminology

Site Names

One challenge encountered when working with archaeological sites from the Scottish Islands is the range of names that a singular site may have. A site will in general have both an anglicised and Gaelic name, which can create difficulties when locating site information. For example, the South Uist site excavated by Niall Sharples Bornais can also be spelt Bornish. The Gaelic spelling can be confusing for those not familiar with the language, and as such similarly named sites can be misunderstood, or potentially damaging spelling mistakes made. Inconsistency in the use of Gaelic and anglicised names within existing records (particularly older excavations) can make finding information for a particular site difficult, and it can also result in confusion since many sites have very similar names and the use of either the anglicised or Gaelic spelling may lead a person to believe that a different site is being discussed when it is actually one that they have already encountered. For example Iron Age Cill Donnain can also be spelt Anglicised as Kildonan, but should not be confused with Medieval Kildonan/Cille

Donain which has been repeatedly published under Cille Donnain (Fleming and Woolf 1993, 329; Parker Pearson 1995, 108).

In this thesis the Gaelic spelling of site names will be used for the majority of sites since it is the form often encountered in published volumes, and it has had less chance to undergo various amalgamations or spelling variations in the Anglicisation process. However, in certain instances when the Gaelic form is never or very rarely used (or is too similar to another site under consideration) the anglicised version will be used throughout for the sake of clarity and to prevent confusion. Appendix Table A3.1 presents the archaeological sites with NGR grid reference and (where available) the Canmore ID and Site Number. This should be referred to where further clarity on a site is required. Within the text the sites will only be referred to by name, e.g. Cladh Hallan.

Such confusion is also not restricted to archaeological sites, with many islands having the same name. For example within the Hebrides there are two called Berneray, two named Scalpay, two Pabbay's and one Pabay. Where necessary grid references or island groupings will be provided to distinguish between them; for example 'Pabbay in the Barra Islands' or 'Pabbay of Harris'.

Periods and Place

In the text archaeological periods will be written out in full. In tables and figures periods will often be abbreviated to provide data in a clear manner which is easy to understand and interpret. The Neolithic (for example) would be shortened to 'Neo'. Abbreviations such as 'IH' will be used in some tables for Inner Hebrides, or 'UNID' for unidentified.

See Appendix Table A3.2 for table of abbreviation codes used. Table or figure numbers preceded by ‘A’ are appendix figures.

The Classification and Terminology of Avian Groups

Like many biological and zooarchaeological fields the terminology applied to the avian resources can be complex and in need of clarification. Birds are commonly referred to by broad groupings such as seabird or wader, within which many different species fall. Specific terms are also used to describe their position in and movement around the landscape, and other behavioural traits.

The term ‘pelagic’ is used to refer to birds who spend much of their lives at open sea, often only coming to land to breed. Ecologically speaking the pelagic zone is the area of seawater not near the shore. Coastal waters are not completely deficient of pelagic species; they may still occur there but do not spend large amounts of time in the coastal waters immediately adjacent to land. Pelagic will also be used to refer to avian behaviour. For example, ‘outside of the breeding season gannets are highly pelagic’ would mean that although the gannet breeds on land, for much of the year it lives and feeds far out to sea. The term ‘marine bird’ can be used instead of pelagic. The word ‘seabird’ is used frequently within this thesis. This is a broader term which encompasses marine and coastal birds who feed in salt water, which the author finds to be a useful grouping when considering wider trends and discussion or when dealing with challenging archaeological material.

Coastal birds can be defined as species which spend a large proportion of their time in the sea surrounding the shore. For example the shag and the cormorant spend much of

their time in waters close to the shore since at night they roost on land. Although classed as a seabird the cormorant in particular can also be found further inland, particularly during winter. Whilst their distribution was more coastal in the recent past, during the last 40 years more have wintered in a wider variety of inland locations (Kirby *et al.* 1995, 93-102; Stone *et al.* 1995, 155-158; Stroud *et al.* 2001a, 47-51). This again shows the flexibility of some bird species and the importance of considering past avian distributions to infer the access that people had to these resources. Vagrant refers to birds occurring outside of their known normal range, e.g. by accident.

Wader is used to refer to the long-legged wading birds of the suborders Charadrii and Scolopaci in the order Charadriiformes (and the stone-curlew from the suborder Chionidi which is a vagrant wader to Britain, but the other species of this suborder and Thinocori do not occur within Britain and are not referred to in this work). Most of the waders are typical shorebirds, making use of muddy shores, soft beaches and estuarine environments in addition to marshes, bogs, freshwater, meadows and farmlands. The woodcock *Scolopax rusticola* is unusual in that although a wader, it does not favour water at all and is a bird of woodland and undergrowth; and so here it is classified as a landwader. If a wader is exclusively freshwater or favours another non-coastal/marine habitat, it will be explicitly described as such in discussion. Although rails such as water rail may appear to be 'wading' in their freshwater environments they (and crakes) actually belong to the order Gruiformes along with cranes. As such they are not placed with the other waders when avian categories are compared.

The term 'shorebird' refers to birds that frequent the shoreline and not as in American use for 'waders'. When the term waterfowl is used this refers to members of the

Anatidae family, which includes ducks, geese, and swans. ‘Waterbird’ refers to birds that frequent fresh water, while ‘aquatic birds’ include birds from any body of water, salt or fresh; for instance shelduck which can be found on coastal and inland water. Such seaducks, grebes and divers move between salt and fresh water; they may breed on fresh water but winter at sea (Booth *et al.* 1984). Many people do not consider these species to be seabirds, despite their behaviour involving a close relationship with the marine resources. In such instances the term ‘aquatic bird’ can be used to imply this mobility and ambiguity of lexis. Or if the time of year for capture is known (depending on the environmental parameters and migration), they can be referred to in terms of their habitat at the moment of capture. Past inhabitants of the Scottish Islands would not have used the same classifications that we do today and if they captured a wintering seaduck from the marine environment they would likely have considered it more akin to seabirds such as the puffin than to freshwater birds and vice versa (Campbell 1986, 120-121; Stroud *et al.* 2001a, 156-158). The common scoter, for example, today breeds in the west of Scotland, Orkney and Shetland (as a summer visitor), but for much of the eastern British seaboard it is a winter visitor which gathers in large rafts offshore when migrants birds arrive from Siberia and Africa (Gibbons *et al.* 1993; Sharrock 1987, 83-84; Stroud *et al.* 2001a, 163-164; Underhill *et al.* 1998, 146-156)

The term ‘fowl’ is often used to refer to birds in general, and in this thesis the term fowling is regularly employed for describing the action of capturing any species of wild bird. However, taxonomically speaking the word fowl is most frequently (and accurately) used for two orders: Galliformes and Anseriformes. These landfowl/gamefowl and waterfowl share a linked ancestry and form the *Galloanserae* clade. The fowl grouping encompasses both domestic and wild species;

for example red junglefowl *Gallus gallus*, and domestic chicken *Gallus (gallus) domesticus*. For clarity the term ‘Domestic Fowl’ will be used to exclusively refer to *Gallus (gallus) domesticus* (this is the most commonly used term in the archaeological documentation and avian-ecology, although ‘domestic chicken’ is sometimes also found) (Maltby 1997, 402-403; Yalden and Albarella 2009, 97-98). In this thesis the term ‘domestic bird’ can be used to refer to domestic chickens, domestic ducks and domestic geese.

‘Altricial’ refers to birds which are highly parent-dependent upon hatching, often with eyes closed and little down. ‘Precocial’ birds have a greater degree of independence upon hatching, but within this there are several different developmental stages which determine the nesting and fledging periods for particular species/families (Gaskell 2004, 231-240; Serjeantson 2009, 11-12). These terms will be used when discussing the capture of young birds by past populations (see appendix Table A3.3 for subdivisions of altricial and precocial birds and example species).

This thesis follows the biological use of the abbreviation ‘*cf.*’ to mean ‘like’. Resultantly a ‘Large grey goose *cf.* Greylag’ is a large grey goose that is probably a greylag goose but which cannot be confidently assigned to that particular species.

Ethical Information

All graphs, tables, images and maps were created by the author unless otherwise stated. The unpublished data kindly provided by Sheila Hamilton-Dyer, Miranda Armour-Chelu and John Stewart will not be used outside of this thesis without expressed consent.

3.2 Problems of Recovery

3.2.1 Taphonomy and Assemblage Creation

The death of an animal, whether natural or inflicted by humans, sets in motion a sequence of events which will determine the state of any remains discovered by an archaeologist. Bird remains are in general archaeologically scarce compared to mammals and fish (Serjeantson 2009, 5; Cartledge and Serjeantson 2012, 342). In many instances this is a result of past populations' exploitation choices, but there are several natural taphonomic factors which impact bird bone survival, in addition to their archaeological recovery.

The first, most obvious, and aforementioned problem is the small size, pneumatic structure and (for all but the largest species) light form of much avian bone; this is significant for both bone survival and archaeological collection.

The compact periosteal surface of bird bones can help them survive better than mammalian bone by making them more resistant initially to micro-organisms; but this only holds for the first stages of decay. However, bird bones preserve less well at the latter stages and on an archaeological scale are disadvantaged by the poor survival in continuing decay situations (Cruz 2008, 30-37; Nicholson 1996, 513-133; Serjeantson 2009, 109). Juvenile bird bone which has not fused or only partially (i.e. still exhibiting some immature porosity) does not have this strong periosteal surface to protect it and so is very vulnerable and survives poorly. Within the avian class large birds and elements (particularly long bones such as the humerus), survive better than smaller or more delicate elements such as the skull or furcula, but even sizable birds such as chickens

and gulls may be more affected by adverse preservation conditions than mammalian bone and even fish.

Thus, conditions which hinder micro-organism-led decay, or those which afford excellent preservation of the periosteal layer, such as the alkaline shell sand of the machair, help bird bone survive over long timescales to the same level as mammal bone by preventing the birds from reaching the later and most damaging levels of decay (Parker Pearson *et al.* 2004, 9; Sharples 2005, 1).

Avian bone is generally well pneumatized/hollow, adapted to be light in flight, and forms the structure of an aerodynamic (and sometimes aquadynamic) creature. As a result it can be more fragile and susceptible to certain taphonomic processes, ranging from the processing and cooking of a bird to animal predation, trampling, or degradation in the soil due to pH and water movement (Armour-Chelu 1985, 3-7; Serjeantson 2009, 107-112). Dogs, for example, can easily annihilate bird bone, and even cats can heavily damage it by gnawing (Serjeantson 2009, 123-124). Damaged and juvenile bird bones are also at a higher risk of being digested by both mammalian and avian predators (Bocheński and Tomek 1997, 384; Serjeantson 2009, 128). Bird bone (and that of small mammals) preyed on by raptorial birds can sometimes be protected by pellet formation from damaging conventional decay and attrition; however raptors have varying stomach acids which can damage bone to different extents (Armour-Chelu 1985, 11-12; Armour-Chelu 1988, 69-76; Bocheński 2005 31-45; Bocheński and Tomek 1997, 372-387; Laroulandie 2002, 333-339; Serjeantson 2009, 128). Those not destroyed by the gnawing or digesting process would be weakened in terms of their structural integrity and be at higher risk of subsequent decay in the burial environment.

The relative size of bird carcasses in comparison to the domestic mammals most commonly used for food (sheep, cattle, pig) means that there is a greater chance of a larger proportion of the carcass being carried off by a predator. Domestic species such as pigs could consume the bird waste left over from human consumption, which would prevent waste, maximise resources and help feed livestock (Serjeantson 2009, 123). Research has illustrated that grazers such as sheep and deer occasionally consume dead birds and will actively kill ground nesting birds including terns, shearwaters and even skua chicks (Furness 1988, 565-573). The mammals appear to chew the bones to prevent mineral deficiencies in deprived grazing environments (Furness 1988, 565-573). Predators can not only determine the survival of bird bone but can also be responsible for introducing bird skeletons into an archaeological context.

Therefore it is essential to remember that the assemblage which reaches the zooarchaeologist was formed by both natural and human-influenced processes which have determined its makeup. These losses and influences, if identified, can in themselves be informative for understanding post-death use and deposition, rapidity of burial, and animal predation. Whilst many of the anthropogenic and non-anthropogenic factors are applicable to mammalian, fish and avian bone (and therefore need not be outlined at length here), there are certain individualities which should be highlighted. Natural morphology may also introduce further biases into the assemblage. For example, the form, meat-bearing capability, and robusticity of an element may determine its selection by predators in addition to its likelihood of being weakened or destroyed by cooking (Bovy 2002, 965-978). There are therefore multiple ways in which material may enter and be removed from an assemblage.

Non-Anthropogenic

More so than with fish and many mammals, birds have an increased chance of independently entering the archaeological record. The variety of bird species present within a particular area surrounding a site, their numbers and their ecological habits will all influence the likelihood of them interacting with humans and their controlled environment. Birds are also present on archaeological sites via a range of non-anthropogenic processes with natural deaths occurring both during and after the period of use. Small passerines may make nests in the eaves or roofs of buildings and become accidentally incorporated into the faunal assemblage. Larger species such as the fulmar, which is a prime food species, are also frequently known to nest in abandoned houses and other anthropogenic structures: see Figure 3.2 (Nicholson 2010, 170; Serjeantson 2003, 150-152). As mentioned, predators may also bring birds into archaeological sites, such as raptors using structures as plucking perches (Bramwell 1994, 153 and 155)

Figure 3.2: Fulmar nesting in the shelter of an abandoned structure (WWW13)



Many birds are attracted to human sites and can die naturally in the area or be killed by animal or human predators. Birds will scavenge human food waste; for example gulls would have frequented middens or fish processing sites in a similar manner to the landfills and dumps that they exploit today. Raptors would be attracted by the presence

of waste animal products, or even livestock. Crop production and processing would draw species such as passerines and gamebirds to a human settlement (and sometimes be intentionally used to attract and kill them) (Fenton 1997, 522; Svanberg 2001, 34-36). Finally smaller birds (such as passerines) may have taken shelter from adverse weather within human structures. To aid distinction between human and natural acquisition within the same archaeological faunal assemblage it is vital that the species information is considered alongside elemental representation and taphonomic features (Armour-Chelu 1985, 1-6; Laroulandie 2005, 25-30). Furthermore it is important to remember that bone assemblages may continue to form at archaeological sites after human abandonment. These must be carefully distinguished from anthropogenic data.

Anthropogenic

The prime reason for the majority of bone (avian or otherwise) entering the archaeological record is due to an animal's use as food for humans. However, there are many other less obvious methods of human derived accumulation. These may include the collection of specific elements or resources from naturally deceased or animal-killed birds for tools or ornamentation. For example bird talons have been particularly cherished in many modern and past societies. In such cases the whole skeleton would not necessarily enter the archaeological assemblage.

The collection of feathers or skins can result in whole birds entering the record (particularly when these are as a secondary acquisition to the meat value); however, some species such as members of the corvid family or birds of prey may only have been exploited for their feathers or for symbolic reasons (Figure 3.3) (Bramwell 1983b, 159 and 164; Bramwell 1994, 154; Cartledge and Grimbley 1999, 285). In such cases only

elements bearing the desirable flight feathers such as the wing bones may return to site, with the rest of the bird being left or disposed of elsewhere. If only the feathers are brought to the archaeological site (with the bird having been plucked elsewhere) there may be no record of this use, except in extremely rare preservation conditions.

Human consumption and processing are key factors in assemblage formation. The structure, size and age/juvenility of avian bone (mentioned above) results in osseous material prone to damage or destruction by activities such as human cooking and eating (Bovy 2002, 965). Weakened bones would then be more vulnerable to degradation and fragmentation in the soil or exposed deposition. Humans can consume small bird bones.

Figure 3.3: Golden (right) and white-tailed (left) eagle flight feathers (WWW14-15)



As suggested above, birds, like other animals, can be processed at the kill site which may not be found archaeologically, particularly due to the small size of avian bone and their ease of predation by a range of species. Waste from animal preparation or cooking could have been moved away from the immediate area of a settlement and thus not excavated. Trade can also prevent animals killed and processed on site from entering a site's faunal assemblage. In a modern example today the men of Ness on Lewis still travel to the rock of Sula Sgeir to kill and process immature gannets known as gugas,

which are transported to Lewis and traded as food (Beatty 1992; Love 2005, 58 and 68). The guga's distal wing is snapped off, and the bird split in half, and its axial skeleton removed before preservation.

The aforementioned structure of avian bone can also make them more susceptible to destruction by fire than larger mammalian food species, whilst their size can allow disposal on a domestic fire (Recchi and Gopher 2002, 139-150; Serjeantson 2009, 150). Bird bone can also be burnt as fuel, and may therefore have been used in this way in island locations to maximize resources, while burning the unwanted parts of the bird would also be a practical method of waste disposal (Baldwin 2005a, 29-31; Payne and Munson 1985, 31-48). The oily composition of seabirds in particular would make both their osseous material and any waste soft organs or entrails particularly suitable for use as fuel. So flammable are particularly oily birds that on occasion a wick has been threaded through them, sucking out oil to form a crude lamp as shown in Figure 3.4 (Mudie 1835, 391; Serjeantson 2009, 206). Experiments by Spenneman and Colley (1989) demonstrated that bird bone could become calcined in a domestic fire of around 500°C. These bones became extremely fragile and as a result fragmented easily with no duress (Serjeantson 2009, 150; Spenneman and Colley 1989, 51-64). At the site of Waitaki in New Zealand, quantities of moa bone ash and small heavily burnt fragments were found around and in the oven fires. If even the substantial, robust moa bones could be reduced to friable fragments and bone ash, then smaller species' bones could be completely destroyed by this use as fuel (Buick 1937, 175-176; Robson 1877, 95).

The form of avian bone has qualities that have made it desirable as a material for working and shaping into tools, musical instruments and decorative items (Figure 3.5).

Its hollow structure and thin wall can be worked into a sharp edge with much less effort than would be required to resize or shape a mammal fragment. Consequently some artifacts may have been disposed of differently or had an extended use period before incorporation into an archaeological assemblage. Awls made from bird bone occur at temporally and geographically distant sites and could be used to pierce materials such as cloth or leather (Gál 2005, 334; van Wijngaarden-Bakker 1997, 339-345).

Figure 3.4: A Storm petrel being used as a lamp (illustrated in Mudie 1835, 391).



Figure 3.5: Bird bone flute from Germany made from the radius of a Griffon Vulture (*Gyps fulvus*), approximately 35,000 years old (Conard *et al.* 2009, 737).



3.3 Assessment and Interpretation

3.3.1 Identification

The identification of archaeological and palaeological avian remains is in essence no different to the identification of other animal bones. It is a complex process which requires access to good comparative reference collections and a zooarchaeologist proficient in recognising identifiable characteristics in the archaeological bone for comparison with the reference collection. It also requires knowledge of which features of the bone are accurate and reliable indicators of species, and which are variable or dubious.

The differences between zooarchaeological identification in mammals and birds arise primarily from ecological and biological issues. Birds are extremely diverse and very mobile, meaning that within one area there can be a wide range of closely related and very similar species which hinders the identification of archaeological bone (Bocheński 2008, 1247-1248; Bocheński and Tomek 1995, 357-359).

The number and diversity of species within an avian assemblage is therefore generally more pronounced than with mammals due to the huge range of species that may be present in an assemblage. Avian assemblages often contain a large number of species, each of which are only represented by a small number of bones (Best and Mulville 2014; Serjeantson 2014). This species diversity increases with assemblage size before plateauing (Grayson 1984, 136-137; Bartosiewicz and Gál 2007, 39). Therefore even for small assemblages a large reference collection is necessary and yet may only be needed for one or two fragments; which is time and resource intensive.

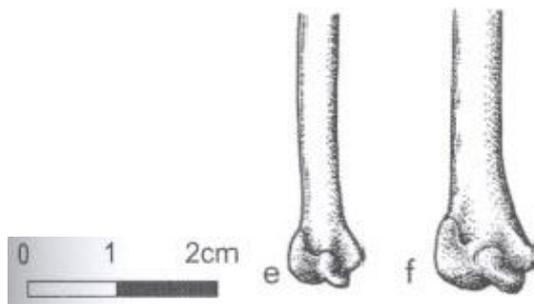
The potentially wide variety of species present at an archaeological site can allow the reconstruction of habitats and their use, environment, and climate. However, this diversity has its own challenges: the specialist has to consider and eliminate a very large range of species in order to arrive at an identification (Serjeantson 2009, 63). Species within a group or family can be very similar skeletally, despite sometimes having very different habits and ecological niches. For example, a large number of morphological features are very similar within many of the smaller passerine species, and within other large groups such as ducks (Bocheński 2008, 1247-1250; Morales 1993, 2).

This heightens the chance of mistaken identification, since while certain traits may be reliable in distinguishing two specific species, it is less likely to remain reliable if a large range of similar species need to be considered/eliminated (Bocheński and Tomek 1995, 357-361; Tomek and Bocheński 2000, 6-7). It is therefore especially important to distinguish which anatomical features possess the stability to be used as identification (Morales 1993, 2). An avian zooarchaeologist therefore must know what level of identification is appropriate. As summarised by Ericson and Tyrberg (2004, 18): “Perhaps the most important knowledge gained in recent years is a better recognition of when an accurate identification is possible, and - probably even more important - when it is not”.

This means that not only are large, well-stocked reference collections essential for avian identification in order to compare many closely related species, but ideally more than one of each species is required to prevent individual ‘quirks’ being taken as determining characteristics (Olson 2003, 26-34; Powell pers. comm.; Serjeantson 2009, 65). In this thesis three separate reference collections were used during analysis to ensure a wide

range of comparative material. A reference collection with multiple specimens of a species also allows intra-species variations in size, sex and morphology (Corke *et al.* 1998, 67-69; Serjeantson 2009, 66). There are many species within closely related species that can overlap in terms of size, both due to sex and individual variation (Bocheński and Tomek 1995, 357-361; Tomek and Bocheński 2000, 6-7). For example if a reference collection only contained a small female specimen of a species such as red grouse (*Lagopus lagopus*), any larger bones occurring in the archaeological record may wrongly be assigned to a different, larger species, such as black grouse (*Tetrao tetrix*), despite subtle anatomical differences (Figure 3.6) (Corke *et al.* 1998, 67-69).

Figure 3.6: Differences in size and morphology of red/willow grouse (left) and black grouse (right) (from Serjeantson 2009, 71).



The diversity of birds as a class dictates that to achieve any form of identification a zooarchaeologist usually starts with the species that are known to be present today in the area under study, or were there in the past (e.g. the now extinct great auk). This also forms the basis for most reference collections, which contain the species expected to make up an archaeological assemblage (Corke *et al.* 1998, 67). However, the faunal analyst must remember that exotic species may be present in archaeological assemblages (Corke *et al.* 1998, 68-69). These unusual species can be vagrants, traded bone items, imported animals (i.e. the parrot from 17th century Castle Mall, Norwich) or evidence of species which were present in the past but no longer frequent the area (e.g.

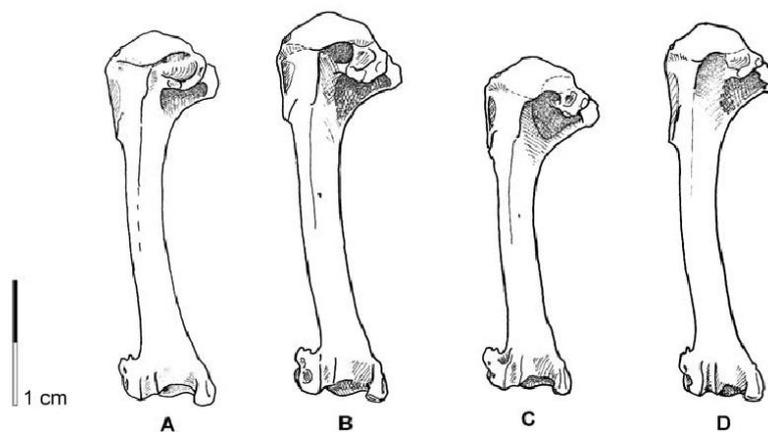
bones from a gadfly petrel previously unidentified in Britain have been found on Scottish Islands) (Albarella *et al.* 1997, 4, 51-52 and 55; Albarella and Thomas 2002, 35; Cartledge and Grimly 2005, 285; Serjeantson 2005, 333-335). A related point is the identification of juveniles or medullary bone from species which no longer *breed* in the area, but may still be visitors. As a result the avian specialist will often have to consult additional reference material to cater for such species.

Recent research papers have helped to expound the importance of identifying unusual species. These help prevent identifying only species expected in a specific area, and highlights the important information that such bird remains can provide. A recent example is Groot *et al.*'s paper (2010, 241) on the cinereous vulture (*Aegyptius monachus*, also known as the black vulture) from Roman period archaeological sites in the Netherlands and Belgium, where today it is an extremely rare vagrant. The paper considers issues such as climatic conditions, symbolic possibilities, and the presence of food sources suited to the species (Groot *et al.* 2010, 241).

The growing number of well-stocked skeletal reference collections and academic works, to which avian zooarchaeologists can turn to for initial identification guidance and error avoidance, provide a very important resource which was not available to those studying archaeological birds several decades ago. As mentioned in Chapter Two, developments in avian archaeology as a whole have resulted in an increased number and range of identification guides and digital reference material being available. These are vital for helping to distinguish between closely related and morphologically similar birds and to know when this is not possible at species level. Zbigniew Bocheński and Teresa Tomek are authors leading in this area at present. Their identification works have included

European corvids (Tomek and Bocheński 2000) and most recently photographic and illustrated guides for accurately identifying domesticates of ducks, geese, fowl and pigeon, and distinguishing their wild relations (Bocheński and Tomek 2009; Tomek and Bocheński 2009). Other work such as that by Joanna Wójcik has focused on problematic small passerines such as thrushes (Figure 3.7) (Wójcik 2002, 369-381). These provide the avian osteologist with a ‘bank’ of reliable traits that can then be used alongside reference material to produce reports of greater accuracy and standardisation. Accurate identification to species is essential for the next stages of analysis, including calculating species abundance by (e.g.) NISP and MNI, assessing elemental representation for different, species, and investigating season, habitat and climate.

Figure 3.7: Humerus variations in small passerines (From Wójcik 2002, 376). A = *Lanius*, B = *Sternus*, C = *Coccothraustes*, D = *Alauda*.



3.3.2 Quantification

Quantifying and Comparing Avian Remains

One of the most difficult problems in quantifying avian data arises from the anatomical features that allow a zooarchaeologist to identify the remains to species. While some species and families are very distinctive and can be identified with certainty from almost every element (both complete and broken), many more are only definitely

identifiable at species level from a few elements such as the humerus (Morales 1993, 5). The gannet and the great auk are examples of species that are very distinctive skeletally and can be assigned to species with confidence even from small fragments. Ducks, geese, and particularly small waders and small passerines are examples of those which can less often be identified to precise species, and where only certain elements are species unique (Albarella and Thomas and 2002, 32-33; Cohen and Serjeantson 1996; Wójcik 2002, 369-381). While this holds true for other zooarchaeological analysis it is exaggerated in avian archaeology by the wide range of species which may be present within an assemblage due to avian diversity and their mobility.

These very varied rates of successful identification between different species (e.g. based on their ease of identification etc.) mean that it would be incautious to draw interpretations of abundance and diversity from the NISP without question. Morales (1993, 5) states that even worse would be to “turn these NISP into MNI and consider these...(or worse still their percentages) as measures of abundance in order to infer hunting strategies, palaeoenvironments etc.”. Whilst the author of this thesis agrees in principle with this statement in that use of such data without acknowledgement of their limitations risks inaccurate inferences, this statement is too broad to be universally applicable.

The NISP is better suited than the MNI for quantifying small assemblages, since the latter has the unfortunate tendency of reducing frequency for major species while making the less abundant ones seem more prolific (Emery 2004, 28; Serjeantson 2007, 1; Serjeantson 2009, 85-86). For example at Late Bronze Age to early Iron Age Cladh Hallan, the cormorant had a NISP of 17 while the Manx shearwater had a NISP of one.

Of course, since there is one Manx shearwater bone, there is inevitably one Manx shearwater present, however the 17 cormorant bones (while only producing an MNI of 2) could in theory also come from 17 birds with one bone per bird surviving. This is one of the problems encountered when examining osteoarchaeological material in general, but it is a particularly prolific issue for avian archaeology since the assemblages (as noted above), while often small, are frequently very diverse and can contain a wide range of species with sometimes only a few birds from each (Bartosiewicz and Gál 2007, 39-42; Best and Mulville 2014; Serjeantson 2009, 84; Serjeantson 2014). However the NISP has the reverse effect of exaggerating the common species or those which are more easily identifiable, and minimising those which may only be identifiable with confidence from a few elements, or are relegated to cautious categories such as ‘small wader’ or ‘medium duck’. This demonstrates the value in considering both the minimum and maximum number of individual birds that could be present in order to help reach a balanced interpretation (O’Connor 2000, 19-27).

Despite its drawbacks and limitations (which particularly affect small assemblages) MNI can still be useful, particularly if limited to elements that are easiest to identify to species and that are relatively robust. Such MNI calculations help to avoid some of the identification and preservation issues which might lead to an over-representation of certain birds by NISP (i.e. the fragmentation of larger species’ bones).

This method has been employed by wildlife biologists, including those studying the prey of carnivorous species such as raptors. For example Glue (1972) used these derived methods of quantification when examining the prey choice of British owls. Rather than constructing MNEs for all elements he chose to use the synsacrum and sternum since

these had been proved to survive well through digestion by owls and raptors (Glue 1972, 91-95).

By only using the MNI/MNE for a particular element some biases of differential levels of identification success could be avoided. It could also help to investigate differential survival, processing, preparation, or disposal. Using MNI/MNE in itself can be important for reducing the impact that differential transport, preparation and deposition has on species abundance. For example, a small bird whose entire carcass enters the site whole may appear higher in counts such as NISP than a larger species for which only the meat bearing-body/elements were transported to site (such as with the modern gugas from Sula Sgeir) (Beatty 1992).

It is fortunate for the study of archaeological bird bone that an element which often occurs most frequently is also one which can be assigned to species with greatest success and accuracy: the humerus. This is beneficial when calculating MNI (and to an extent MNE) since it helps counteract the low numbers created by small assemblages. These can then be compared to the NISP and in some situations used to investigate elemental distributions. MNI is also one form of quantification that can be used in reconstructing dietary input and contribution (see section 3.3.3).

Quantifying Eggshell

Eggshell is notoriously problematic to quantify, both in terms of the overall abundance of fragments recovered and also ascertaining the frequencies of individual species or families once identified (Serjeantson 2009, 176). A context may contain hundreds of eggshell fragments that may all come from one or two eggs. Eggshell can be identified

to species by visual observation and metrics using microscopy but now also by mass spectrometry (ZooMS), the techniques of which are explored more below in section 3.4.2.

Weight is one possible method for inferring the number of eggs present on a site, but the fragility and extreme fragmentation of archaeological eggshell renders this highly minimalistic. This is particularly the case for material identified by microscopy since such small amounts of eggshell are identified to species level that weight would never usually identify more than one individual egg. Consequently species represented by the eggshell material are in general recorded on a presence or absence basis (Eastham and ap Gwynn 1997, 85-94).

The ZooMS technique can process a large quantity of fragments, which raises different difficulties in quantifying the results. Even small eggshells can break into a very large and generally unpredictable number of fragments, which are often small in size. Therefore a large number of ‘duck’ fragments might be identified but all could come from one shell. The curvature of the shell can be examined, but this is a very limited assessment technique for fragments since it is very labour intensive and there is significant overlap within one eggshell and great inter- and intra-species variation⁶ (Gill 2000, 131; Keepax 1981, 321; Mikhailov, 1997; Oskam *et al.* 2011, 2592; Serjeantson 2009, 172). Unlike bones, no zoning technique can be used since there are no distinctive, identifiable, non-repeatable elements to distinguish a fragment. Thus assessing quantity is problematic. Therefore with the ZooMS technique species

⁶ Curvature, diameter and length assessment are much more useful as techniques to aid species identification when whole eggs or very large fragments are encountered (Keepax 1981, 321; Serjeantson 2009, 172). For example shape and curvature has proved useful in the identification and study of moa eggshell (see Gill 2000, 131 and Oskam *et al.* 2011, 2592).

frequency is presented by considering the proportion of eggshell containing contexts to produce a given species. For example chicken might be identified in 80% of the contexts producing eggshell, whilst duck may only occur in 30% of the contexts. This technique provides a valuable indication of frequency by distribution, but naturally is still limited in terms of overall quantity. For example a single gull egg might be present in 60% of the contexts, whilst 50 puffin eggs could be present in a single context. Therefore using eggshell and bone data together is valuable for understanding both forms of material more fully.

Interclass Comparison – Birds and the Wider Animal Assemblages

An altogether larger and more complex set of difficulties faces interclass comparisons. NISP is frequently chosen for interclass comparisons since it is the level of quantification most often available for multiple classes (and in many instances the only form of avian quantification). As mentioned, there are different levels and issues of survival and recovery between classes. Furthermore, large mammalian bones may fragment to more pieces than smaller animal bones, which inflates the mammalian NISP (Lyman 1994, 1994a and 2008; Reitz and Wing 2008; VanDerwarker and Peres 2010, 4). A key problem of quantification (but one which can be rectified) is the different total number of bones within a skeleton for different species, even within classes. For example, dogs have more phalanges than horses. These figures can be corrected for since the total number of bones for different species is known, but it is time consuming and approximate. However the avian skeleton (which has evolved to be light) also has a reduced total number of elements within a individual/species and therefore using NISP to compare the contributions of different classes inevitably produces a deflated and small value for birds (Serjeantson 2009, 92). Jennie Coy assessed the average bones per

individual (using Southampton University's modern reference collection) for a chosen species of each class which is commonly found archeologically (Coy 1982, 107-116). The typical figures were: 100 bones for a domestic chicken, 250 for a sheep (with teeth included), and around 300 for a cod (Coy 1982, 107-116).

Additionally, out of this smaller total number of bones per avian skeleton an even smaller proportion of these are identifiable (Coy 1982, 107-116; Serjeantson 2009, 92): if one had equal numbers of bird and mammal bones, more of the mammalian bones would be identifiable. Consequently the NISP of birds can be considered significantly lessened in comparison to the other considered taxa. Despite these flaws, NISP is still really the only (relatively) reliable comparative interclass and intersite quantification technique since many of the assemblages are too small to facilitate deeper analysis (i.e. MNI), and many of the sites do not provide this nor any further levels of identification or analysis that would allow them to be compared. For example, as discussed in Chapter Two, when examining avian studies for the Scottish Islands (and other locations) it is fortunate if one can access the full NISP presented by period, let alone MNI, MNE, bone weights, or any elements. Comparing class contribution by bone weight can override some of the biases of identification success (although still not accounting for differential degradation and survival), but only one published site provided weight data making such work potentially valuable but currently unfeasible (see section 3.3.3).

Complete animals/skeletons (i.e. burials) will skew bone counts (but not MNI), and so should be identified in order to allow both their inclusion and exclusion. However, birds are more likely to enter a site whole as they require less processing and are easier to transport, potentially making MNI useful where available but not always directly comparable to other classes (Armour-Chelu 1985, 1-7; Bartosiewicz and Gál 2007, 42).

The different methods of counting and quantifying archaeological bone should also be considered for application to any particular assemblage dependent on the method of accumulation of the archaeological deposit in question. Thus, whilst NISP is the most commonly and widely implementable level of quantification, MNI can be useful in assemblages that are either dominated by a small number of species (hence their value for mammalian domesticates) or in instances where the faunal assemblage has undergone little post-mortem modification/transportation (anthropogenic and/or natural), and where the process of deposition and incorporation into the archaeological record is a quick process without subsequent deposition of material (Serjeantson 2009, 88). One example of the latter is the kill site model, a comparatively confined and ‘catastrophic event’, such as the concentrated guga slaughter on Sula Sgeir (Beatty 1992). In cases such as this the animals are killed simultaneously and, when butchered and processed at the kill site, generally the same waste elements for each individual are left at the kill site and the others enter the consumption location; thus rendering MNI a valid form of quantification. While this scenario is unlikely to be applicable to avian archaeology in general, the MNE upon which MNIs are based are valuable for preventing the overestimation of elements which have become more fragmented. The success of this method, and the value of zones for quantification and frequency of different parts of the carcass was demonstrated for domestic fowl from Carisbrooke Castle (Serjeantson 2009, 88). It is therefore important that zoning is applied to bird bones in order to aid compatibility of comparison with the mammalian data.

Choosing to record identified bones with zone data will in general not alter the NISP from analyses where it was not employed. This ensures comparability between the new and collated data, which largely uses NISP for quantification (as mentioned element and

MNE/MNI data is rare). However, if an analyst only identified a selection of elements or (for example) just articular surfaces, then the NISP would be lowered. Such possibilities must be considered when handling a wide range of zooarchaeological data.

3.3.3 Dietary Contribution: Food Value, Meat Weights and Calories.

A useful and informative method of examining faunal assemblages is to consider their food input; however, calculating inter- and intra-class dietary contribution can be notoriously difficult and unreliable for a variety of reasons. Yet despite the range of problems associated with dietary reconstruction, theoretically it can be one of the more accurate ways of comparing different classes (birds, fish, shellfish, mammals) where traditional quantification may present an unbalanced picture and/or where each class has been subjected to different levels of analysis. For avian archaeology, dietary calculations are most valuable as an intra-class technique for considering the actual food contribution both overall and by different groups of birds such as seabirds, landbirds or waders.

Meat Provision from Bone Weight

As with mammals and fish, avian dietary contribution can be calculated by using bone weight as a proxy for meat, eliminating some problems associated with different levels of quantification between classes (Masson 2004, 98-99). By multiplying the raw archaeological bone (or shell) weight by the appropriate conversion figure an approximation of meat weight can be reached (Table 3.1) (Colten 1995, 93-101; Reitz and Wing, 2008, 225). For birds which often have low NISP for reasons such as preservation, number of skeletal elements and problems of identification, this may allow a fuller insight into their overall contribution to an assemblage. Dietary contribution

based on bone weight means that the contribution of unidentifiable bird fragments can be included. It can also prevent overrepresentation in the NISP of small specimens that while numerous may not have contributed greatly to the overall diet.

This method does not account for bone degradation or the different dietary contributions of (for example) fat seabirds compared to lean terrestrial birds, but does facilitate broad inter-class comparisons. However, while this technique can be very informative for inter- and intra-class comparisons, the lack of weight data available means that its application is limited and impractical; it would be a mammoth undertaking far beyond the scope of this thesis to calculate weight data for birds in the collated dataset, let alone all classes (Parks and Barrett 2009, Smith 2011, 1). For this reason dietary contribution calculated by calorific input or meat weight of whole animals based on MNI is often a more practical approach, although again the available quantification dataset are limited.

Table 3.1: Conversion factors for inter-class dietary comparison based on that presented in Colten 1995, 100.

Taxon	Meat Yield Multiplier	Reference
Shellfish	x0.332	Glassow and Wilcoxon 1988
Fish	x27.7	Tartaglia 1976
Marine Mammal	x24.2	Glassow and Wilcoxon 1988
Terrestrial Mammal	x10.0	Tartaglia 1976
Bird	x15.0	Ziegler 1975

Dietary Contribution of Individuals based on MNI and NISP

For avian analyses the range of species present within an assemblage provides an added level of difficulty when using MNI to determine the dietary contribution of one whole animal. Rather than having to calculate the calorific contributions and meat weights for a small range of repeatedly occurring domestic and wild species (i.e. cattle, sheep, pig, deer etc.), a wide range of avian species must be considered. The more species present

the greater the margin for error and the more work needed before dietary calculation can begin. To calculate dietary contribution via individuals it is essential to know what proportion of the animal would provide food (i.e. the meat weight) and ideally nutritional values such as fat, protein and kcal (kilocalorie). But collecting such data for the range of species within a given avian assemblage can in itself be problematic. White's 1953 paper is still used for general avian meat weight calculation, taking 70% of total bird weight as usable meat (White 1953, 396-398).

While this provides a basis for calculation, it is important to remember that these were generalized quantities based on ethnographic study of aboriginal hunters' use of larger animals (White 1953, 396-398). Less waste and processing may have occurred with bird species; for example, bird skin is generally eaten and is unlikely to have been removed (Oakes and Stone 1990, 4; Serjeantson 2009, 204). Some studies have suggested that bone makes up between 4.2 to 9 % of the bird's weight, slightly less than in mammals (Coy 1983). However the values for estimating usable meat weight of *specific* birds is limited and has been focused on sizable birds such as rheas, emus and moas (Garvey *et al.* 2010; Giardina 2006; Smith 2011). Additionally, where avian dietary input has been calculated, in some instances the weight values presented are for whole, unprocessed birds rather than the dressed carcass, while others do not clarify how the kcal data has been calculated or what it refers to (see Table 3.2) (Emery 1996, 99; Tivoli 2010, 133).

Although there are some detailed studies for a small number of species expressing fat, kcal and protein values by weight (see Table 3.3), this information is biased unless applied to the meat weight of the individual bird rather than its entire weight (Paul and Southgate 1978, 107-111). Also this dietary information is not accessible for a large number of the species encountered in the archaeological assemblages.

Table 3.2: Nutritional data for avian categories based on Tivoli 2010, 133

Taxon	English Name	kcal	Reference
Spheniscidae	Penguins	2880	Schiavini 1993
Chloephaga picta	Upland Goose	2461	Tivoli and Pérez 2008
Diomedeidae	Albatross	2027	Tivoli and Pérez 2008
Phalacrocoracidae	Cormorants/Shag	1501	Tivoli and Pérez 2008
Laridae	Gulls	712	Tivoli and Pérez 2008
Procellariidae	Fulmar, Petrels, Shearwaters etc.	396	Schiavini 1993

Table 3.3: Nutritional values for roasted wild and domestic birds (including skin) per 110g (Based on Serjeantson 2009, 234 using Paul and Southgate 1978, 107-111)

Taxon	kcal	Protein	Fat
Duck	339	19.6	29.0
Goose	319	29.3	22.4
Pigeon	230	27.8	13.2
Chicken (Roasted)	216	22.6	14.0
Pheasant	213	32.2	9.3
Partridge	212	36.7	7.2
Chicken (Boiled)	183	29.2	7.3
Grouse	173	31.3	5.3
Turkey	171	28.0	6.5

Ian Smith (2011)'s work on meat weights and nutritional values for New Zealand's archaeofauna (including a wide range of birds) presents a general working pattern for the calculation of avian dietary contribution from MNI. Using methods initially presented by White (1953) and Denniston (1972) and refined in later studies, he explores dietary contribution through meat weight, energy yield, protein, carbohydrate and fat for species in his study area. The total usable meat weight (MTWT) was conservatively taken as 70% of total weight (following White 1953 and his own work 1985), allowing the MTWT to be calculated for any species occurring in an archaeological assemblage. Obviously this does not take into consideration the difference in meat-bearing capacity between birds with differing biological make up and

skeletal structure (i.e. waders with long leg elements, flightless species with different bone density etc) (Cruz 2005). However, studies such as Coy (1983, 181-195) have assessed the percentage bone for a small range of species and suggested that bone:weight percentages are fairly consistent for birds with very different body structure (i.e. snipe, pochard and domestic hen; Table 3.4). However a greater range of species would be needed to fully investigate this fully.

Smith (2011) then used the 70% MTWT to calculate kcal, protein, carbohydrate and fat by means of a proxy. To avoid having to acquire nutritional components for every single species encountered, the birds were divided into two categories based on their contributions. Nutrition and energy values from a medium fat duck were employed for ‘Marine’ and ‘Wetland birds’ (waders, waterbirds, seabirds) which have higher fat and lower protein content than ‘Terrestrial’ birds whose values were based on chicken (see Table 3.6 for New Zealand data) (Smith 2011, 11).

Table 3.4: Bone as % of weight (Based on Coy 1983)

Species	% bone	Condition
Common Snipe	4.2	Shot
Pochard	4.3	Shot
Domestic hen	4.9	Killed
Teal	5.6	Shot
Woodcock	6.2	Shot
Coot	6.7	Killed by car

The benefit of this approach is that these simple formulas can be applied with ease and transferred to a wide variety of species, facilitating the broad calculation of avian contribution within its class and theoretically between classes (Table 3.5). However there are many issues which affect its application accuracy. While taxa-specific values for usable meat weight and nutritional yields have been conducted in detail and are used

for certain mammals, fish and marine mammals; birds are still subject to a more general overview, which may bias inter-class comparisons. This results from the fact that, as was seen in Tables 3.2 and 3.3, individual bird species are subject to a wide range of variation in the dietary contribution they provide, meaning that while these proxies largely hold true and facilitate broad (but useful) calculations, their accuracy is limited. This means that the dietary input can vary depending on the level of accuracy chosen.

Table 3.5: Minimum dietary input based on MNI for large gulls and geese from Cille Pheadair (By the author based on Smith 2011 formula)

Cille Phaedair	MTWT kg	Protein g	Fat g	Carb. g	Energy kcal
14 Gulls (MNI LBB 10 GBB4)	9.408	1505.3	2728.3	0	30199.7
4 Geese (MNI 3 Grey 1 black)	10.1136	2831.8	606.8	0	17799.9

In Table 3.7 the dietary input for a greylag goose was calculated following two methods which produced very different results. The Smith method employing the dietary values from a proxy in row one has in this case underestimated the fat content and therefore the overall calorific contribution, whereas row two uses values from an actual goose and is subsequently more accurate (Paul and Southgate 1978; Smith 2011). For the Scottish Island avian assemblages this is particularly relevant since the heavy exploitation of fatty, oily seabirds such as the gannet and the fulmar cannot be expected to equate to a ‘medium fat duck’. For example, one fulmar may produce half a pint of oil from its defensive gag-reflex in addition to its actual body fat. It was for this reason that the fulmar was particularly prized by the St Kildans who used this spitting-oil for everything from medicine to agricultural lubricant (Maclean 1992, 94-95).

Table 3.6: Avian body weight (BWT), meat weight (MTWT), nutritional and energy yields (Smith 2011, 8-11)

Taxon		Habitat	Body Wt kg	MTWT kg	Protein g/kg	Fat g/kg	Carb. g/kg	Energy kcal/kg
Northern brown kiwi	<i>Apteryx mantelli</i>	T	1.500 ³	1.050	280	60	0	1760
Southern brown kiwi	<i>Apteryx australis</i>	T	1.500 ¹	1.050	280	60	0	1760
Little spotted kiwi	<i>Apteryx owenii</i>	T	1.200 ¹	0.840	280	60	0	1760
Great spotted kiwi	<i>Apteryx haastii</i>	T	2.200 ¹	1.540	280	60	0	1760
NZ quail	<i>Coturnix novaeseelandiae</i>	T	0.100 ¹	0.070	280	60	0	1760
Black swan	<i>Cygnus atratus</i>	W	5.000 ¹	3.500	160	290	0	3210
North Island goose	<i>Cnemiornis gracilis</i>	T	8.000 ¹	5.600	280	60	0	1760
South Island goose	<i>Cnemiornis calcitrans</i>	T	10.000 ¹	7.000	280	60	0	1760
Scarlett's Duck	<i>Malacorhynchus scarletti</i>	W	0.800 ¹	0.560	160	290	0	3210
NZ musk duck	<i>Biziura delautouri</i>	W	2.000 ¹	1.400	160	290	0	3210
Paradise shelduck	<i>Tadorna variegata</i>	W	1.400 ¹	0.980	160	290	0	3210
NZ merganser	<i>Mergus australis</i>	W	0.900 ¹	0.630	160	290	0	3210
Finch's duck	<i>Chenonetta finschi</i>	W	0.800 ¹	0.560	160	290	0	3210
Blue Duck	<i>Hymenolaimus malacorhynchus</i>	W	0.750 ¹	0.525	160	290	0	3210
Grey teal	<i>Anas gracilis</i>	W	0.425 ¹	0.298	160	290	0	3210
Brown teal	<i>Anas chlorotis</i>	W	0.500 ¹	0.350	160	290	0	3210
Grey duck	<i>Anas superciliosa</i>	W	1.000 ¹	0.700	160	290	0	3210
Australasian shoveler	<i>Anas rhynchotis</i>	W	0.600 ²	0.420	160	290	0	3210
duck Anas ?sp	<i>Anas ?sp</i>	W	0.631 ⁴	0.442	160	290	0	3210
NZ scaup	<i>Aythya novaeseelandiae</i>	W	0.650 ¹	0.455	160	290	0	3210
Australasian crested grebe	<i>Podiceps cristatus australis</i>	W	1.100 ¹	0.770	160	290	0	3210
NZ dabchick	<i>Poliiocephalus rufopectus</i>	W	0.250 ¹	0.175	160	290	0	3210
NZ crested penguin	<i>Eudyptes pachyrhynchus</i>	M	4.000 ¹	2.800	160	290	0	3210
penguin Eudyptes ?sp	<i>Eudyptes ?sp</i>	M	4.000 ³	2.800	160	290	0	3210
Yellow-eyed penguin	<i>Megadyptes antipodes</i>	M	5.250 ¹	3.675	160	290	0	3210
Waitaha penguin	<i>Megadyptes waitaha</i>	M	5.250 ³	3.675	160	290	0	3210
Little penguin	<i>Eudyptula minor</i>	M	1.100 ¹	0.770	160	290	0	3210
penguin ?sp	<i>Spheniscidae ?sp</i>	M	3.450 ⁴	2.415	160	290	0	3210
Wandering albatross	<i>Diomedea exulans</i>	M	8.000 ²	5.600	160	290	0	3210
Southern royal albatross	<i>Diomedea epomorphora</i>	M	8.000 ²	5.600	160	290	0	3210
Grey-headed albatross	<i>Thalassarche chrystostoma</i>	M	4.500 ²	3.150	160	290	0	3210
Black-browed albatross	<i>Thalassarche melanophris</i>	M	4.500 ²	3.150	160	290	0	3210
Buller's albatross	<i>Thalassarche bulleri</i>	M	4.500 ²	3.150	160	290	0	3210
White-capped albatross	<i>Thalassarche cauta</i>	M	4.500 ²	3.150	160	290	0	3210
Chatham Island albatross	<i>Thalassarche eremita</i>	M	4.500 ²	3.150	160	290	0	3210
Salvin's albatross	<i>Thalassarche salvini</i>	M	4.500 ²	3.150	160	290	0	3210
Light-mantled sooty albatross	<i>Phoebetria palpebrata</i>	M	4.500 ²	3.150	160	290	0	3210
Albatross ?sp	Diomedidae ?sp	M	4.500 ²	3.150	160	290	0	3210
Southern giant petrel	<i>Macronectes giganteus</i>	M	4.500 ²	3.150	160	290	0	3210
Northern giant petrel	<i>Macronectes halli</i>	M	4.500 ³	3.150	160	290	0	3210
Cape petrel	<i>Daption capense</i>	M	0.500 ²	0.350	160	290	0	3210
Grey-faced petrel	<i>Pterodroma macroptera gouldi</i>	M	0.500 ¹	0.350	160	290	0	3210
White-headed petrel	<i>Pterodroma lessonii</i>	M	0.500 ²	0.350	160	290	0	3210
Chatham taiko	<i>Pterodroma magentae</i>	M	0.500 ²	0.350	160	290	0	3210
Mottled petrel	<i>Pterodroma inexpectata</i>	M	0.325 ¹	0.228	160	290	0	3210
Black-winged petrel	<i>Pterodroma nigripennis</i>	M	0.180 ²	0.126	160	290	0	3210

Taxon		Habitat	Body Wt kg	MTWT kg	Protein g/kg	Fat g/kg	Carb. g/kg	Energy kcal/kg
Cook's petrel	<i>Pterodroma cookii</i>	M	0.200 ¹	0.140	160	290	0	3210
Pycroft's petrel	<i>Pterodroma pycrofti</i>	M	0.160 ¹	0.112	160	290	0	3210
petrel - Pterodroma ?sp	<i>Pterodroma ?sp</i>	M	0.342 ⁴	0.239	160	290	0	3210
Blue petrel	<i>Halobaena caerulea</i>	M/W	0.200 ²	0.140	160	290	0	3210
Broad-billed prion	<i>Pachyptila vitata</i>	M	0.200 ²	0.140	160	290	0	3210
Fairy prion	<i>Pachyptila turtur</i>	M	0.125 ¹	0.088	160	290	0	3210
Fulmar prion	<i>Pachyptila crassirostris</i>	M	0.150 ²	0.105	160	290	0	3210
prion - Pachyptila ?sp	<i>Pachyptila ?sp</i>	M	0.158 ⁴	0.111	160	290	0	3210
White-chinned petrel	<i>Procellaria aequinoctialis</i>	M	1.100 ³	0.770	160	290	0	3210
Westland petrel	<i>Procellaria westlandica</i>	M	1.100 ¹	0.770	160	290	0	3210
Parkinson's petrel	<i>Procellaria parkinsoni</i>	M	0.700 ¹	0.490	160	290	0	3210
Grey petrel	<i>Procellaria cinerea</i>	M	1.100 ³	0.770	160	290	0	3210
Buller's shearwater	<i>Puffinus bulleri</i>	M	0.900 ²	0.630	160	290	0	3210
Flesh-footed shearwater	<i>Puffinus carneipes</i>	M	0.900 ²	0.630	160	290	0	3210
Sooty shearwater	<i>Puffinus griseus</i>	M	0.800 ¹	0.560	160	290	0	3210
Short-tailed shearwater	<i>Puffinus tenuirostris</i>	M	0.600 ²	0.420	160	290	0	3210
Fluttering shearwater	<i>Puffinus gavia</i>	M	0.300 ¹	0.210	160	290	0	3210
Scarlett's shearwater	<i>Puffinus spelaeus</i>	M	0.250 ¹	0.175	160	290	0	3210
Hutton's shearwater	<i>Puffinus huttoni</i>	M	0.350 ¹	0.245	160	290	0	3210
Norfolk little shearwater	<i>Puffinus assimilis</i>	M	0.200 ¹	0.140	160	290	0	3210
Shearwater - Puffinus ?sp	<i>Puffinus ?sp</i>	M	0.538 ⁴	0.376	160	290	0	3210
Grey-back storm petrel	<i>Garrodia nereis</i>	M	0.035 ¹	0.025	160	290	0	3210
White-faced storm petrel	<i>Pelagodroma marina</i>	M	0.045 ¹	0.032	160	290	0	3210
NZ storm petrel	<i>Pealeornis maorianus</i>	M	0.050 ³	0.035	160	290	0	3210
Common diving petrel	<i>Pelecanoides urinatrix</i>	M	0.130 ¹	0.091	160	290	0	3210
South Georgian diving petrel	<i>Pelecanoides georgicus</i>	M	0.120 ¹	0.084	160	290	0	3210
Petrel ?sp	Procellariidae ?sp	M	0.325 ⁴	0.228	160	290	0	3210
Australian pelican	<i>Pelecanus conspicillatus</i>	M	2.000 ²	1.400	160	290	0	3210
Australasian gannet	<i>Morus serrator</i>	M	2.300 ¹	1.610	160	290	0	3210
Little shag	<i>Phalacrocorax melanoleucos</i>	M	0.700 ¹	0.490	160	290	0	3210
Black shag	<i>Phalacrocorax carbo</i>	M	2.200 ¹	1.540	160	290	0	3210
Pied shag	<i>Phalacrocorax varius</i>	M	2.000 ¹	1.400	160	290	0	3210
Little black shag	<i>Phalacrocorax sulcirostris</i>	M	0.900 ²	0.630	160	290	0	3210
Shag - Phalacrocorax ?sp	Phalacrocorax ?sp	M	1.633 ⁴	1.143	160	290	0	3210
N.Z. King shag	<i>Leucocarbo carunculatus</i>	M	2.500 ¹	1.750	160	290	0	3210
Stewart Island shag	<i>Leucocarbo chalconotus</i>	M	2.500 ¹	1.750	160	290	0	3210
Spotted shag	<i>Stictocarbo punctatus</i>	M	1.200 ¹	0.840	160	290	0	3210
shag ?sp	Phalacrocoridae ?sp	M	1.583 ⁴	1.108	160	290	0	3210
White heron	<i>Ardea modesta</i>	W	0.900 ¹	0.630	160	290	0	3210
White-faced heron	<i>Egretta novaehollandiae</i>	W	0.550 ³	0.385	160	290	0	3210
Reef heron	<i>Egretta sacra</i>	W	0.400 ¹	0.280	160	290	0	3210
Australasian bittern	<i>Botaurus poiciloptilus</i>	W	1.000 ¹	0.700	160	290	0	3210
NZ little bittern	<i>Ixobrychus novaeseelandiae</i>	W	0.150 ¹	0.105	160	290	0	3210
Australasian harrier	<i>Circus approximans</i>	T	0.500 ²	0.350	280	60	0	1760
Eyles's harrier	<i>Circus teauteensis</i>	T	2.500 ¹	1.750	280	60	0	1760
Haast's eagle	<i>Aquila moorei</i>	T	12.000 ¹	8.400	280	60	0	1760
NZ falcon	<i>Falco novaeseelandiae</i>	T	0.500 ¹	0.350	280	60	0	1760

Taxon		Habitat	Body Wt kg	MTWT kg	Protein g/kg	Fat g/kg	Carb. g/kg	Energy kcal/kg
North island adzebill	<i>Aptornis otidiformis</i>	T	8.000 ¹	5.600	280	60	0	1760
South Island adzebill	<i>Aptornis defossor</i>	T	10.000 ¹	7.000	280	60	0	1760
Banded rail	<i>Gallirallus philippensis</i>	T	0.170 ¹	0.119	280	60	0	1760
Weka	<i>Gallirallus australis</i>	T	0.700 ¹	0.490	280	60	0	1760
Snipe rail	<i>Capellirallus karamu</i>	T	0.275 ¹	0.193	280	60	0	1760
Spotless crane	<i>Porzana tabuensis</i>	W	0.045 ¹	0.032	160	290	0	3210
Marsh crane	<i>Porzana pusilla</i>	W	0.040 ¹	0.028	160	290	0	3210
Hodgen's waterhen	<i>Gallinula hodgenorum</i>	W	0.450 ¹	0.315	160	290	0	3210
Pukeko	<i>Porphyrio melanotus</i>	W	1.000 ²	0.700	160	290	0	3210
North Island takehe	<i>Porphyrio mantelli</i>	W	3.500 ¹	2.450	160	290	0	3210
South Island takehe	<i>Porphyrio hochstetteri</i>	W	3.000 ¹	2.100	160	290	0	3210
NZ coot	<i>Fulica prisca</i>	W	1.000 ¹	0.700	160	290	0	3210
North Island snipe	<i>Coenocorypha barrierensis</i>	T	0.105 ¹	0.074	280	60	0	1760
South Island snipe	<i>Coenocorypha iredalei</i>	T	0.105 ¹	0.074	280	60	0	1760
Lesser knot	<i>Calidras canutus rogersi</i>	M	0.080 ²	0.056	160	290	0	3210
Whimbrel	<i>Numenius phaeopus</i>	M	0.400 ²	0.280	160	290	0	3210
Bar-tailed godwit	<i>Limosa lapponica</i>	M	0.400 ²	0.280	160	290	0	3210
Variable oystercatcher	<i>Haematopus unicolor</i>	W	0.725 ¹	0.508	160	290	0	3210
South Is. pied oystercatcher	<i>Haematopus finschi</i>	W	0.550 ¹	0.385	160	290	0	3210
Pied stilt	<i>Himantopus himantopus</i>	W	0.220 ³	0.154	160	290	0	3210
Black stilt	<i>Himantopus novaeseelandiae</i>	W	0.220 ¹	0.154	160	290	0	3210
NZ dotterel	<i>Charadrius obscurus</i>	M	0.145 ¹	0.102	160	290	0	3210
Banded dotterel	<i>Charadrius bicinctus</i>	W	0.060 ¹	0.042	160	290	0	3210
dotterel ?sp	<i>Charadrius ?sp</i>	W	0.103 ⁴	0.072	160	290	0	3210
Wrybill	<i>Anarhynchus frontalis</i>	M	0.055 ¹	0.039	160	290	0	3210
Shore plover	<i>Charadrius antarctica</i>	M	0.060 ¹	0.042	160	290	0	3210
Southern skua	<i>Catharacta antarctica</i>	M	1.950 ¹	1.365	160	290	0	3210
Arctic skua	<i>Stercoraria parasiticus</i>	M	1.400 ²	0.980	160	290	0	3210
Southern black-backed gull	<i>Larus dominicanus</i>	M	0.850 ¹	0.595	160	290	0	3210
Red-billed gull	<i>Larus novaehollandiae</i>	M	0.260 ¹	0.182	160	290	0	3210
Black-billed gull	<i>Larus bulleri</i>	M	0.250 ¹	0.175	160	290	0	3210
gull ?sp	<i>Larinae ?sp</i>	M	0.453 ⁴	0.317	160	290	0	3210
Fairy tern	<i>Sternula nereis</i>	M	0.070 ¹	0.049	160	290	0	3210
Caspian tern	<i>Hydroprogne caspia</i>	M	0.700 ¹	0.490	160	290	0	3210
Black-fronted tern	<i>Chilidonias albostrata</i>	M	0.080 ¹	0.056	160	290	0	3210
White-fronted tern	<i>Sterna striata</i>	M	0.160 ¹	0.112	160	290	0	3210
tern ?sp	<i>Sterninae ?sp</i>	M	0.253 ⁴	0.177	160	290	0	3210
wader ?sp	<i>Charadriiforme ?sp</i>	M/W	0.289 ⁴	0.202	160	290	0	3210
NZ pigeon	<i>Hemiphaga novaeseelandiae</i>	T	0.650 ¹	0.455	280	60	0	1760
Kakapo	<i>Strigops habroptilis</i>	T	2.000 ¹	1.400	280	60	0	1760
Kaka	<i>Nestor meridionalis</i>	T	0.425 ¹	0.298	280	60	0	1760
Kea	<i>Nestor notabilis</i>	T	0.800 ¹	0.560	280	60	0	1760
Red-crowned parakeet	<i>Cyanoramphus novaeseelandiae</i>	T	0.070 ¹	0.049	280	60	0	1760
Yellow-crowned parakeet	<i>Cyanoramphus auriceps</i>	T	0.040 ¹	0.028	280	60	0	1760
Orange-fronted parakeet	<i>Cyanoramphus malherbi</i>	T	0.035 ¹	0.025	280	60	0	1760
parakeet ?sp	<i>Cyanoramphus ?sp</i>	T	0.048 ⁴	0.034	280	60	0	1760

Taxon		Habitat	Body Wt kg	MTWT kg	Protein g/kg	Fat g/kg	Carb. g/kg	Energy kcal/kg
Shining cuckoo	<i>Chrysococcyx lucidus</i>	T	0.025 ¹	0.018	280	60	0	1760
Long-tailed cuckoo	<i>Eudynamis taitensis</i>	T	0.125 ¹	0.088	280	60	0	1760
Morepork	<i>Ninox novaeseelandiae</i>	T	0.175 ¹	0.123	280	60	0	1760
Laughing owl	<i>Sceloglaux albifaces</i>	T	0.600 ¹	0.420	280	60	0	1760
NZ owl-nightjar	<i>Aegotheles novaeseelandiae</i>	T	0.200 ¹	0.140	280	60	0	1760
NZ kingfisher	<i>Todiramphus sancta vagans</i>	T	0.065 ¹	0.046	280	60	0	1760
Rifleman	<i>Acanthisitta chloris</i>	T	0.007 ¹	0.005	280	60	0	1760
Bush wren	<i>Xencius longipes</i>	T	0.016 ¹	0.011	280	60	0	1760
Rock wren	<i>Xencius gilviventris</i>	T	0.020 ¹	0.014	280	60	0	1760
Lyall's wren	<i>Traversia lyalli</i>	T	0.022 ¹	0.015	280	60	0	1760
South Is. stout-legged wren	<i>Pachyplichas yaldwyni</i>	T	0.050 ¹	0.035	280	60	0	1760
Long-billed wren	<i>Dendroscansor decurvirostris</i>	T	0.030 ¹	0.021	280	60	0	1760
North Island kokako	<i>Callaeas wilsoni</i>	T	0.230 ¹	0.161	280	60	0	1760
South Island kokako	<i>Callaeas cinerea</i>	T	0.230 ¹	0.161	280	60	0	1760
North Island saddleback	<i>Philesturnus rufusater</i>	T	0.070 ¹	0.049	280	60	0	1760
South Island saddleback	<i>Philesturnus carunculatus</i>	T	0.070 ¹	0.049	280	60	0	1760
Huia	<i>Heteralocha acutirostris</i>	T	0.300 ¹	0.210	280	60	0	1760
Stitchbird	<i>Notiomystis cincta</i>	T	0.030 ¹	0.021	280	60	0	1760
North Island piopio	<i>Turnagra tanagra</i>	T	0.130 ¹	0.091	280	60	0	1760
South Island piopio	<i>Turnagra capensis</i>	T	0.130 ¹	0.091	280	60	0	1760
Grey warbler	<i>Gerygone igata</i>	T	0.007 ¹	0.005	280	60	0	1760
NZ bellbird	<i>Anthornis melanura</i>	T	0.026 ¹	0.018	280	60	0	1760
Tui	<i>Prosthemadra novaeseelandiae</i>	T	0.090 ¹	0.063	280	60	0	1760
Whitehead	<i>Mohoua albicilla</i>	T	0.015 ¹	0.011	280	60	0	1760
Yellowhead	<i>Mohoua ochrocephala</i>	T	0.025 ¹	0.018	280	60	0	1760
Brown creeper	<i>Mohoua novaeseelandiae</i>	T	0.011 ¹	0.008	280	60	0	1760
NZ fantail	<i>Rhipidura fuliginosa</i>	T	0.008 ¹	0.006	280	60	0	1760
NZ raven	<i>Corvus antipodum</i>	T	0.950 ¹	0.665	280	60	0	1760
Tomtit	<i>Petroica macrocephala</i>	T	0.011 ¹	0.008	280	60	0	1760
North Island robin	<i>Petroica longipes</i>	T	0.035 ³	0.025	280	60	0	1760
South Island robin	<i>Petroica australis</i>	T	0.035 ¹	0.025	280	60	0	1760
Fernbird	<i>Bowdleria punctata</i>	T	0.035 ¹	0.025	280	60	0	1760
NZ pipit	<i>Anthus novaeseelandiae</i>	T	0.040 ¹	0.028	280	60	0	1760

Habitat codes: M – marine; T – terrestrial; W – wetland.

Body weights from : 1 – Holdaway 1999: Appendix 1; 2 – Smith 1985: Tables 96, 97; 3 – based on comparable species;
4 – mean of relevant species

Since few terrestrial species were exploited in these island sites to any degree, these calculations may downplay the dietary contributions made by the birds that were specifically chosen for exploitation. This demonstrates the benefit of using species specific dietary values, but as mentioned this is not possible for all species, and in these cases a standardized proxy based comparison could be considered appropriate. However, the discordance in the results shown in Table 3.7 may arise from Smith

classifying the geese under the ‘Terrestrial’ proxy, when they are more appropriately considered a wetland bird if wild (Paul and Southgate 1978, 107-111). This can be corrected for. If the calculations are run again using the ‘Marine/Wetland’ proxy, the results are more homogeneous (Table 3.8). This shows that a broad proxy-based study can be of use if applied with consideration and rigour, with the added benefit of removing the need for acquiring species specific nutritional data within very diverse assemblages.

Table 3.7: Calculation of dietary input for one greylag goose using two methods

One Greylag Goose	Body Wt kg	MTWT kg	Protein g	Fat g	Energy kcal
Based on Smith 2011	3.612	2.5284	707.952	151.704	4449.984
Based on Paul & Southgate 1978 (in Serjeantson 2009)	3.612	2.5284	673.4738	514.8742	7332.36

Table 3.8: Rerun calculation of dietary input for one greylag goose using two methods

One Greylag Goose	Body Wt kg	MTWT kg	Protein g	Fat g	Energy kcal
Based on Smith 2011 ‘Wetland’	3.612	2.5284	404.544	733.236	8116.164
Based on Paul & Southgate 1978 (in Serjeantson 2009)	3.612	2.5284	673.474	514.874	7332.360

However both techniques fail to consider the contribution of immature birds. Like some young mammals, immature birds can hold more fat than their adult counterparts, however juvenile birds can also weigh more than adults before and during fledging providing more food per kill and maximising resources (Harman 1996, 99). For example gannets can weigh up to 4250g before fledging and up to 3650g at fledging whereas an adult weighs between 2941g and 3120g dependent on sex (Harman 1996,

99). This is quite an important consideration for seabird species whose main dietary and calorific contribution is made through fat since the additional weight in these young birds would primarily be fat.

Furthermore, the large number of species often present in avian assemblages combined with the taphonomic factors affecting their preservation and problems of differentiating between similar species with overlapping habitat, all add up to reduce the MNI values of avian assemblages. Consequently these calculations of dietary input will only ever be based on a very minimised number.

3.4 The Methodology Employed in the Analysis of Novel Assemblages

3.4.1 The Bone Assemblages

As part of this thesis a number of previously unexamined assemblages from North-East Atlantic islands have been analysed. These analyses have provided valuable information on avian exploitation for the individual sites in question and for the wider study of avian exploitation. These new analyses have also served the purpose of demonstrating how much information can be acquired from the study of birds if they are analysed and recorded to a level more on par with mammalian remains. It is, for example, possible to conduct more in depth comparisons and data analysis if bird remains have been studied and recorded to a consistent level that is detailed enough to allow further information to be sourced from it. If elements (for example) have not been recorded or zoned, frequency is very much limited to NISP and further calculations of i.e. meat weight based on MNI are near impossible. The methodology outlined below therefore provides the information and explanations needed to understand the techniques, processes,

categories and systems used in this thesis, but it could also potentially act as an outline for people wishing to approach an avian assemblage, to be used in conjunction with specialised works such as Cohen and Serjeantson (1996) and Serjeantson (2009).

Identification to Species

The bird remains were primarily identified to species using Cardiff University Department of Archaeology's reference collection and at the English Heritage Centre for Archaeology's skeletal resource in Portsmouth. Additional identification was also conducted at Southampton University's avian reference collection. Domestic birds were identified using the reference collections and via the criteria outlined in Bocheński and Tomek (2009) and Tomek and Bocheński (2009). Where bones were not identifiable to species they were recorded to the next highest level of identification. Using Atlantic puffin as an example:

1. Species: Atlantic Puffin *Fratercula Artica*
2. Genus: *Fratercula*
3. Family: Alcidae (Auk)
4. Order: Charadriiformes

Where factors such as fragmentation, preservation, juvenility or species specific size overlap prevented separation of similar species they were assigned to categories such as shag/cormorant. Taxonomically unidentifiable bones were recorded by broad size categories outlined below (based on Ayres *et al.* 2003, 360-406; Serjeantson 2009, 81-2) in order to extract data even from highly fragmented or damaged material. Whilst not a precise measure, the categories help to display general size profiles and fragmentation.

- Very Large Bird (refers to birds of goose size and larger)
- Large Bird (domestic fowl/duck size birds, including curlew, tawny owl)
- Medium Bird (pigeon/partridge size, including teal, woodcock, kestrel, godwit)
- Small Bird (thrush size birds)
- Tiny Bird (birds smaller than thrushes, those of finch or bunting size)

Quantification

The bird bone was recorded following the conventions outlined by Cohen and Serjeantson (1996). Each element is divided into eight zones (see Appendix Figures A3.1 to A3.6). A zone was recorded as 'present' if 50% or more of it was represented, as this constitutes a non-repeatable unit. Vertebrae and phalanges are not zoned and were only recorded if more than 50% of the element was present. The use of zones enables more accurate recording of which parts of the bone are present, and facilitates calculation of the MNE. MNE was taken for an individual species as the sum of the most frequently occurring zone of each element (taking side into account). The MNI is the highest MNE for a species (for a single side since a left and a right element can represent a single individual) (Mulville 1999, 235). These calculations help counteract the biases of fragmentation, which can create an overrepresentation of larger bones and species in the NISP (Mulville 1999, 235). MNI and MNE for groupings such as 'shag/cormorant' are considered alongside the individual species data (e.g. shag and cormorant) since the bones could come from individual birds already accounted for. Where skeletons are present they are indicated by an asterisk: *.

Taphonomy

Taphonomic information was recorded for all bones, including taxonomically unidentifiable fragments. Examination was conducted using a 10x magnification hand lens with a daylight lamp, and where necessary a light microscope. Burnt bone was recorded as burnt, charred or calcined. Surface gnawing, digestion, carnivore gnawing, carnivore puncture marks and rodent gnawing were recorded, and possible examples also identified. For butchery knife cuts, chop marks and working were recorded; processing indicators such as peeling and overextension were also identified. Abrasion, fracture patterns and root etching were noted in a comments column.

Age

Unfused bones and those displaying age-related porosity were recorded as ‘Juvenile’ and the age stage (Very Young, Immature or Subadult) identified where possible. ‘Adult’ birds were recorded where identifiable and ‘No Evidence’ was used if age could not be assigned due to incompleteness or damage etc. Epiphyseal fusion is rarer in birds than in mammals and maturation takes a different form (Cohen and Serjeantson 1996, 7-8). The bones forming the carpometacarpus are the first limb-bones to fuse, followed by the proximal tibiotarsus epiphysis fusing to its shaft, and the metatarsi which fuse to the hypotarsus creating the tarsometatarsus (Cohen and Serjeantson 1996, 7-8; Serjeantson 2009, 38-39). The ilium, ischium and pubis fuse together, and then fuse to the sacrum. These were recorded with further comments.

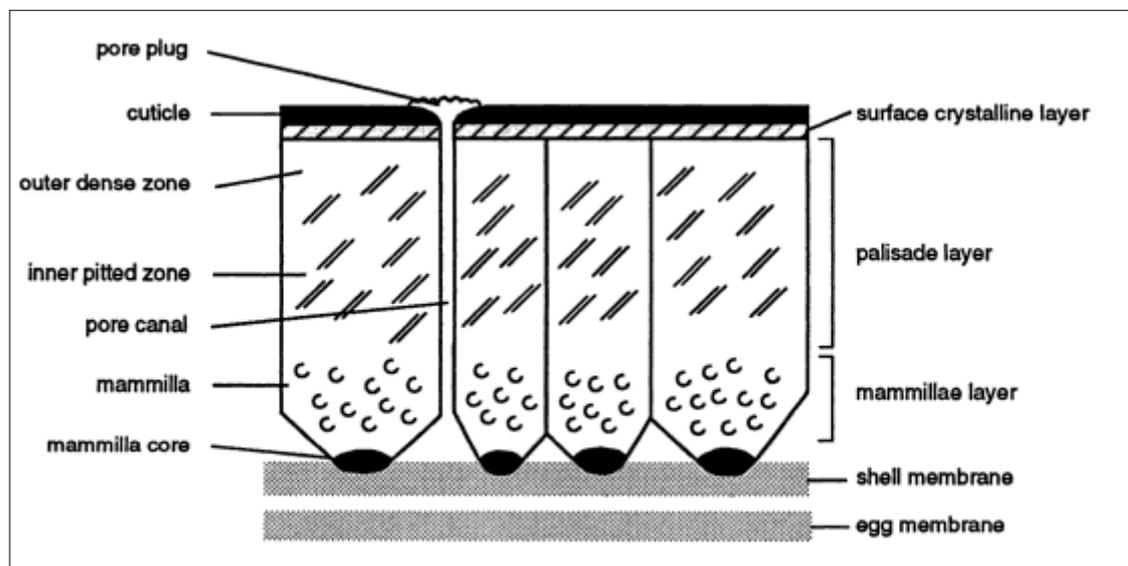
Sex, Pathology, Articulation and Measurements.

Sex was recorded for all fragments (presence, absence or lack of evidence). The presence of medullary bone was identified in fragmented bones only, and recorded by degree of fill following Lentacker and Van Neer (1996, 488-496) with consideration of Van Neer *et al.* (2002, 123-134), see section 4.7 for further detail. Since x-ray or destructive sampling was not conducted (due to scale, cost and for preservation), medullary bone is likely to be under-represented, particularly for robust bones which survived whole. However, it has provided a valuable insight into its frequency, form and distribution which could help target future work. Spur presence/absence was noted (based on Sadler 2001 with reference to Serjeantson 2009 and Habermehl 1975), and sexing via metrics was considered. Pathologies and articulations were noted for all bones. Where possible measurements were taken from mature bones following the conventions in Cohen and Serjeantson (1996, 2-14) Appendix Figures A3.4 to A3.6).

3.4.2 The Eggshell

An egg when laid had both inorganic and organic elements to its structure with an organic coating of the internal and external surfaces, however these are no longer present in archaeological material (except in very exceptional preservation conditions) (Sidell 1993, 6-7; Sidell 1993a 46-47). The general structure of eggshell is presented in Figure 3.8. The mammillae, each with a mammilla core are observed on the internal surface of the eggshell. The gaps between these are known as fissures, and sutures are the fusion points between the mammillae (Sidell 1993, 7; Sidell 1993a, 48). Membrane facets refer to the shaping or sculpting visible on the mammillae surface (see Figure 3.9) (Sidell 1993, 6-7; Sidell 1993a, 48).

Figure 3.8: Main structural components of archaeological eggshell (Sidell 1993, 6).



A Method of Identification

Eggshell can be recovered from archaeological sites and with improvements in sampling, sieving and recovery techniques it is ever more frequently retrieved. The recovery of archaeological eggshell is also very much dependent on preservation (Keepax 1981, 313-319; Sidell 1993, 5-9). Once collected the archaeological eggshell

presents a different challenge: identification. This material can be identified to species or useful taxonomic order by using microscopy to examine its form both metrically and visually. This process involves light microscopy and use of the Scanning Electron Microscope (SEM).

Egg Development and Hatching

In addition to species identification, examination by SEM reveals the developmental stage of the egg and whether the chick had hatched by observing the reabsorption of the mammillae structure (Beacham and Durand 2007, 1610-1615). Naturally, since different species have different incubation periods this is not a precise technique but it allows a general understanding of the time from lay and developmental sequence. This evidence is valuable archaeologically, particularly when combined with species information, since it enables the identification of fowl management practices in domesticates and can also help to exclude intrusive material if eggshell from wild species exhibits hatching. With domesticates determining the hatching stage of the eggshell can indicate what the birds were being used for: meat (hatched shells = live young) or eggs (un-hatched and partial reabsorption) (Beacham and Durand 2007, 1610-1615; Simons 1971) (see Figure 3.9).

With wild species it is unlikely that hatched shell material would have been intentionally brought to a site unless it was then to serve some useful function such as in the manufacture of decorative beads. In such cases the eggshell almost exclusively belongs to large bird species not present in the British Isles; such as ostrich, emu, rhea or moa (Gill 2000, 131-145; Gill 2010, 115-122; Kandel 2005, 1711-1721; Serjeantson 2009, 179). Eggshell material (both hatched and un-hatched) can accidentally enter the

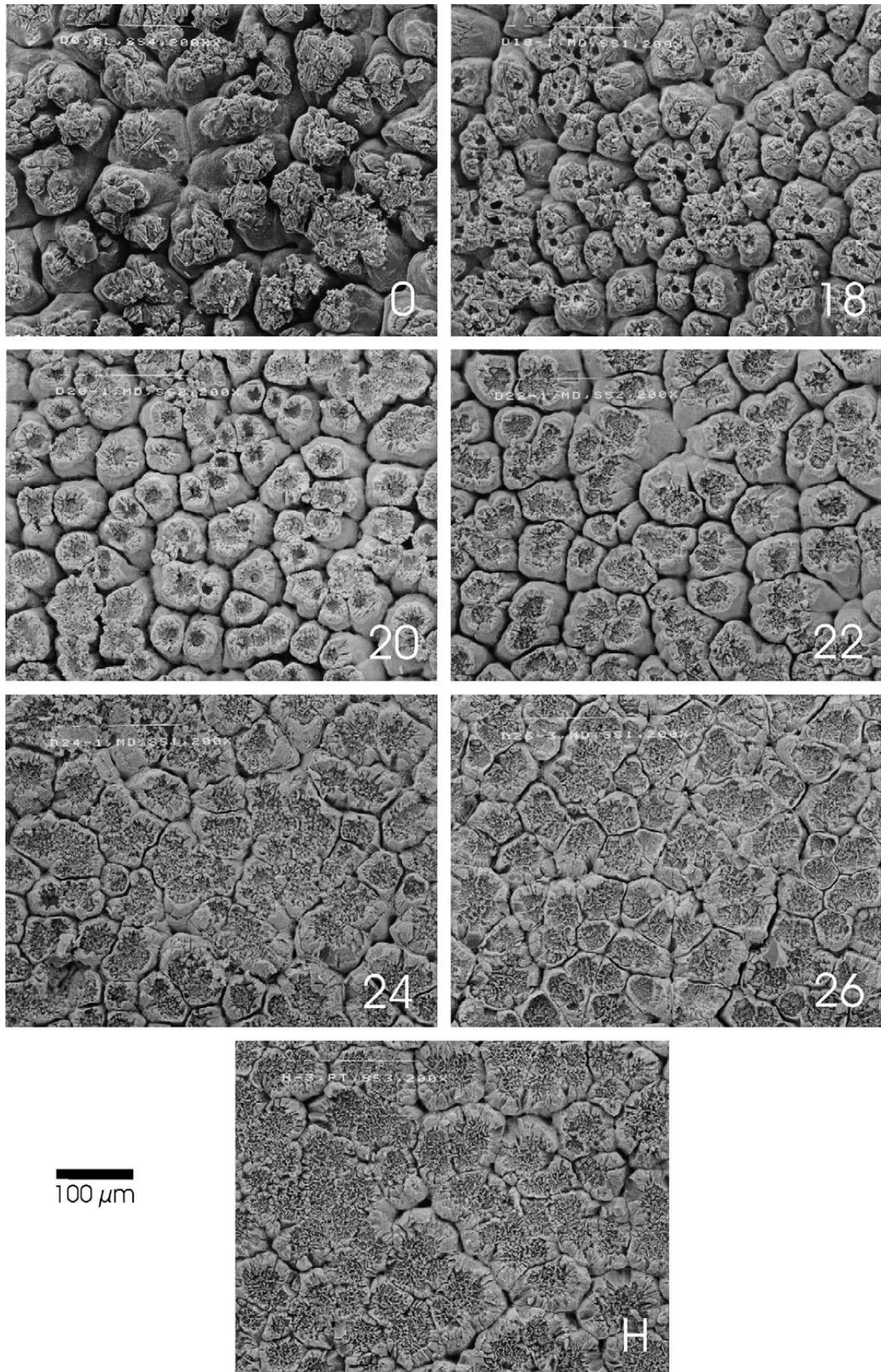
archaeological record from birds nesting in the vicinity, soil movement (natural and/or through midden spreading and fertilisation) or by animal agents. Mammals, rodents and other birds may prey on eggs. The nesting birds themselves (in particular small passerines) may remove the shell from their nesting site and deposit it at some distance to help prevent them being located by predators while raising the chick.

The New Eggshell Analysis

A sample of archaeological eggshell from Bornais was analysed for this thesis to complement the bone identification. This site was selected since it was the largest novel bone assemblage analysed for this work, had a long multi-period chronology, was well preserved, and produced both domestic and wild birds in the bone identifications. Samples were chosen from each temporal period (Late Iron Age, Pre-Norse/Pictish, Early Norse, Middle Norse and Late Norse) and from each of the mounds, but with a focus on Mounds 2 and 2A (since the largest bird bone assemblage came from these mounds). Eggshell was taken from contexts that had also produced avian bone to facilitate further taxonomic comparisons (See Chapter 7.2 for further information on the Bornais Eggshell material sampled).

The archaeological eggshell was prepared following the standards outlined by Jane Sidell (1993, 5-11 and Sidell pers. comm.). The eggshell was washed using an ultrasonic tank to thoroughly clean it prior to microscopy work. The ultrasonic tank removes dirt gently from the eggshell's surface without damaging the material and (as such) the structure needed for SEM analysis. The eggshell was placed in a container of distilled water and washed for one minute at either 20 or 50 percent power (dependent on the dirtiness, thickness and fragility of the eggshell).

Figure 3.9: Image of reabsorption of mammillae/cones by number of days incubated (0, 18, 20, 22, 24, 26) and then a hatched specimen (Beacham and Durand 2007, 1615).



A light microscope was used to check that the eggshell had been sufficiently cleaned; if dirt still adhered to the surface then the specimen was returned to the ultrasonic tank for a further minute. After cleaning, the eggshell was air dried in a petri dish. The cleaned eggshell was then studied by light microscope to identify damaged or poorly preserved material and to sort the eggshell into types based on morphology, thickness, texture and pore count. From this sorted sample material the specimens for SEM analysis were then selected, based on context and condition. A light microscope was again used to conduct initial species identification. This included measuring the thickness of the shell (mm), the mean number of pores per mm², ratio of the mammillae to palisade layer (see Figure 3.8) and any evidence for hatching of live young from the egg (Sidell 1993, 5-11). The samples were then mounted onto stubs using carbon cement and coated in gold using Bio-Ras Microscience Division SC500 Sputter Coater, at the School of Earth and Ocean Sciences, Cardiff University, under the guidance of Mr Peter Fisher.

An initial trial was made using carbon to coat the specimens instead of gold. However, although the eggshell's basic micromorphology could be observed, the finer resolution provided by gold coating was deemed necessary for identification to species. Gold is the usual medium chosen for examining specimens with a very irregular surface (such as eggshell) however it is more costly than the carbon coating and fewer locations are equipped to offer this service. Coating in gold also ensured that this work was comparable with that of Jane Sidell, and that any problems of identification rose from circumstances such as preservation rather than this material choice, and that high quality images could be attained for study and future use.

Once mounted and coated in gold the specimens were examined using the SEM. A series of counts, descriptions and photographs were taken to facilitate the identification to species. At 200x magnification a count of the number of mammillae per mm² was taken. This was repeated 20x to achieve an average (Sidell 1993, 5-11). The internal surface was then examined and described following set criteria to facilitate speciation:

- The regularity, size, shape and spacing of the mammillae
- The depth of fissuring and the sutures form and depth
- Fiber trails and struts are noted.

Examination of the internal surface was conducted from 300x magnification to 1000x magnification. Photographs were taken at 300x and 800x magnification to allow further comparison with reference materials.

3.4.3 Statistical Analysis

Statistical analysis was used when appropriate to analyse the avian data within this thesis. This research has aimed to create a holistic consideration, interpretation and discussion of the avian material and as such statistical analysis has not been the driving force nor the main concern of this work. Statistical tests have been used to assess the significance of data (for example the species representation between two populations/sites and or periods). Because the archaeological dataset being used in this instance is ordinal (rather than ratio or interval) and not normally distributed, the Mann-Whitney U test was selected since this is a nonparametric test. The Mann-Whitney U test is a powerful nonparametric test for statistical significance (it is also known as Wilcoxon–Mann–Whitney test, Mann-Whitney-Wilcoxon or the Wilcoxon rank-sum test). It does not require normally distributed data and it can also be used with small sample sizes (Shennan 1997, 65-68). The Mann-Whitney U test is able to handle

populations/samples of uneven size, which is vital in an archaeological situation where (unlike for example in a modern survey of a selected number of participants) the sample size is often predetermined by other uncontrollable factors such as preservation or recovery⁷. Developed statistical analysis of the data could be a valuable avenue for future work on avian remains from the Scottish Islands, particularly for sites which have had thorough sampling and strong avian analysis. However, this is beyond the scope of this thesis to consider fully without sacrificing other analysis areas. In this thesis the term average is used in referring to the arithmetic mean.

3.5 Selecting and Eliminating Data from the Collation

The choices made regarding the data included in this collation were in part based on the deductions concerning the previous analysis outlined in the last chapter. Some further relevant points are outlined here for clarity.

The recommended minimum size for detailed examination of a mammalian assemblage (following Hambledon 1999) is a NISP of 300. As such, where appropriate these small assemblages can be excluded from comparative analysis. However in some situations, such as early periods where data may be limited (e.g. Early Bronze Age Sligeanach), even a small mammalian assemblage of 80 can provide valuable insight. For birds this is less clear cut, particularly since many avian assemblages are small in number both as a result of preservation and actual role within the economy. Naturally larger avian assemblages provide more opportunities for detailed analysis. However with birds even

⁷ The T-test can be described as its parametric counterpart and is used for normally distributed data.

a single example of a species can provide information on habitat, season and wild resource use. Therefore even a small assemblage can divulge useful information. Where appropriate avian assemblages with a NISP lower than five are excluded in order to give clearer and more representative presentation of the data (e.g. graphically).

Contentious material that could bias a period profile is separated. At Beachview, for example, the phase Z contained deposits in which the Norse remains were mixed with the topsoil and modern material (Rackham *et al.* 1996 and 1996a). Therefore these are separated from the pure deposits below and placed in a different category. The same practice is applied for sites such as Howe which had some mixed remains (Iron Age-Modern) (Bramwell 1994, 153-157).

Cnoc Coig is a valuable Mesolithic site in the Inner Hebrides which is key for extending knowledge of fowling in the Mesolithic and the exploitation of avian resources in a pre-agricultural context. This site is particularly important as others of the same temporal and geographical location were not available for study (discussed in Chapter Two). Caroline Grigson has valiantly been ploughing through Don Bramwell's pre-computer paper records left for these sites and finalising a long delayed publication on them (Grigson pers. comm.). Understandably she was unwilling to release the information for inclusion within this collation until the long-awaited report is completed. However, she kindly provided a table of NISP values for Cnoc Coig, based on these paper records. An older pre-existing thesis examining the spatial patterning of finds at Cnoc Coig, written in 1986 by Richard Nolan, also contained avian data from this site. The decision was made to use Richard Nolan's material exclusively for this collation since: it was provided directly by Don Bramwell and was reported on/written down at a time far

closer to the actual analysis which helps reduce errors over time, loss of information and confusion. It also contained more data than the provided NISP table, including juveniles present, elemental information and patterns of recovery. Whilst this means that the NISP values may be slightly different from those in Grigson's final report, the author believes that by choosing Nolan's report a more detailed and potentially more accurate collation could be ensured which includes important juvenile data for this early point in the fowling economy of the Scottish Islands.

3.6 The Database

The database created to collate the existing and novel avian data was designed to allow detailed records, but with easy search and query capabilities. Each site/period subdivision had its own unique Site ID which allowed multiple tables to be investigated and queried. The database contained a main Archaeological Site Data table which housed the needed information on the archaeological sites investigated (including location, date, type) and also contained information on the level of avian analysis recorded (for example) whether juveniles or butchery had been identified (see Figure 3.10).

The largest table and associated input form was for species (Figure 3.12). This vital part of the database was used to input the NISP data for avian species and taxonomic groupings. This formed the basis for a large part of the data analysis. Also within the database each taphonomic characteristic (e.g. butchery or burning) has its own table and form. As does juvenility, sex, elemental distribution, MNI and eggshell (Figure 3.11). All tables are linked via the Site ID relationship.

Figure 3.10: The key table for containing the site data and the condition/extent of the avian assemblage and analysis (top) and further site notes (bottom).

The screenshot shows the Microsoft Access interface for the 'Birds of the Atlantic Islands E: Database (Access 2007)'. The 'Archaeological Site Data' form is displayed, showing the following data for site ID 175:

SITE ID:	175	BUTCHERY:	Unknown
SITE NAME:	Bu	GNAWING:	Unknown
ISLAND:	Mainland	BURNING:	Unknown
ISLAND GROUP:	Orkney	ELEMENTS:	Unknown
PERIOD:	Early Iron Age	AGE:	Unknown
SITE TYPE:	Roundhouse Broch-like	SEX:	Unknown
NA SAMPLE SIZE:	Unknown	EGGSHELL:	Unknown
MAMMAL NISP:	Unknown Noddle destroyed		
FISH NISP:			
AVIAN SAMPLE SIZE:	Unknown		
AVIAN NISP:	270		
AVIAN MNI:			

The bottom section of the form contains the following text:

REFERENCE: Bramwell, D. 1987. 'The Bird Remains'. In J.W. Hedges (ed.) Bu, Gurness and the brochs of Orkney. Part 1: Bu,135-136, Oxford: Archaeopress BAR British Series 163.

COMMENTS: there is no evidence that it ever had any of the features of the hollow-walled construction technique so characteristic of the dry stone towers. This is important because of the far-reaching claims that were made, soon after the excavation, about the site being an early Iron Age broch, much older than any other known. Radiocarbon dates. Four dates were obtained, two for Phase Iia, one for Iib and one for IIIa. Because of the time span into which the site falls the dates cannot be calibrated so precisely as, for example, those from the later broch period.
The first two were 2470 +/- 95 bp (GU 1228, charcoal) and 2460 +/- 80 bp (GU 1154, bone); when calibrated they suggest a time span of about 800-450 BC at a 68% degree of confidence (the first date is slightly more

Figure 3.11: Example of a form used to input data into a table in this case for butchery.

The screenshot shows the 'Butchery' form in Microsoft Access. The form contains the following data:

SITE ID:	7	ELEMENT:	Ulna
2ndARY ID:		TYPE:	Knife Cut
RECORDS ALL BUTCHERY:	<input checked="" type="checkbox"/>	LOCATION:	Distal Shaft
JUST MENTIONED:	<input type="checkbox"/>	FREQUENCY:	1
% OF NISP:		COMMENTS:	Slice at break
% OF COUNT:			
TOTAL SITE FREQUENCY:	2		
SPECIES:	Goose Sp		

The form also includes a small image of a bird (likely a goose) and a status bar at the bottom indicating 'Record: 4 of 9 of 157'.

Figure 3.12: Form to input species data into table and collate the data.

Site ID: 127	
FULMAR:	9
GANNET:	20
MANX SHEARWATER:	4
GREAT SHEARWATER:	
SOOTY SHEARWATER:	
SHEARWATER SP:	
LEACH'S PETREL:	
GADFLY PETREL CF FEAS:	
CORMORANT:	1
SHAG:	1
CORMORANT/SHAG:	
PELECANIFORME:	
ANATIDAE:	
SWAN SP:	
MUTE SWAN:	
COMMON GULL:	
HERRING GULL:	3
LESSER BLACK BACKED GULL:	1
HERRING / LESSER BLACK BACKED GULL:	
COMMON / HERRING GULL:	
GREAT BLACK BACKED GULL:	1
GLAUCOUS / GREAT BLACK BACKED GULL:	
GULL SP:	
KITTIWAKE:	4
BLACK HEADED GULL:	
GULL CF COMMON:	
SMALL GULL SP:	
LARGE GULL SP:	
GREAT SKUA:	
SKUA SP:	
GULL / WADER:	
SMALL GULL / SKUA:	
OYSTERCATCHER:	3
PLOVER:	
CURLEW:	2
GOLDEN PLOVER:	4
RINGED PLOVER:	1
GREY PLOVER:	
PLOVER CF GOLDEN:	
LAPWING:	
KNOT:	
DUNLIN:	1
LAPWING / GODWIT:	
BAR-TAILED GODWIT:	
BLACKTAILED GODWIT:	
REDSHANK:	1
SPOTTED REDSHANK:	
GREENSHANK:	
SNIPE:	2
JACKSNIFE:	

3.7 Closing Summary

This chapter has presented the wide range of techniques and methods used within this thesis to facilitate the conduction of novel analysis, the collation of existing avian reports and their limitations in order to enable thorough manipulation, presentation and interpretation of the remains. Also covered were the general considerations in handling archaeoavian bone such as preservation and recovery, to the challenges of quantification, dietary contribution and interclass comparison. The chapter documented the conventions followed in analysing the new assemblages, to ensure accurate comparable data from all the analysed sites, including those from the case-study island of South Uist, which are now considered in Chapter Four.

CHAPTER FOUR

RESULTS

The Avian Picture of South Uist: A Case Study



4.0 Introduction

This chapter presents the island of South Uist as an in depth case study for investigating archaeological fowling. As introduced in Chapter Two the recently excavated and well preserved assemblages from South Uist provide an ideal opportunity for both detailed individual analysis and compatible inter-site comparison. It was also essential that the large avian assemblages from South Uist were analysed so that they could be incorporated into the wider examination of avian resource use in the Scottish Islands and to rectify this gap in the archaeological record. The accessible nature of data from previously conducted avian analyses on South Uist was also important in its selection as the ideal location for initial collative work.

Firstly in this chapter the island of South Uist will be contextualised in greater detail than was possible in Chapter Two, exploring its past and present form. The avian data will then initially be presented as part of the wider faunal assemblage incorporating the mammalian and fish remains⁸. The birds are then considered by broad taxonomic grouping over time and by site in order to investigate general patterns of resource use. This then leads to consideration of birds by species groupings and individual species via period, allowing comparison and discussion of patterns and trends in bird use. Having examined the species present the seasonality of avian resource use on South Uist can be presented and then developed further by addressing the age and sex data, which helps to develop a fuller understanding of the fowling calendar and the habitats being utilised. Finally the taphonomic profile will be examined to contextualise the use of birds within subsistence and wider activities practised by the South Uist populations over time.

⁸ The limited mollusc data will be incorporated and explored in Chapter Seven, when all islands are considered as part of the wider faunal assemblage from Faroe and Iceland.

4.1 Situating South Uist: a Modern Place?

As introduced in Chapter Two, the Outer Hebrides is made up of several individual islands. South Uist is situated towards the southern end of this chain. Today to the north of South Uist lie the islands of Benbecula and North Uist (Figure 4.1). These three larger islands (along with other areas such as the small tidal island of Baleshare) cluster to form a ‘middle section’ of the Outer Hebrides which is separated from Harris and Lewis to the north and Barra to the south by larger expanses of water (hashed section on Figure 4.1). However the island today known as South Uist is part of an area of the Outer Hebrides which in the past had a different physical and perceived identity which could have determined movement around the landscape and wild resource acquisition.

Even today the islands themselves are constantly changing physically and as such their boundaries and appearance are continually being redefined. As explored in Chapter Two gradual erosion and sudden natural events are in particular altering the profile of the western shore of these islands. However, in the past this ‘middle section’ of the Outer Hebrides was in fact a more singular entity. During (and prior to) the Mesolithic and Neolithic the islands of South Uist, North Uist and Benbecula formed a single landmass, which were then separated by a process of sea level change around 2000 BC during the Bronze Age (Parker Pearson *et al.* 2004, 25 and 34). This process would have resulted in a changed landscape of occupation (Parker Pearson *et al.* 2004, 56). However, with the daily tidal movement of the sea and its seasonal or climatic variation being intrinsically present for people living in these exposed island settings, the physical separation and division of islands in the past could have held a degree of fluidity and as such may not have been perceived as rigidly as our modern mapping suggests. Even

today there is only a small causeway needed to connect the islands, but the inhabitants are keenly aware that a single storm can alter their coastline dramatically. Both daily variation and dramatic change are documented historically and record that even in the late medieval period it was still possible to walk from the Monach Isles (with their substantial bird populations) to North Uist's tidal island of Baleshare at a low tide; a journey of five miles (Haswell-Smith 2004, 254-255; Martin 1716, 60-71). It is thought that this path was destroyed by a tidal wave storm in the late 15th century AD (Haswell-Smith 2004, 255). The affect that similar events may have had for earlier occupants of the islands can easily be imagined.

Figure 4.1: Outer Hebrides Map highlighting Uists and Benbecula (drawn by Ian Dennis).

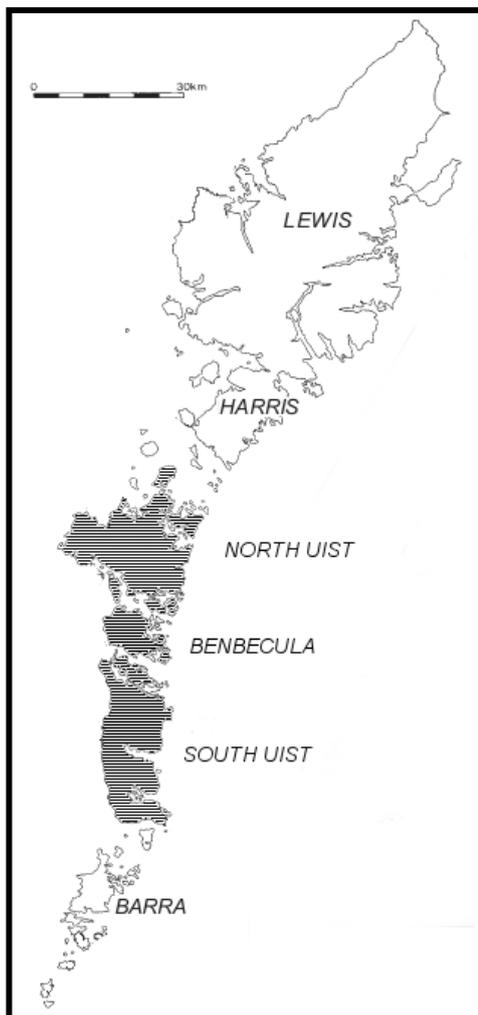
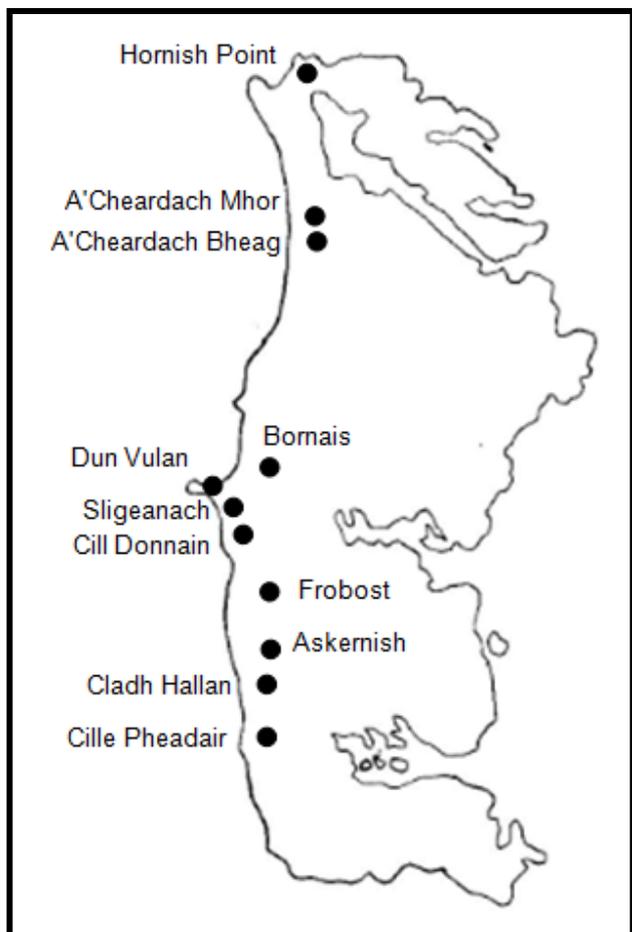


Figure 4.2: Map showing the key archaeological sites on South Uist.



This variability in island access and relation to surrounding islands would have had an impact on how South Uist's overall morphology was perceived by its human inhabitants and their movements within the landscape. Furthermore a physical change does not automatically enforce a conceptual alteration of how the island is perceived. Indeed, long after the complete physical separation of South Uist, Benbecula and North Uist had occurred, and well into the recent past, the Uists were frequently considered as one entity, for example they are collectively referred to as 'Vyist' by a 16th century High Dean of the Isles (MacQueen 1794; Parker Pearson *et al.* 2004, 8).

So in some ways the island of South Uist as considered in this case study is a modern 'place', which reemphasises the dangers and ramifications of applying our current definitions, characterisations and island groupings to the data of the past. As such in this thesis 'South Uist' is used as a case study since in modern geographic terms this is where many of the newly analysed assemblages originated from. However, this island will be fully integrated with the wider island body in Chapter Five.

South Uist as a case study has a number of unique characteristics that make it best placed for comparative study. The material preservation for many sites is excellent, affording large assemblages recovered from modern excavation. Good access to data from previously well-analysed assemblages was also possible. By analysing several assemblages from this location a greater degree of comparative analysis and data compatibility was attained than is available in many other instances, since assemblages were analysed using the same conventions and to the same level of detail (i.e. recording of sex, age, elements, taphonomy etc.). While South Uist should by no means be considered in isolation, this case study facilitates an in-depth exploration of the island's

avian landscape and resource use over time which can then act as a springboard for wider exploration of avian themes. The case study also demonstrates the wealth of information and level of interpretation that can be achieved via thorough analysis, consistent conventions, access to full datasets, and by transcending the boundaries often imposed upon avian studies (such as developing species data via sex, age and season).

South Uist also serves as a valuable case study since there are substantial modern bird surveys and research taking place in the locality, particularly on nearby North Uist at Balranald, a RSPB bird reserve. Such long term studies are a vital tool in the avian zooarchaeologist's arsenal; by using this material we have the potential to reconstruct bird behaviour of the past and infer distribution and seasonality (among other things). Reserves such as Balranald provide a valuable area of less disturbed landscape which may be more akin to past environments. Examples of relevant research include Paterson's (1987) censuses of greylag goose populations which document changes in flock size and distribution in relation to population movements between North and South Uist, and to moult areas. Others such as Clode *et al.* (2000) analysed the avian response to ground predators focusing on gulls and terns. The location of Balranald also makes it a valuable station for observing passage birds and rare species (Andrews 2011, 287; Davenport 1979, 216). Without these modern studies attempts to reconstruct human activities from avian material would be limited and much valuable information could be missed.

While there are limitations in using modern populations to infer past avian behaviour and distribution, and the risk of making incorrect comparisons, these datasets allow insights into areas that would otherwise be intangible. Such studies can for instance

infer seasonality which in turn helps reconstruct the abundance of avian resources available for capture, e.g. which species are swollen in winter by the arrival of visitors from outside Britain. Modern censuses can also inform on past distributions by observing behavioural traits and regularity of action; it can be assumed that these characteristics and degree of variability would have also been true for this species in the past. For example, if a bird species has been recorded in modern times to have changeable behaviour and be flexible in responding to various surrounding stimuli, in the past it may well have altered its behaviour (and as such its nesting or geographical range) with little reason or traceable origin. This could help explain irregular capture patterns. On the other hand if recent studies have noted a species to be precise and fixed in its behaviour then any changes that occur in its past distributions may be more easily assigned to a particular cause or set of influences.

To demonstrate the above points, two contrasting species will be briefly considered. The now extinct great auk was restricted in its choice of breeding areas due to its inability to fly and its lack of mobility on land (which it only visited to nest). If this species was present in a particular area or island group and then became absent it is unlikely to have shifted its breeding location to a different type of breeding site. There are a fixed number of locations around the Scottish coast which would have been suitable, and while the great auks may have chosen to nest in those sites where predation was lower, there was a limit to this relocation. By contrast many birds are very opportunistic (large gull species in particular) and their diet and numbers in an area can vary dramatically dependent on location and specific conditions (it is easy to observe gulls' adaptive ability through their prolific invasion of modern cities). While many birds may scavenge, gulls are notably successful in this activity and any human activity in a

habitation area, with associated refuse production, may have attracted large gulls into the vicinity of a site. For example, if we consider the Bornais mounds then the mixture of human habitation, middening activity, and disposal of waste material (i.e. from food processing) at this site is likely to have attracted avian scavengers (Webb *et al.* 1990, 179 and 189). An area specific case study can help to investigate such trends.

4.2 The Archaeological Sites

The majority of material compared in this chapter dates from the Middle Bronze Age to the Norse period, although some of the sites also produced small Medieval/Post-Medieval assemblages which will be briefly outlined (Table 4.1). As mentioned in Chapter Two there is no Mesolithic archaeology on South Uist. Whilst the island contains several Neolithic sites, the bone preservation at these is poor since the majority are situated on the blacklands rather than the alkaline shell sand of the machair (see Figure 2.5 and Figure 4.2) (Parker Pearson *et al.* 2004, 32-34 and 38-40).

A number of later sites produced large assemblages of sufficient size to facilitate extensive examination and comparison. Although bird bone did not survive at some sites or suffered from problems of recovery during excavation, compared to other Scottish Island areas the South Uist (avian) archaeology is well preserved and produced a comparatively high number of sites with sizeable (and accurately/holistically recovered) assemblages. These are Cladh Hallan, Bornais, Cille Pheadair, Dun Vulcan and to an extent Hornish Point. The key sites investigated in this chapter are presented below (Table 4.1). Bornais produced the largest avian assemblage and is also valuable due to its in-depth site analysis, site size and longevity. Detailed analysis of individual sites (within wider comparative work) is valuable since it limits the risk of observed

patterns being the result of intersite compatibility problems such as preservation and excavation methods rather than reflecting the actual avian profiles. Bornais allows consideration of the avian remains by spatial location (the different settlement mounds) and by period: Late Iron Age, Pre-Norse/Pictish, Early Norse, Middle Norse and Late Norse. This provides a very valuable databody, although naturally it is contextually limited. The Norse phases of Mound 2 and 2A produced the largest assemblages, and as such these are most suited for closer analysis.

Table 4.1: Site shown by period and bird bone analyst.

Site Name	Period	Bird Bone Analyst	Reference	
Cladh Hallan	Middle Bronze Age	Julia Best	Best and Mulville 2013. Best and Powell In Preparation.	
Cladh Hallan	Late Bronze Age	Julia Best (with Adrienne Powell)		
Cladh Hallan	Early Iron Age	Julia Best		
Bornais M1	Late Iron Age	Judith Cartledge & Dale Serjeantson	Cartledge and Serjeantson 2012.	
Bornais M1	Norse	Judith Cartledge & Dale Serjeantson		
Bornais M2	Pre-Norse/Pictish	Julia Best	Best In Preparation.	
Bornais M2	Pre-Norse/Pictish / Norse	Julia Best		
Bornais M2	Early Norse	Julia Best		
Bornais M2	Middle Norse	Julia Best		
Bornais M2	Late Norse	Julia Best		
Bornais M2	Norse (Unphased)	Julia Best		
Bornais M2A	Early Norse	Julia Best		
Bornais M2A	Middle Norse	Julia Best		
Bornais M2A	Late Norse	Julia Best		
Bornais M3	Norse	Judith Cartledge		
Cille Pheadair	Norse L10th/E11 th - M-L 13 th	Julia Best		Cartledge 2005.
Dun Vulcan	Middle - Late Iron Age	Judith Cartledge & Caroline Grimbly		Best & Cartledge In Press
Dun Vulcan	Late Iron Age to Medieval	Judith Cartledge & Caroline Grimbly		
A'Cheardach Mhor I	Iron Age 2nd C AD	Judith Finlay	Cartledge and Grimbly 1999.	
A'Cheardach Mhor II	Iron Age	Judith Finlay		
A'Cheardach Mhor IV	Late Iron Age 7th - 8th C AD	Judith Finlay		
A'Cheardach Bheag	Iron Age	Judith Finlay		
Cill Donnain	Iron Age	Saleem ul Haq & Claire Ingrem	Finlay 1984	
Hornish Point	Iron Age	Dale Serjeantson	Unpublished reports	
Askernish	Iron Age	Julia Best	Serjeantson 2003.	
Frobost	Medieval 13th - 14th Century	Julia Best		
Sligeanach	Early Bronze Age	Julia Best		
Sligeanach	Early Iron Age	Julia Best		
				Best Unpublished.

4.3 Birds as a Part of the Wider Mammal and Fish assemblages

In this section NISP will be used as a basic value for interclass comparisons between birds, mammals, fish and (briefly in the Chapter Six, where data availability allows) molluscs. As has already been discussed, the problems of comparing abundance via NISP are even more prevalent between classes than within class examination, particularly for fish and shellfish (see methodology for discussion of the challenges and benefits of interclass comparisons). While interclass comparison is not a key focus of this thesis and only forms a very small part of the work, it is nonetheless essential for understanding general changes in bird usage and their place within the wider faunal resource base, as it is important to consider birds as a proportion of the overall food economy. The birds would have been used alongside the domestic (and limited number of wild) mammals. The contextual landscape also affords access to other marine foodstuffs (including fish and molluscs), meaning that the avian resources are part of much wider faunal exploitation strategies and livestock management practices. Unfortunately, not all of the South Uist sites had all three classes (birds, mammals and fish) analysed, resulting in a smaller sample of sites. It also meant a smaller sample of data for each period. As such the results are limited by the evidence available, demonstrating how essential it is to expand this case study with the wider island dataset (Chapters Five and Six).

Birds as a Part of the Overall Faunal Assemblage – Mammals

On South Uist birds in general make up a small proportion of the combined mammalian and bird NISP. Once again, it is important to stress that while the bird remains are clearly far less numerous than their mammalian counterparts, they have fewer bones per

individual (particularly when loose teeth count toward the mammalian NISP). It is also less likely that a bird bone will be identifiable due to the range of species which are very similar morphologically (Coy 1982, 107-116; Serjeantson 2009, 92).

Within the South Uist archaeological sites (and period subdivisions) birds most frequently constitute between 1-5% of the combined mammal and avian NISP (see Tables 4.2 to 4.3 and Figure 4.3), with a mean/average contribution of 5%⁹. However, interestingly at 13 sites birds formed above 5% (Table 4.2). This is a higher than average use of birds, as they typically form between 2-5% of the combined mammal and avian identified bones at sites from Britain/Scotland (Cartledge and Serjeantson 2012, 342). Birds probably form a higher proportion of the combined NISP in these very marine island landscapes due to the abundance of wild avian resources provided by the coastal/seascape setting, which would be a bountiful faunal addition to the domestic livestock and wild mammals. Although at other inland sites domestic birds may play a more prominent role and become established earlier, these resources have to be maintained (food provision and labour investment), and in many areas there are limited other wild avian resources to be captured. Sites at which birds form a higher than average proportion of remains are found across the Scottish Islands; however the frequency with which this occurs on South Uist was unexpected and suggests that while birds may have a numerically minor contribution they are not a sideline resource or insignificant economically (See Chapter Five for further exploration of South Uist's character against the other islands).

⁹ Based on the 31 period based assemblages outlined in Table 4.4. The Pictish/Norse entry from Bornais Mound 2 with its avian dominance of 90% is an anomaly based on a small number of mixed deposits, and as such it is excluded from the average calculations. When the Pictish/Norse figure is included the average rises to an unrepresentative 7.42%.

Table 4.2: Number of sites per range (birds as % of combined mammal/avian NISP)

Range	Frequency
Below 5%	19
5-10 %	8
Above 10 %	5

Table 4.3: Avian and Mammal NISP by site and birds as % of combined mammal and Avian NISP

Site Name	Mammal	Bird	Combined Mammal/ Bird Sample Size	Bird as % of combined NISP
Cladh Hallan (EBA)	29	0	29	0
Cladh Hallan (MBA)	443	6	449	1
Cladh Hallan (LBA)	16702	307	17009	2
Cladh Hallan (EIA)	3254	41	3295	1
Bornais M1 (LIA)	3347	315	3662	9
Bornais M1 (EN)	415	17	432	4
Bornais M1 (MN)	588	51	639	8
Bornais M2 (PN/Pict)	389	13	402	3
Bornais M2 (PN/Pict/N)	1	9	10	90
Bornais M2 (EN)	505	65	570	11
Bornais M2 (MN)	4219	514	4733	11
Bornais M2 (LN)	1287	171	1458	12
Bornais M2 (Unphased Norse)	1821	77	1898	4
Bornais M2A (EN)	3827	154	3981	4
Bornais M2A (MN)	565	51	616	8
Bornais M2A (LN)	2596	195	2791	7
Bornais M3 (MN)	397	9	406	2
Bornais M3 (LN)	318	46	364	13
Cille Pheadair (N)	6436	645	7081	9
Dun Vulcan (M/L IA)	3548	383	3931	10
Dun Vulcan (Med)	125	4	129	3
A'Cheardach Mhor III (LIA)	54	0	54	0
A'Cheardach Mhor I & II (IA)	305	3	308	1
A'Cheardach Mhor IV (LIA)	139	1	140	1
A'Cheardach Bheag (IA)	188	2	190	1
Cill Donnain (IA)	4694	8	4702	<1
Hornish Point (IA)	443	12	455	3
Askernish (IA)	139	4	143	3
Frobost (Med)	25	2	27	7
Sligeanach (EBA)	80	7	87	8
Sligeanach (EIA)	63	1	64	2
Sligeanach (LIA)	19	0	19	0

Figure 4.3: Avian and Mammal as % NISP by site grouping (in period order, period shown in brackets)

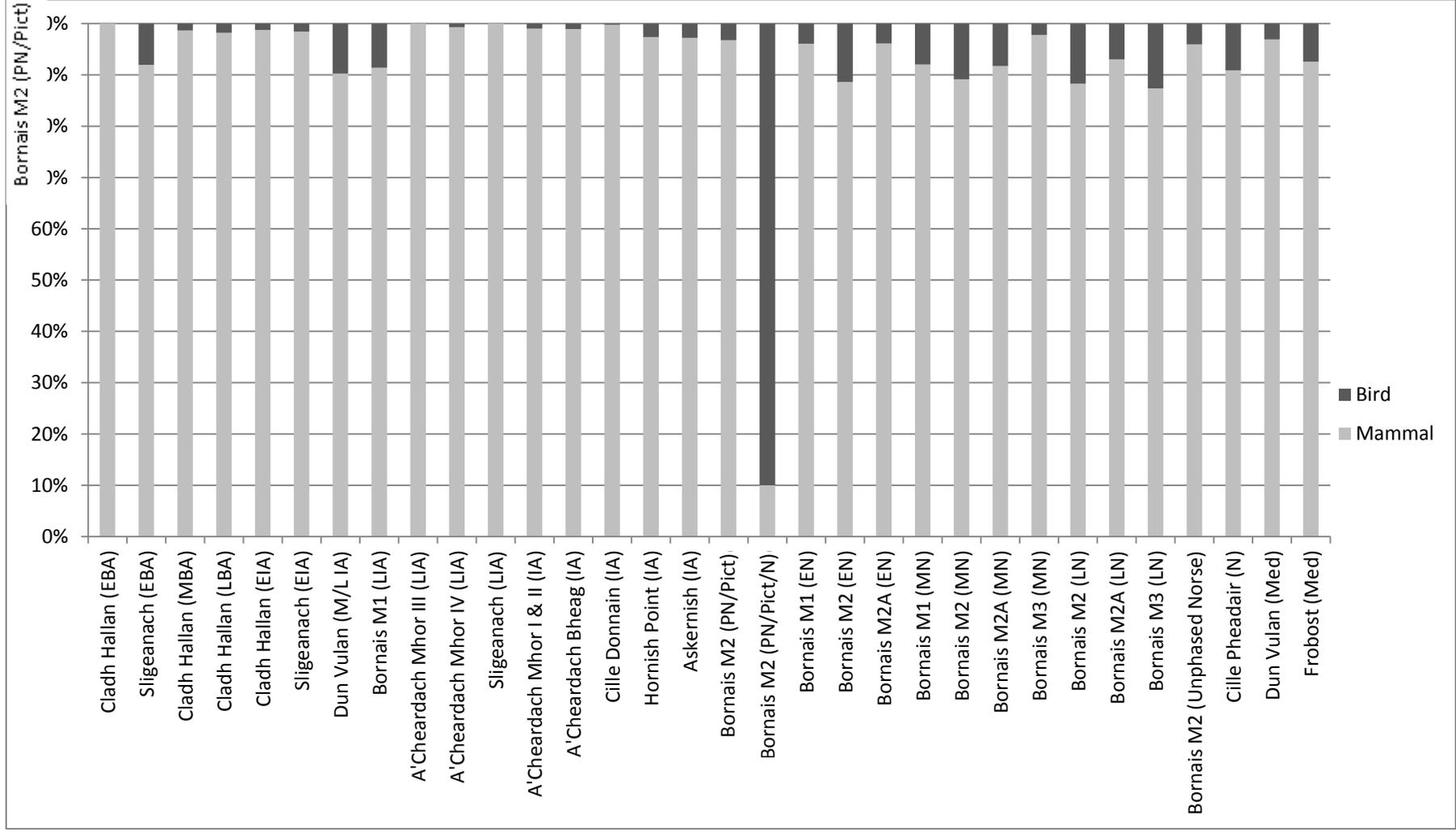
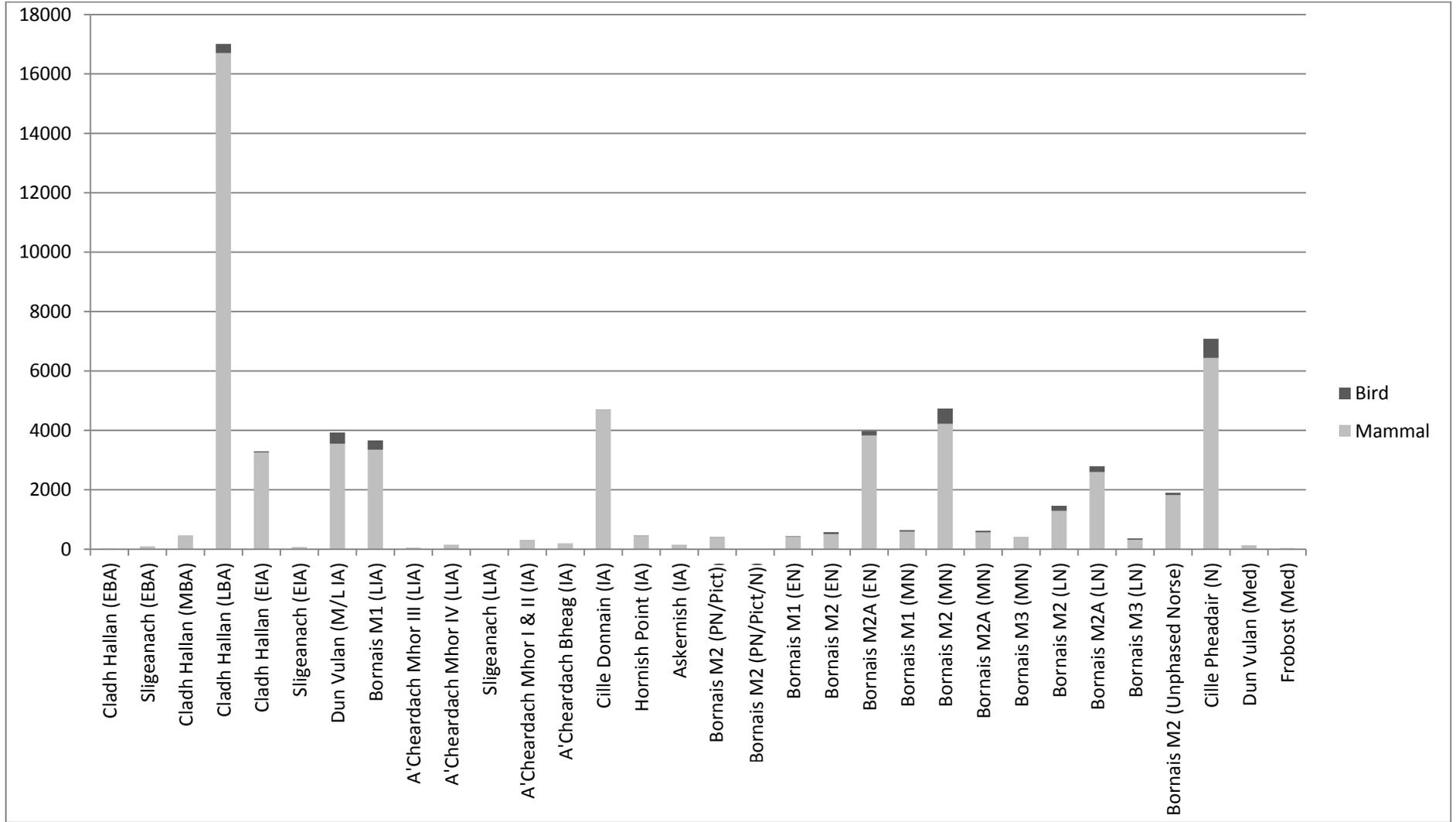


Figure 4.4: Avian and Mammal NISP in period order (see Table 4.3 for NISP data)



The use of avian resources as part of the wider faunal assemblage increases notably in the Norse period on South Uist with an average of 8%, in comparison to the Iron Age average of slightly over 2% (both periods having a sample size of 12 sites) (see Figures 4.3 and 4.4, and Table 4.4). This difference is highly significant (p-value is 0.0008. The result is significant at 95% confidence, see Test 4.1 in Appendix). Overall the Norse sites more consistently have a higher representation of birds, whereas in the Iron Age the avian contribution to the assemblages is generally low with two exceptions (Bornais Mound 1 and Dun Vulcan) (Table 4.3 and Figure 4.3).

Table 4.4: Average birds as a % of combined mammal and avian NISP for each period.

Period	Average %	Number of Sites
Bronze Age	3	4
Iron Age	2	12
Pre-Norse/Pictish	3	1
Norse	8	12
Medieval	5	2

For example, the Late Iron Age birds from Bornais Mound 1 reached a high 9% of the combined NISP. While the good preservation, recovery techniques and the skill of the avian analysts previously mentioned for Bornais, Cille Pheadair and (to a large extent) Dun Vulcan must of course be considered in the high number of identified bird remains (compared to those lacking some or all of these), the validity of these particular results are supported by the Late Bronze Age and Early Iron Age Cladh Hallan assemblages, which benefited from the same good preservation, recovery and identification, but where the birds made up an average 1-2% of the combined mammalian/avian NISP. It therefore appears that at many Iron Age sites birds made up a smaller proportion of the overall faunal resources than in the preceding and following periods, and that the Norse period saw an overall increase. This will be examined within the wider avian assemblages from the Scottish Islands in Chapter Five

The majority of the Norse period's faunal data on South Uist comes from Bornais (Mound 1, Mound 2, Mound 2A and Mound 3). Overall, Bornais is particularly prominent in the class NISP comparisons, with birds making up over 6% of the combined avian/mammal NISP in nine of the 14 period based subdivisions. Multiple occupation areas of Bornais exhibit a high avian abundance, with birds making up over 10% of the combined mammalian and avian NISP in the Early, Middle and Late Norse phases of Mound 2, and in the Late Norse phase of Mound 3 (Table 4.3, Figures 4.5 and A4.6). However, Cille Pheadair also displays a high use of avian resources in the Norse period; here birds again make up 9% of the combined avian/mammal NISP, accounting for over 6% of the remains in every individual phase, and ranging up to 17% in some phases (see Appendix Figure A4.5).

It is also clear that at Bornais birds are prominent within each mound's individual faunal assemblage as a percentage of the combined mammalian and avian NISP. This shows that in the different spatial areas birds were contributing to the overall faunal economy (Figure 4.7).

Figure 4.5: Temporal and Spatial variation in Mammalian and Avian NISP

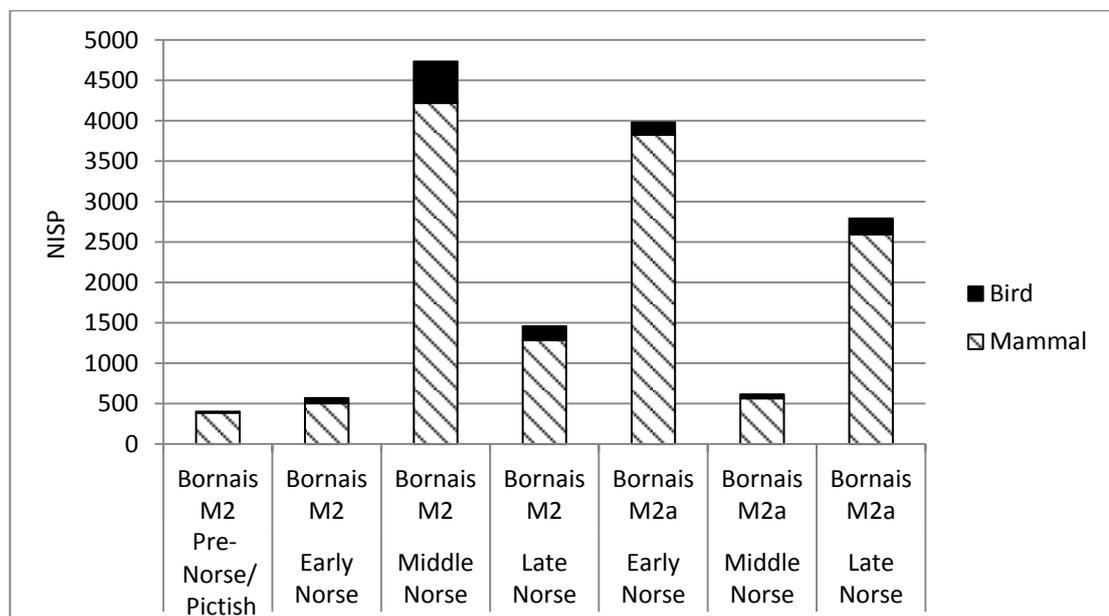


Figure 4.6: All Bornais Mounds combined. Avian and Mammal NISP by Period.

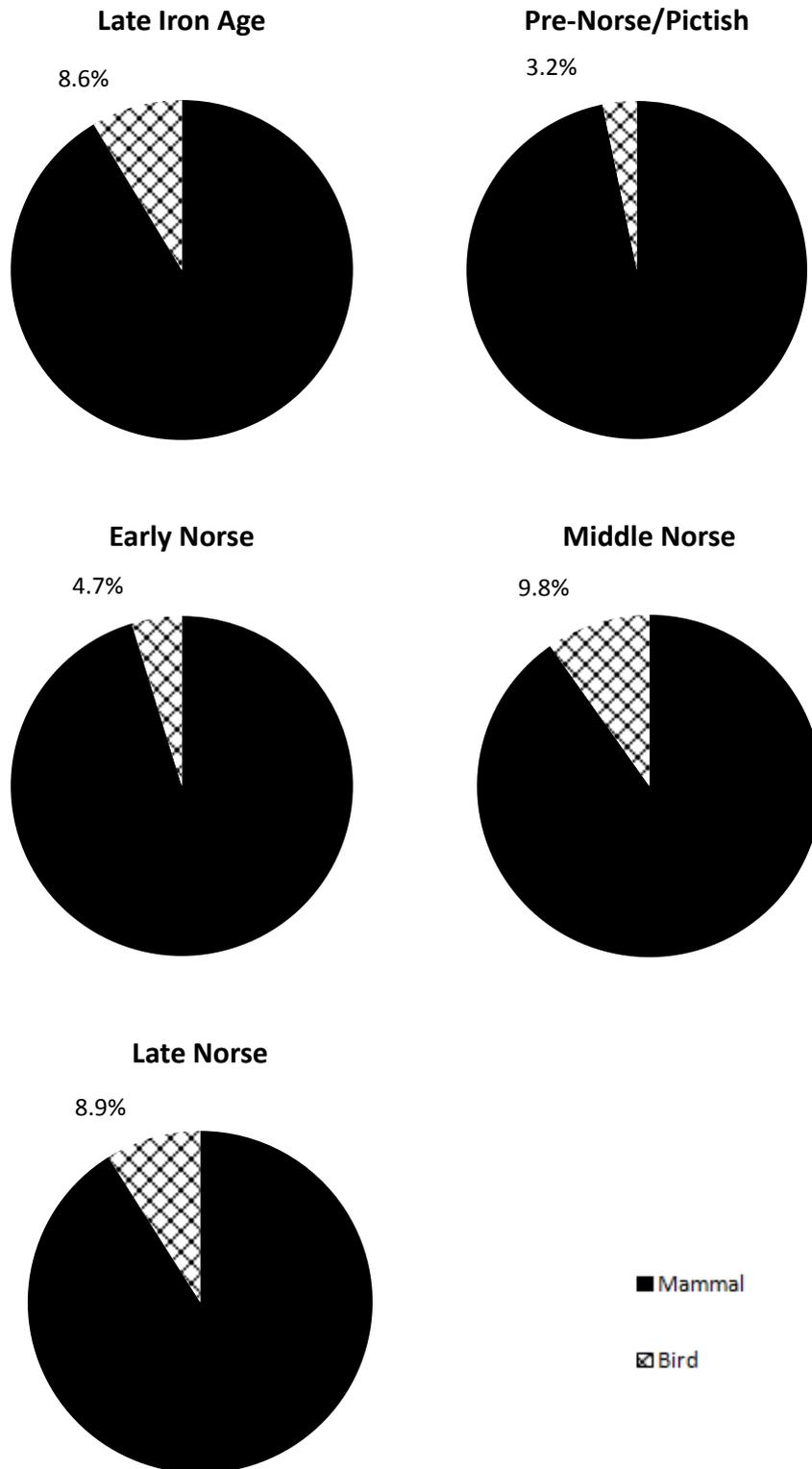
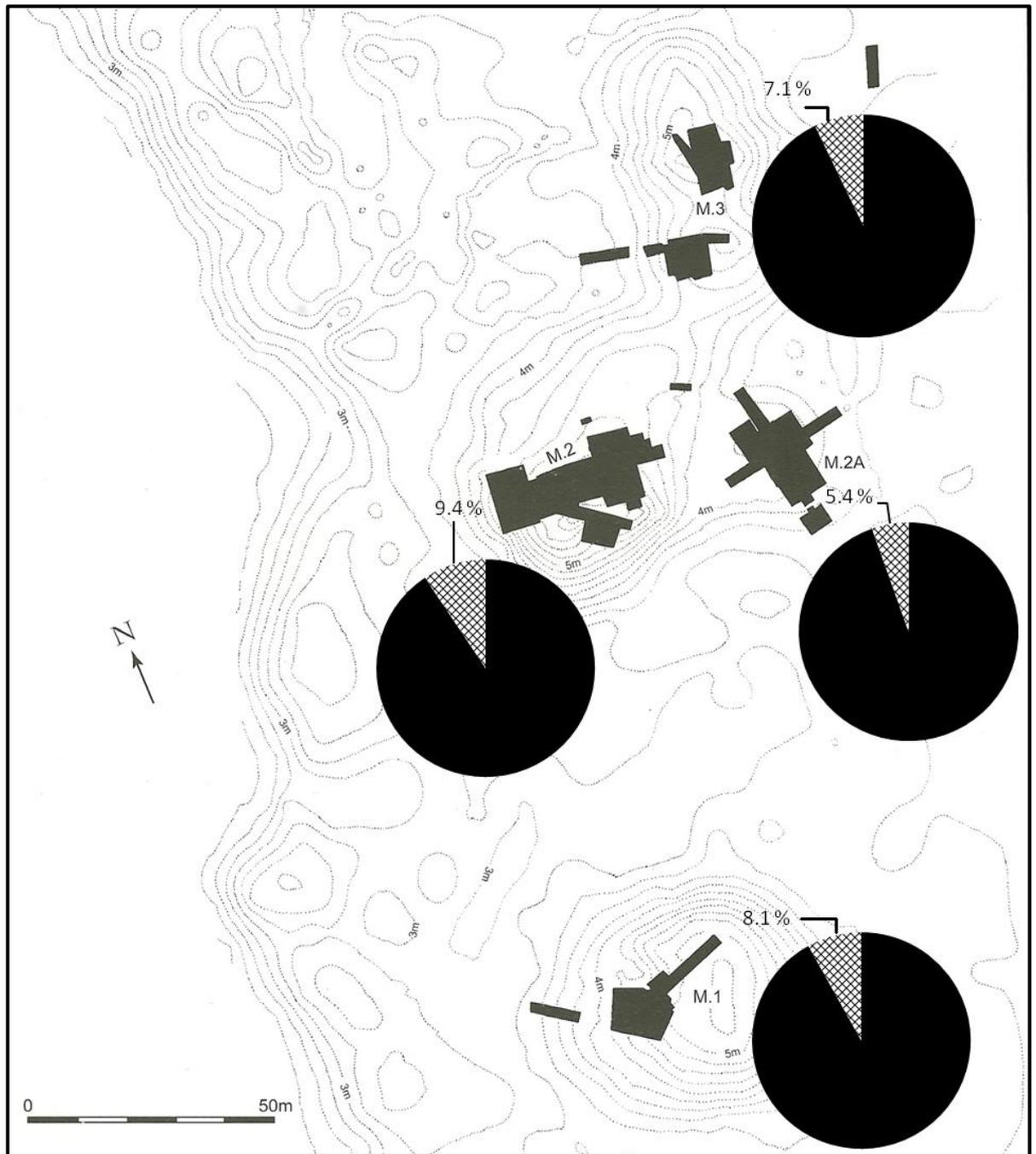


Figure 4.7: Bornais birds (hashed) as proportion of mammalian remains (black) by Mound (Background map showing trenches from Sharples 2012, 2 Figure 1.A.).



Birds as a Part of the Overall Faunal Assemblage – Mammals and Fish

As shown, birds on South Uist form a small but higher than expected proportion of the combined mammal and avian resource base. When fish are also incorporated it becomes clear that birds again form a small but significant proportion of the overall combined

bird/mammal/fish NISPs from South Uist, particularly when their underrepresentation due to NISP is considered (as discussed in Chapter 3.3.2). Birds in general comprise between 1 and 5 % of the combined mammalian, fish and avian NISP with an average of nearly 3% (see Table 4.5). Again at Bornais the birds form a higher proportion of the remains than at other contemporaneous and comparable sites, implying that birds played a greater role in the economy of this population. The highest avian representation comes from Late Iron Age Bornais Mound 1 where they accounted for just over 7% of the combined NISP.

Table 4.5: Birds, mammal and fish NISPs for South Uist sites with all three classes identified, and birds expressed as a percentage of their combined NISP

Site Name	Mammal NISP	Fish NISP	Avian NISP	Birds as % NISP
Cladh Hallan (EBA)	29	0	0	0
Cladh Hallan (MBA)	443	161	6	1
Cladh Hallan (LBA)	16702	5035	307	1
Cladh Hallan (EIA)	3254	332	41	1
Dun Vulcan (M/LIA)	3548	2905	383	6
Bornais M1 (LIA)	3347	637	315	7
A'Cheardach Mhor III (LIA)	54	0	0	0
A'Cheardach Mhor IV (LIA)	139	1	1	1
A'Cheardach Mhor I & II (IA)	305	2	3	1
A'Cheardach Bheag (IA)	188	1	2	1
Cill Donnain (IA)	4694	4	8	<1
Hornish Point (IA)	443	100	12	2
Bornais M1 (EN)	415	35	17	4
Bornais M2 (EN)	505	975	65	4
Bornais M2A (EN)	3827	2063	154	3
Bornais M1 (MN)	588	970	51	3
Bornais M2 (MN)	4219	4935	514	5
Bornais M2A (MN)	565	245	51	6
Bornais M3 (MN)	397	296	9	1
Bornais M2 (LN)	1287	2983	171	4
Bornais M2A (LN)	2596	1429	195	5
Bornais M3 (LN)	318	2728	46	1
Cille Pheadair (N)	6436	15623	645	3

Figure 4.8: Bird, fish and mammal as percentage of combined NISP shown by site in period order (sites without identified fish excluded)

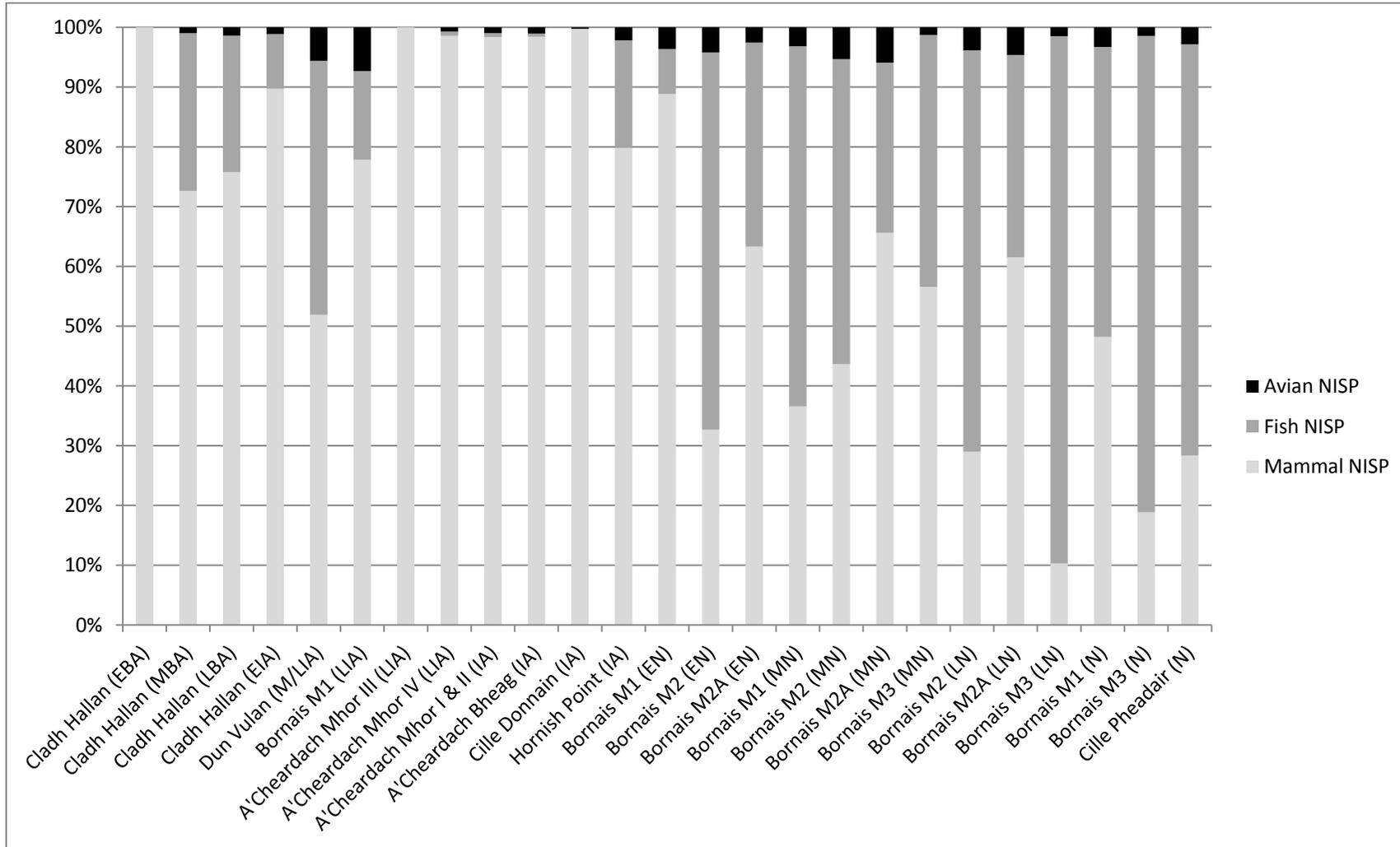


Figure 4.9: Bird, fish and mammal NISPs shown by site in period order (sites without identified fish excluded see Table 4.5 for NISP data)

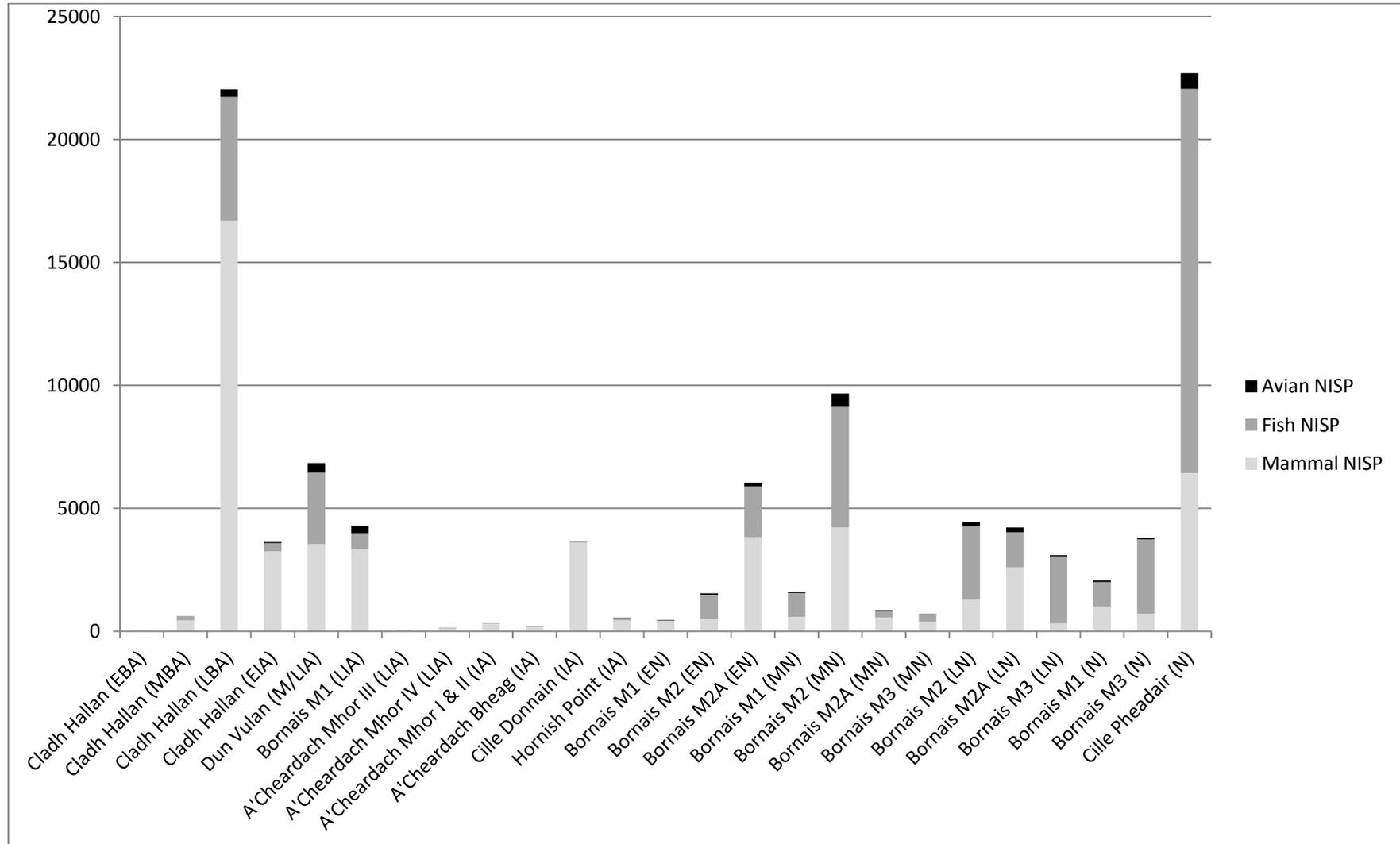


Figure 4.8 shows that in the Norse period, there is a clear and sustained increase in fish as a percentage of the overall faunal assemblage. This can be largely attributed to developments in seafaring and fishing (and a proposed rise in commercial fishing), and the skill-sets and pre-existing subsistence strategies brought with the Norse settlers to complement pre-existing fishing economies (Barrett 1997, 634-635; Ingrem 2012, 225-226; Nicholson 1998, 26-27). Small saithe, found in inshore waters, dominate the Bornais Iron Age fish assemblage. However, grown herrings were prevalent in the Norse material and larger saithe were present indicating a movement from inshore to offshore fishing (Ingrem 2012, 225-226). The Norse increase in fish seen in Figure 4.8 correlates with the higher representation of birds in this period identified in the combined mammalian/avian NISPs. This suggests that greater movement around the seascape and different seafaring patterns could have increased access to seabird resources such as dense breeding colonies (of e.g. gannets) on offshore islands and stacs. Intensified fishing would have also increased the chances of accidental catches of seabirds and perhaps access to flocks wintering at sea. It is also reasonable to conjecture that increased settlement in these island environments would have necessitated greater use of all available resources, including those that are more labour intensive to acquire (Dugmore *et al.* 2005, 27-28). The more marginal the landscape coming under increased human population, the often greater need to make use of a larger range and scale of wild resources. This theme will be explored more fully in Chapter Six to incorporate other North Atlantic Island environments.

However, when examining birds' (numerically, relatively) small contribution as a part or a percentage of the combined mammal, fish and bird NISP (Figures 4.8 and 4.9), changes in their abundance are masked and they do not appear as an important part of

the economy. Ironically, this is due in large part to the increased fish presence creating an underrepresentation of the avian abundance via NISP (see Chapter 3.3.2). As such they do not appear to increase notably in the Norse period. However, when we look at the average values for birds as a percentage of the combined mammal, fish and bird NISPs by period, it can be seen that the Norse value is higher than in the Iron Age, and statistically slightly significant (p-value is 0.0464. The result is significant at 95% confidence) (Table 4.6, Test 4.2). Potentially, if one was to imagine multiplying the avian NISP by three to make it comparable to the fish (based on Coy 1982), then their presence would be amplified to a theoretically more accurate level.

Table 4.6: Average birds as a % of combined mammal/fish/avian NISP for each period.

Period	Average %	Number of Sites
Bronze Age	1	3
Iron Age	2	9
Norse	4	11

Once again a large part of the dataset with these three classes present comes from Bornais. As seen in the avian/mammal comparison Bornais, Mound 2 has the highest quantity of birds as a percentage of the combined mammalian and avian NISP for all phases (Figure 4.7). The Middle Norse phase of Mound 2 produced the greatest quantity of bird and fish remains¹⁰ (Figures 4.10 and 4.11). Figures 4.10 to 4.12 also illustrate that Mound 2 overall contains a higher frequency and proportion of fish than Mound 2A. This suggests that wild resource exploitation and processing may have been conducted on a larger scale around the Mound 2 area of the Bornais site. Mound 2 was of higher status than Mound 2A, so the data may potentially be identifying differences in access to and use of wild resources, and varied levels of dietary variety.

¹⁰ Although, birds form a slightly higher proportion of the resources as % of the combined mammal, bird and fish in Middle Norse Mound 2A, see Figure 4.11. However, this is a much smaller assemblage overall.

Figure 4.10: Bornais temporal and spatial variation in NISP – All Recorded Classes

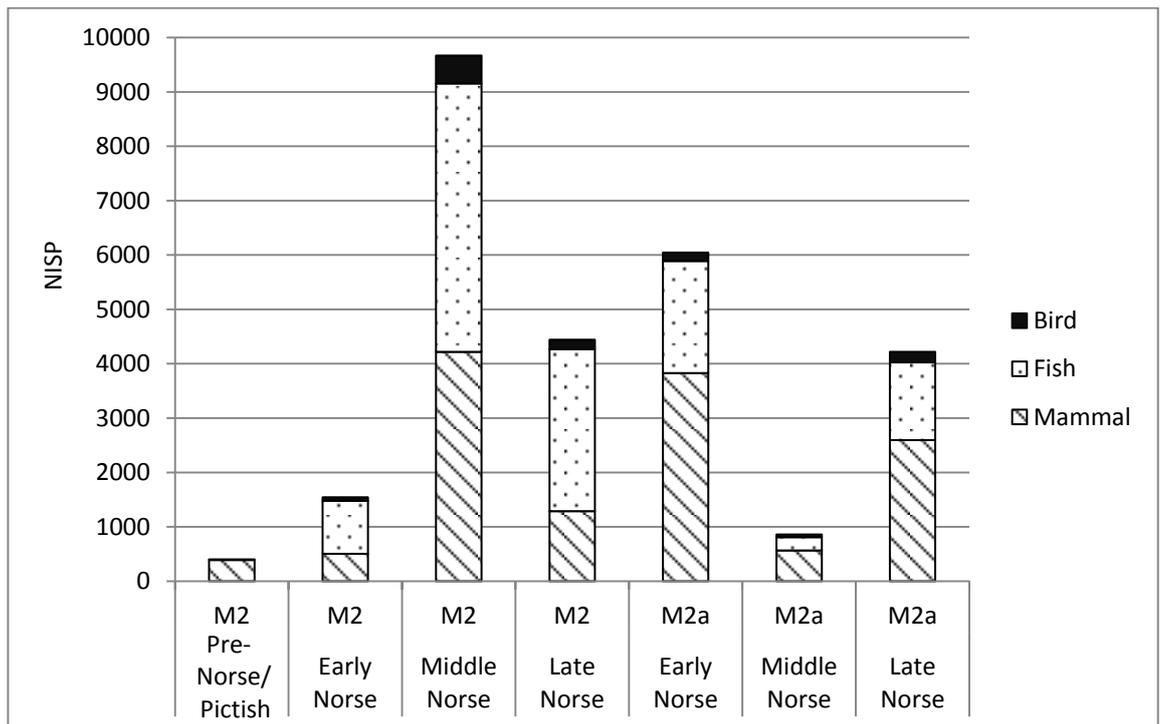


Figure 4.11: Bornais variations all recorded classes as percentage of total NISP

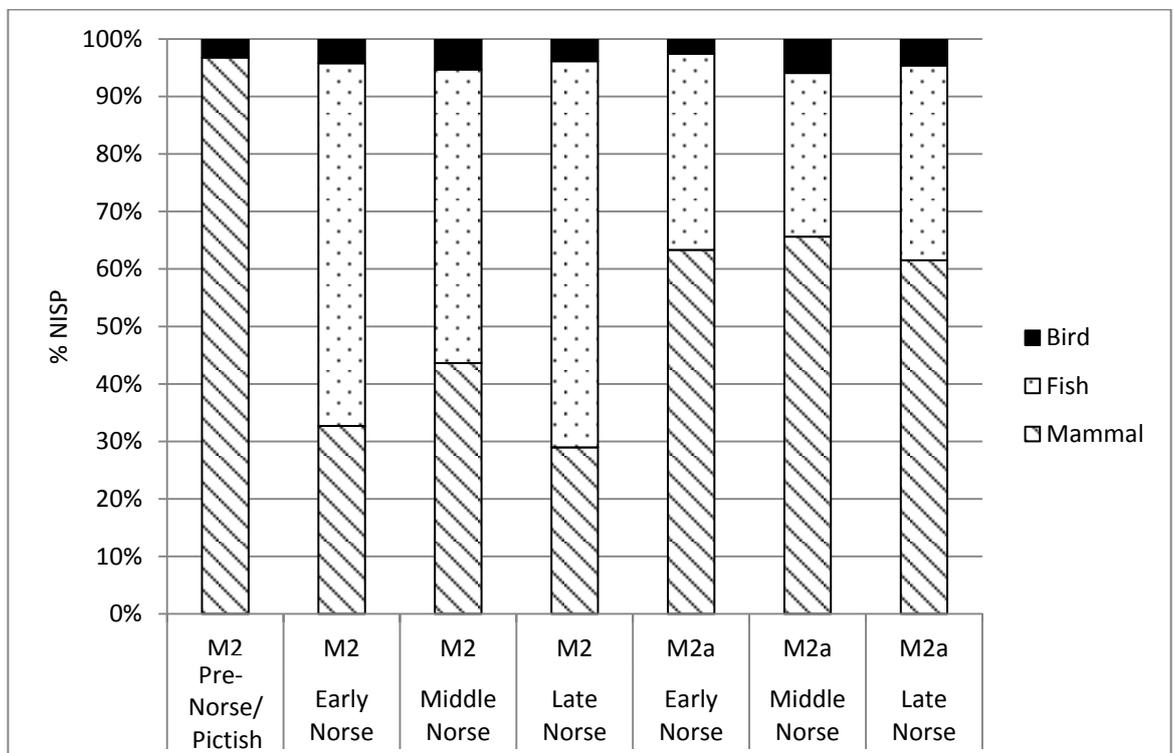


Figure 4.12: Temporal and spatial variation in fish and avian NISP

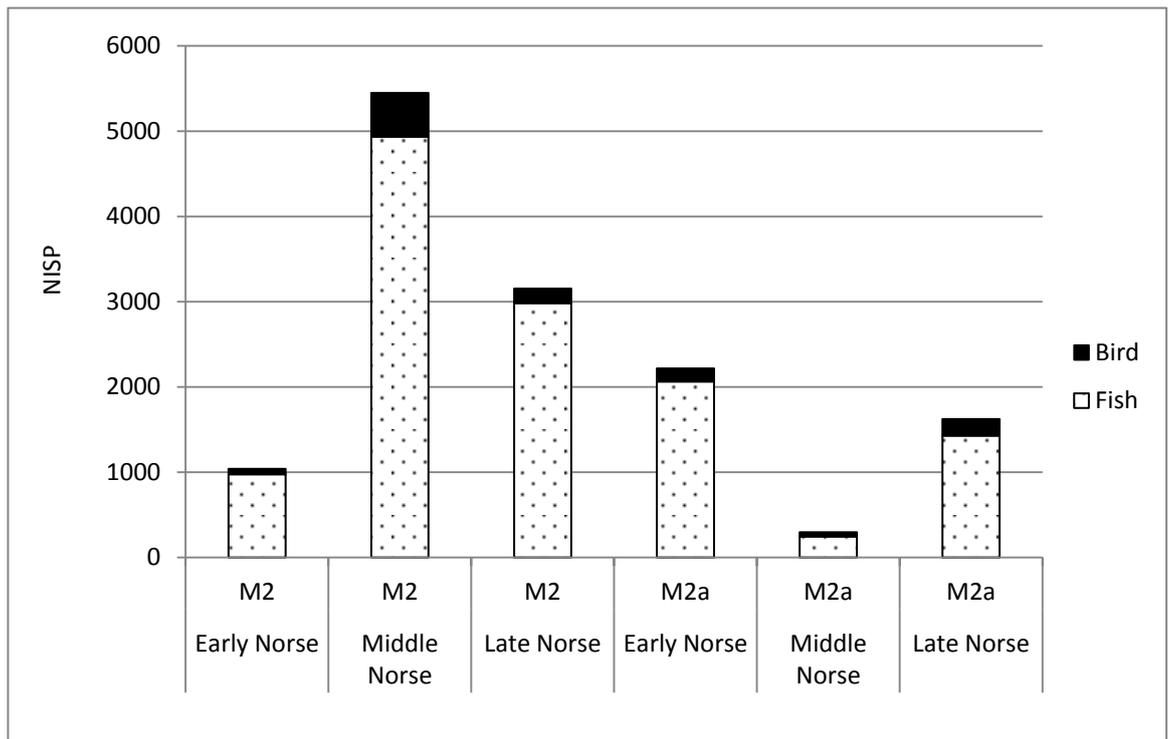
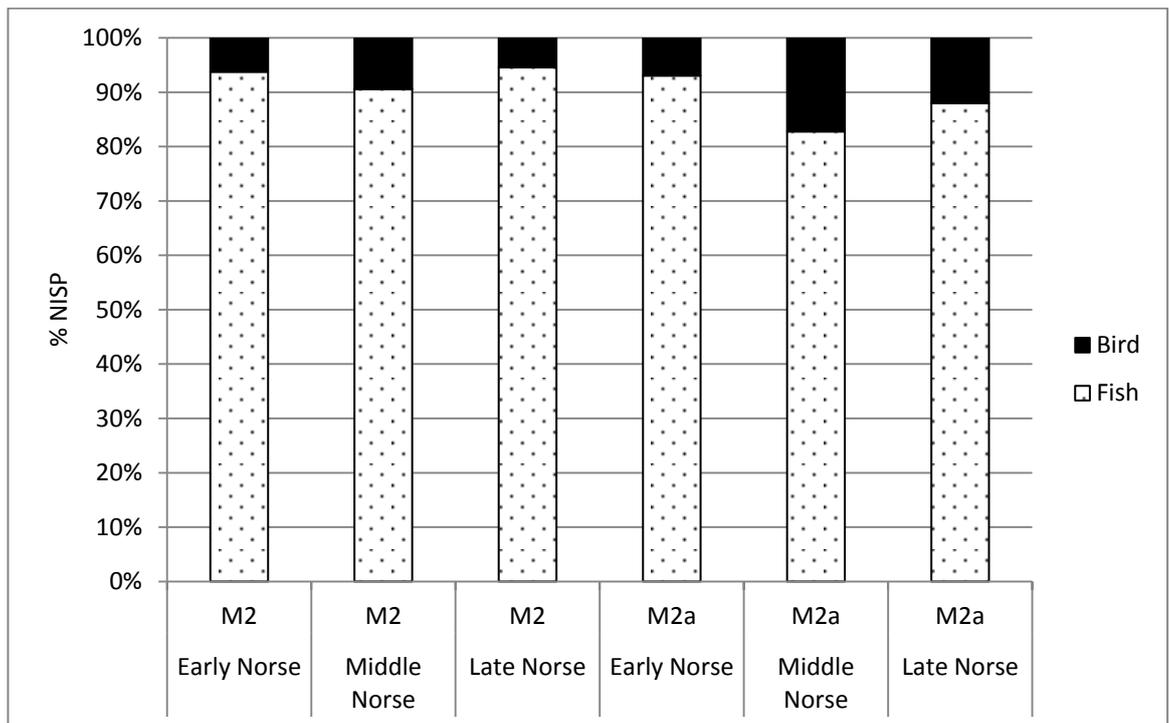


Figure 4.13: Temporal and spatial variation of birds and fish as percentage of total NISP



4.4 The Avian Resources of South Uist – Birds as Their Own Faunal Assemblage

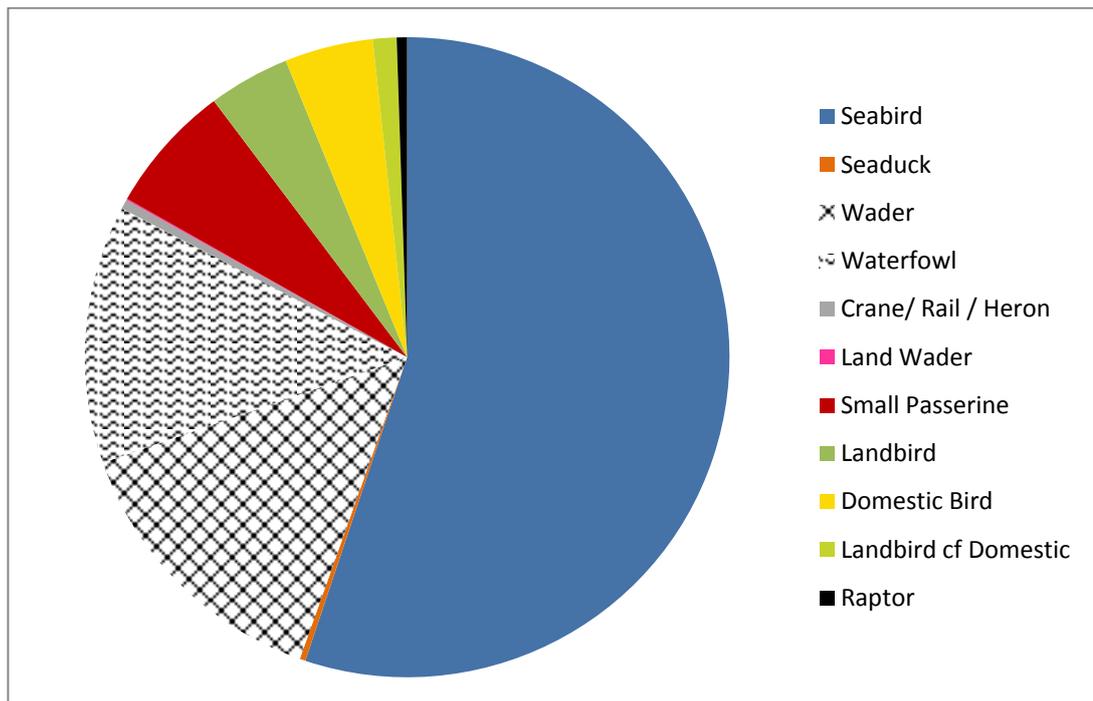
Overall the archaeological bird remains of South Uist are highly marine, with seabirds and other birds of the sea and shore being heavily targeted. When the species abundances from all sites and time periods are considered together (Figure 4.14), seabirds, seaducks and marine/shore waders together make up 70% of the archaeological avian remains. Waterbirds including duck, geese and swans are the next largest contributor to the avian resources (13%), with freshwater and non-exclusively marine waders making a very small contribution. Domestic birds make up a modest 4% of the overall NISP, only rising to just over 5% if *cf.* domestic birds are added, demonstrating their limited overall impact and the context specific nature of their role.

A minimum of 58 species are represented in this broad overview, but many more are likely to be present. This indicates that past inhabitants of South Uist made good use of the resources provided by the island location. Species of seabird, wader and waterfowl are much more numerous than landbirds in this environment. Seabird behaviour also makes them attractive for calculated exploitation, for example dense breeding colonies.

Table 4.7: All South Uist archaeological avian remains combined and shown by broad taxonomic category: NISPs and % of bird remains by NISP

Type	NISP	% NISP
Seabird	1714	55
Seaduck	9	<1
Wader	443	14
Waterfowl	406	13
Crane/Rail/Heron	15	<1
Land Wader	2	<1
Small Passerine	203	7
Landbird	127	4
Domestic Bird	138	4
Landbird <i>cf.</i> Domestic	37	1
Raptor	16	1

Figure 4.14: All South Uist data combined by avian grouping.



Within the combined South Uist data herring/lesser black back gulls predominate, mainly due to their prominence within the large Bornais assemblages (see Appendix Table A4.1 and A4.2). However gannets are also very numerous, with cormorant, great black backed gull, domestic fowl, shag, puffin, guillemot and great auk following high in the NISPs. Due to the difficulties in assigning geese to exact species, the impact of particular individual species is hard to calculate; however large grey geese (the majority of which are likely to be wild greylags) are also prominent within the overall archaeological record. While waders and other waterfowl such as ducks contribute heavily to the overall category make up of the material (wader, waterfowl, landbird etc) they contribute less by individual species (Table A4.1). This is partially a result of identification limitations surrounding these groups, but also a result of the diverse number of similar species within i.e. 'geese' or waders. It also potentially reflects different exploitation patterns; for example ducks or geese may have been taken when encountered in the landscape indiscriminate of exact species (perhaps while freshwater

fishing, tending animals or peat cutting), whereas species such as gannets are more likely to have been specifically targeted.

4.5 Avian Overview Through Time: Avian Groupings

This section will present the bird remains through time using wide taxonomic groupings outlined in Table 4.7. Separating the avian data into these categories allows general trends in avian exploitation and husbandry to be clearly observed, which then directs further species-specific exploration. It should again be noted that period assemblages are of very different sizes ((Figure 4.17 and Table A4.3), explored earlier in the chapter) and as such proportions of the avian NISP are employed alongside pure counts in order to aid comparability over time.

Figure 4.15: South Uist Avian distribution by category and period (as % of avian NISP)

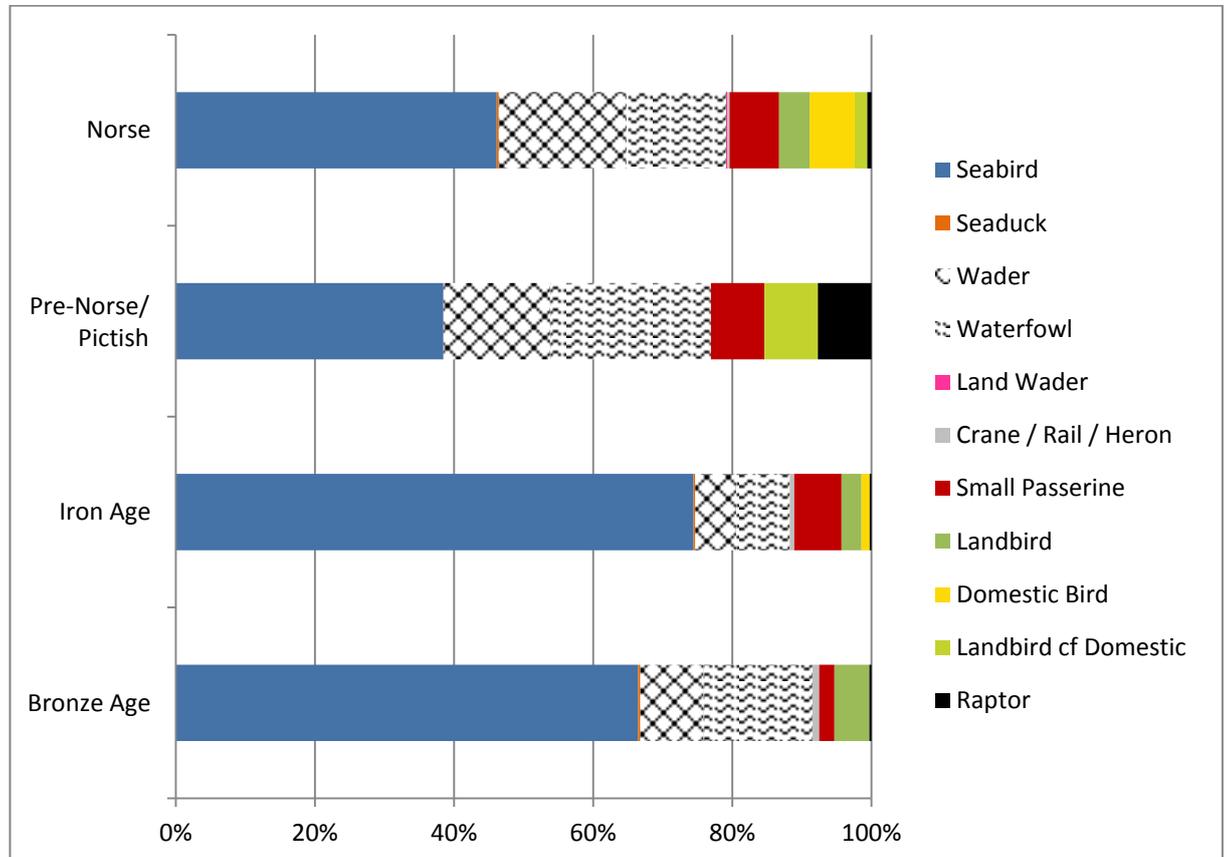


Figure 4.16: Avian groupings by site in period order showing frequency % NISP

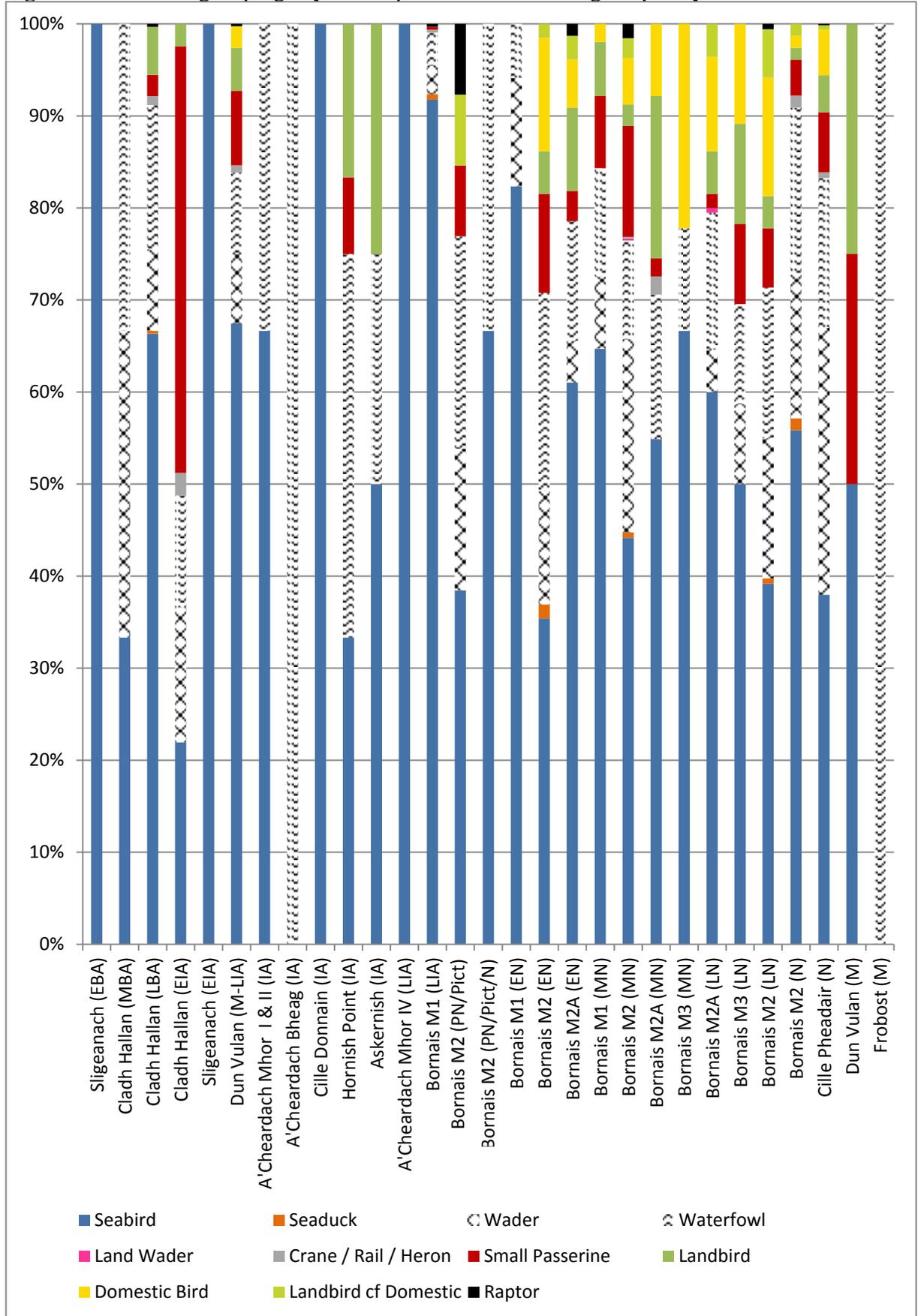
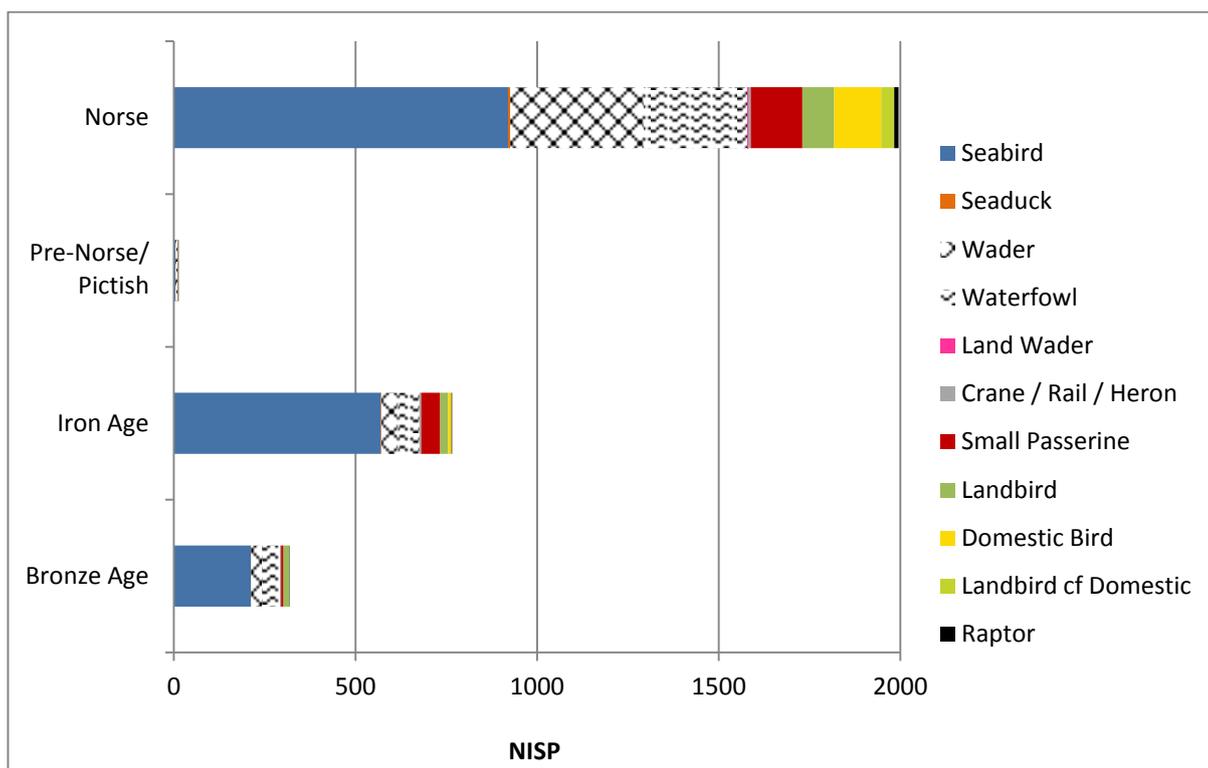


Figure 4.17: South Uist Avian distribution by category and period (NISP)



Seabirds

Across time from the Bronze Age to the Norse period bird use on South Uist is focused on marine species. Seabirds are the largest individual component grouping in each of the period assemblages (Figures 4.15 and 4.17). Seabirds are less numerous in the Pre-Norse/Pictish period, although unfortunately this assemblage is very small (13 specimens), meaning that its overall abundances are biased and of limited use. However, even in this small assemblage seabirds were the main avian target, and in addition many of the unidentifiable remains were *cf.* gull. Despite the range of birds represented, seabirds dominate the majority of the individual sites and period based subdivisions (Figure 4.16). If small passerines are excluded and sites with NISPs under 5 removed, seabirds are the largest individual contributor at all but two sites, and they make up over 50% of the avian assemblage at two thirds of the sites (Figure A4.10). Where seabirds were not the largest individual contributor (Middle Bronze Age Cladh

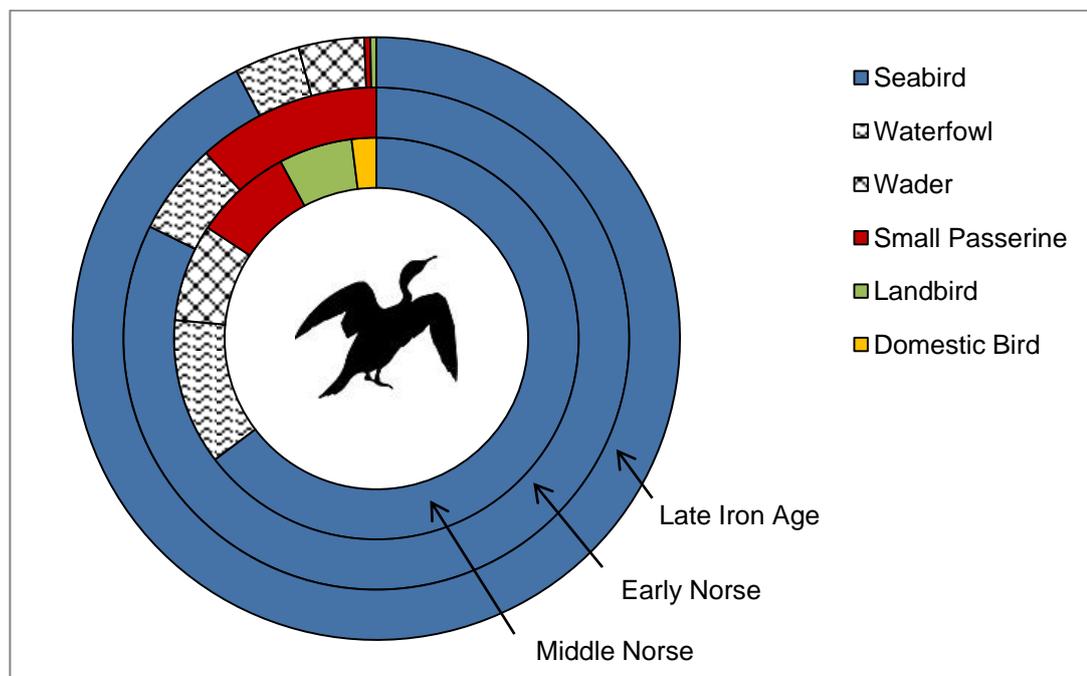
Hallan and Iron Age Hornish Point), the assemblages were very small assemblages with NISPs of 5 and 12 respectively.

As mentioned, Bornais produced a large quantity of avian remains from multiple periods making it an important source of data. All of the periods and mounds (areas) display a prominent overall use of seabird resources, demonstrating that these birds were a stable part of fowling activities through time across the Bornais site. However Mound 1 (the only settlement area to produce Iron Age data) exhibits the greatest domination by seabirds. They dominate all the Mound 1 phases from the Late Iron Age into the Middle Norse period, but are most numerous in the Late Iron Age where seabirds account for 92% of the avian NISP (Figure 4.18). Several of the Iron Age assemblages had a very heavy and almost exclusive focus on seabirds. The only other Iron Age assemblage on South Uist of a comparable size to Bornais is Dun Vulcan (this is unfortunately the only other Iron Age avian NISP over 50). This too displays a heavy seabird focus with them comprising around 70% of the NISP¹¹. This suggests that Iron Age fowling on South Uist strongly targeted seabirds, but that many of the assemblages are too small to clearly illustrate this on an individual basis (Figures 4.15-4.16). Mound 1 is also important avifaunally since while birds make up over 8% of the mound's avian and mammalian remains with all phases combined (Figure 4.7), in the Late Iron Age midden they make up an astonishingly high 14% of the mammals and birds (Bornais phase CG) (Cartledge and Serjeantson 2012, 342). This suggests that at Late Iron Age Bornais seabirds were used in a particular and repeated manner and formed an unusually prominent part of the human diet (Cartledge and Serjeantson 2012, 342).

¹¹ Seabirds form 67% of the NISP when small passerines are included and reaches 73% without them.

Figure 4.15 also indicates that seabirds make up a lesser proportion of the overall Norse avian assemblage than in the earlier periods. This appears to be the result of an increased presence of domesticates, and also a higher use of waders (in addition to a notable use of waterfowl and non-domestic landbirds). The transition from Late Iron Age to Norse exhibited at Bornais (Mound 1) reveals a decrease in the overall prominence of seabirds within Norse fowling. They fall from 92% of the NISP in the Iron Age to 82% and 65% in the Early and Middle Norse phases respectively. This manifestation of a more diverse regime includes a greater number of domesticates.

Figure 4.18: Bornais Mound 1 by phase and avian category (NISP)



Domestic Birds

Domesticates are virtually unknown on South Uist before the Norse period, with a mere nine bones coming from Mid-Late Iron Age Dun Vulcan. Of these Iron Age examples three are probable domestic geese and six are domestic fowl¹². The increase of domestic

¹² These three geese were recorded by Cartledge and Grimby (1999) as domestic geese, but with no specified criteria outlined. These bones were not re-examined for this thesis and so caution has been applied to their classification and they are treated as ‘probable’ domesticates, since there are many wild relatives in the area with which domestic goose could potentially be confused. However, being familiar with Cartledge’s work the author believes that this identification is likely to be accurate.

fowl in the Norse period is visible both in terms of their increased frequency (129 specimens) and their wider distribution, with specimens being present at all of the Norse sites and period based sub divisions except for Early Norse Bornais Mound 1 (which had a very small NISP of 17) (see Figures 4.15 – 4.16). There are no definite domestic geese from the Norse South Uist sites, but nine probable bones are present. Chickens were thus the main domesticate. This is also visible in the eggshell material, explored in Chapter Seven section 7.2 to 7.4 (Stewart *et al.* In Prep; Stewart pers. comm.).

Small Passerines

An informed assumption can be made in suggesting that the small passerine NISP includes a large number of specimens which entered the archaeological record through non-anthropogenic means. However, one small passerine sternum from Norse Cille Pheadair was cut, showing that these remains should not automatically be excluded from analysis. The contribution of small passerines varies dramatically between sites (Figure 4.16), with the highest abundance coming from Early Iron Age Cladh Hallan and Medieval Dun Vulan. The small medieval Dun Vulan assemblage comes from abandonment layers within and surrounding the Broch (Cartledge and Grimby 1999, 283). The Early Iron Age Cladh Hallan assemblage is also likely have contained intrusive small passerine remains from abandonment contexts present within the transitional occupation layers, including those from the ending of the main occupation sequence of the roundhouse terrace (Parker Pearson *et al.* Forthcoming). This reinforces the suggestion that while small passerines may have made an occasional and small contribution to the diet and economy of the South Uist population through time, this avian category contains many species prone to entering the archaeological record of their own volition (i.e. through nesting) or through accumulation as a result of animal predation (owls, carnivores etc).

Landbirds

Landbirds make a small overall contribution to the fowling economies both by overall period and individual site. Raptors are present in every period, occurring in small numbers at a range of sites. However, they are only present within 8 of the 27 site/period assemblages (Figure 4.16 and Appendix Table A4.2). These birds were probably caught for reasons beyond food.

Waterfowl

Waterfowl (while being an important avian grouping in all periods) were exploited in moderate numbers in every Norse assemblage, signifying a repeated use.

Waders

Waders form an increased proportion in the overall Norse avian assemblage (Figure 4.15). Within the Norse material at Bornais waders are most numerous and form a greater proportion of the bird bones during the Middle Norse period (18%) than the Early and Late (7% and 10%) (Figures 4.20 and 4.21). The area of the site 'Mound 2' has a much lower proportion of seabirds in comparison to the other areas (44%), particularly when it is considered against Mound 2A (60%) which was also occupied through the Early, Middle and Late Norse periods and produced a similar sized avian assemblage size (Figure 4.19). Instead, waders make up (21%) of the Mound 2 birds; a much higher proportion than in the other areas of Bornais. The Middle Norse waders come largely from Mound 2 (110 NISP). This inconsistent but occasionally large use of waders suggests concentrated opportunistic fowling of these less repeatedly targetable species. This can give a partial insight into the result of a particular fowling event based on a window of resource opportunity. Developing this point, the avian assemblage from

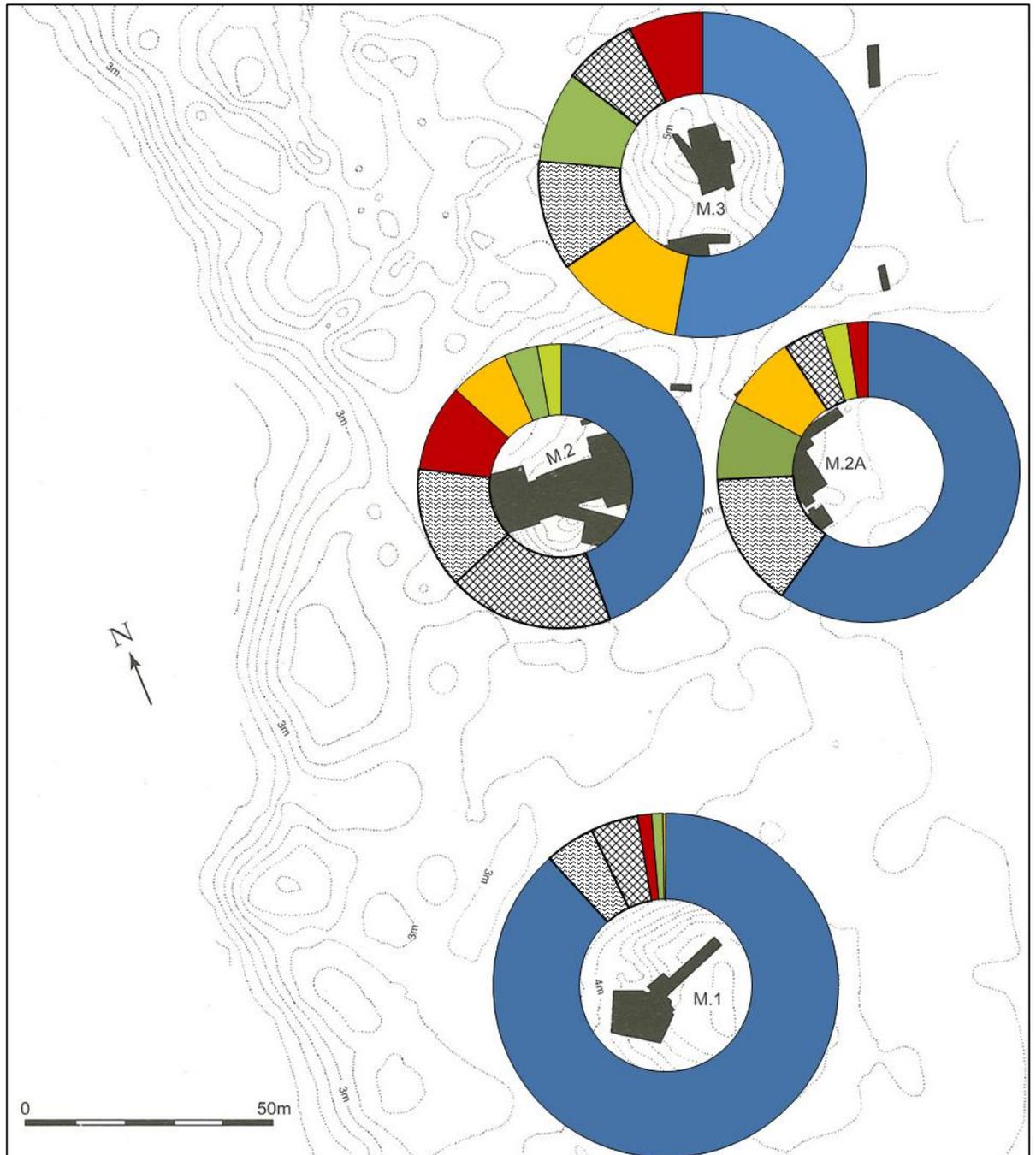
Norse Cille Pheadair also contained a very large number of waders, the frequency of which is again not evenly distributed throughout all phases (see Appendix Table A4.4). This suggests that these birds could play an important role in fowling activities *when* the opportunity arose (e.g. winter flocking of small waders). It also shows that the Norse inhabitants had the skill and knowledge to capture these (sometimes) tricky, speedy birds, and suggests that netting from the air was probably employed to catch many of the smaller waders. It also infers that varied available resources were used adjustably to supplement the overall faunal economy in a reflexive relationship with the environment.

The Picture of Norse Diversification: Further Investigation via Bornais

As discussed earlier Bornais provides a valuable opportunity to examine these patterns in more detail. Figure 4.19 shows that even within this one site the makeup of the avian assemblages (based on taxonomic category) varies quite dramatically between the different areas, with Mound 1 being the most unusual in terms of its overall composition, with its heavy use of seabirds in the Iron Age.

Figure 4.19 also highlights the distribution of domestic birds in the Bornais landscape. The very low presence of domestic birds in Mound one is clearly visible, with the only example in this area coming from the Middle Norse period. By comparison domestic birds form a sizeable proportion in Mounds 2, 2A and 3. Figures 4.20 and 4.21 clearly show a rise in domestic fowl in the Norse period, with them making up a greater proportion of avian resources and producing their largest NISP in the Late Norse phases. Also observable is an increase in waterfowl which contributes to an enhancement of overall diversity in the Norse periods compared to the Iron Age (again the very small Pre-Norse/Pictish and Pictish/Norse assemblages limit their input/interpretation).

Figure 4.19: Bornais avian NISP categories shown by Mound (Background map showing trenches from Sharples 2012, 2 Figure 1.A).



- Seabird
- ▨ Waterfowl
- Landbird
- Domestic Bird
- ▨ Wader
- Landbird of Domestic
- Small Passerine

Figure 4.20: Bornais avian NISP by period (all mounds combined)

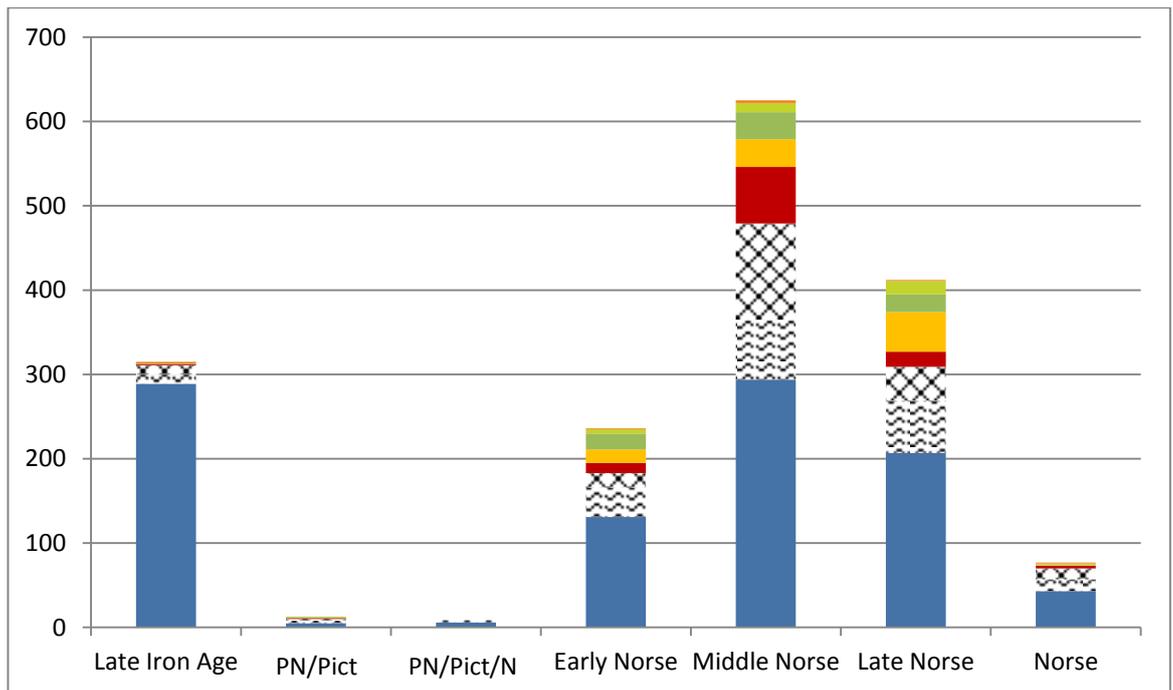
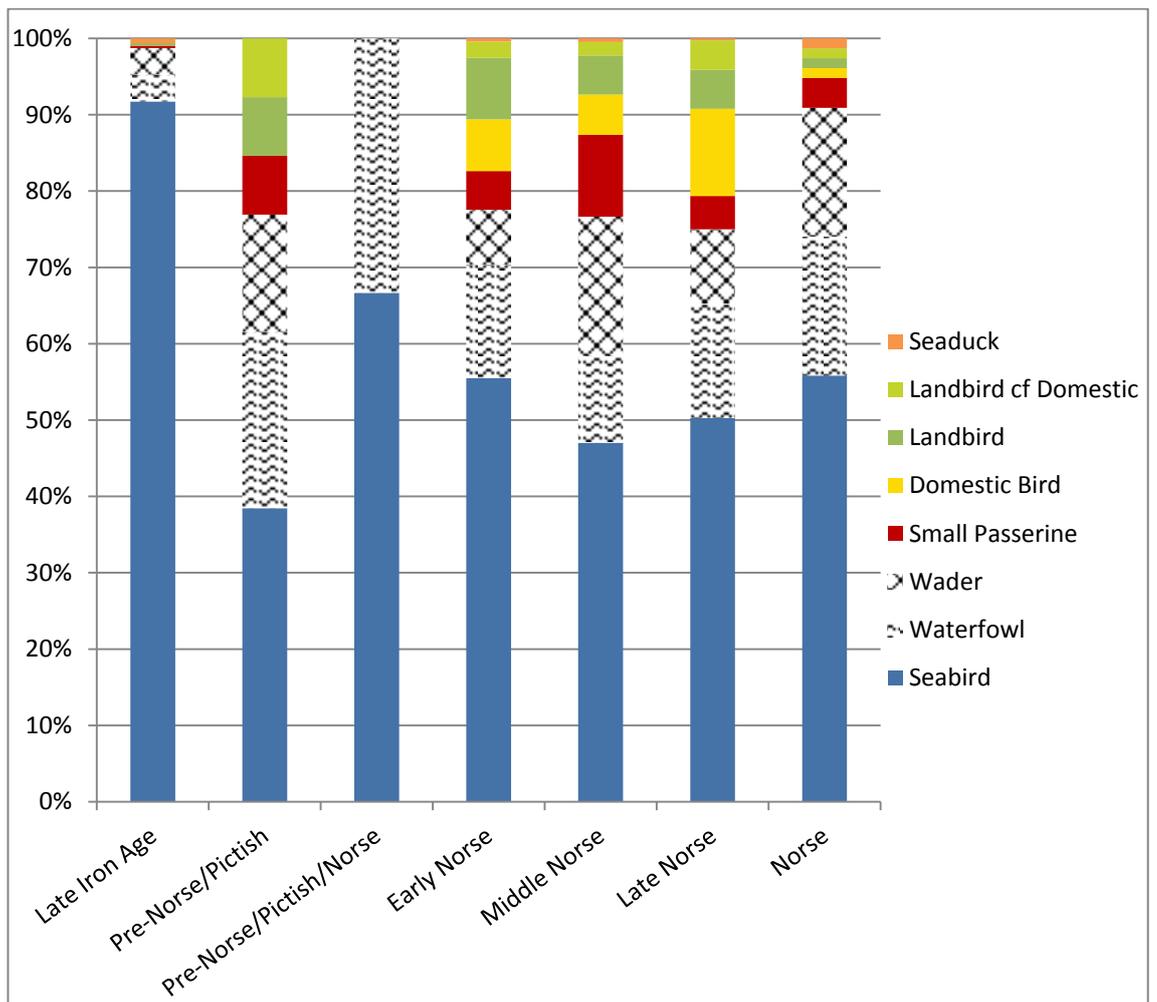


Figure 4.21: Bornais by period (all mounds combined), categories as % of avian NISP



In Mound 2, where the aforementioned waders and waterfowl made up a higher proportion of the NISP, the overall abundance of seabirds is lowered when examined by period (see Appendix Figure A4.7 and Table A4.2 for period/phase categorisation). It is possible to postulate that this large, higher-status mound may have been using the wild resources in a different manner.

This variation within the Bornais site (and particularly the changes present in the Late Iron Age to Norse assemblages in Mound 1) suggest that human agency, choice and understanding of the avian resources created different fowling patterns in the Norse period, since a similar range of species present in the locality would be expected during both the Late Iron Age and Early Norse Periods. Thus it is possible to propose that here we see the impact of an incoming Norse population on interaction with the wild resources, and also their influence on avian husbandry and stock keeping.

The overall Norse dataset indicates that during the Norse period a more diverse body of avian resources was used on a more regular or frequent basis (Figures 4.15- 4.17). This is interesting since at surface value this would suggest that changes in seafaring during the Norse period did not (in this instance) provide greater access to marine birds. (As mentioned earlier, birds form a larger proportion of the combined mammalian and avian remains in the Norse period). However, when the NISPs are considered (rather than employing % NISP to aid comparability between sites/periods), there is evidence of increased use of seabirds in terms of the quantity exploited, but they are part of a generally larger and apparently more diverse fowling economy (see Figure 4.17 and Appendix Tables A4.2-A4.3).

Norse period remains suffer less temporal degradation between deposition and archaeological excavation (in comparison to the earlier periods), which aid survival and preservation. However, the lack of any repeated patterns of difference in the overall size (count) of mammalian/avian faunal assemblages across time, does suggest an increased use of birds and a more diverse range of avian resources in the Norse period, although their overall abundance is still small (see Appendix Tables A4.2-A4.3 and Figure A4.8).

4.6 Species Distributions of South Uist: Trends by Time and Space

South Uist is today frequented by a large number of avian species including resident birds, summer visitors, winter arrivals, passage birds and occasional vagrants. As such the main periods will be briefly outlined to identify their characteristics and important species. Key themes and species can be explored in greater detail over time and space in this chapter and in Chapter Five. This ecological diversity is reflected in the archaeological record through taxonomically diverse avian assemblages. A minimum of 34 species are present in the Bronze Age material (NISP 319), 40 in the Iron Age (NISP 766), 9 in the Pre-Norse/Pictish assemblage (NISP 13) and 45 in the Norse data (NISP 1995). Individual sites frequently have a high abundance of species (including Late Bronze Age Cladh Hallan 34, Norse Cille Pheadair 24, Middle Norse Bornais Mound 2A 30). This shows human populations making use of the variety of wild avian resources inhabiting their environmental setting to supplement domestic mammals and other wild food sources. This demonstrates the importance of location in fowling choices and species availability. However, while some species were highly exploited, many are represented in the individual assemblages by less than five fragments. This indicates that while certain species were repeatedly captured and purposefully targeted, fowling was also diverse, flexible and opportunistic.

The Bronze Age

The majority of the Bronze Age dataset comes from the Late Bronze Age phases at Cladh Hallan (NISP 307). The Early Bronze Age phase at Sligeanach and the Middle Bronze Age phase at Cladh Hallan only produced a small number of bird bones (as part of small overall faunal assemblages) with NISPs of 7 and 6 respectively.

Sligeanach (Bronze to Iron Age) only produced a very small avian assemblage, with a total of 8 identifiable bird bones. However, as 7 of these came from the Early Bronze Age material it means that even this small assemblage is valuable for understanding resource and landscape use in this early period of South Uist's past, for which the faunal assemblages are very limited. Unfortunately no bird bone was recovered from the Early Bronze age features at Cladh Hallan for comparison, thus Sligeanach provides the only temporal insight into avian-human relations in the area prior to Middle and Later Bronze Age Cladh Hallan.

The Sligeanach assemblage was focused on auks, which made up over half the NISP (Table A4.6). Two puffin bones were present, one guillemot, and an additional specimen was classified 'puffin/black guillemot'. This provides some indication of seasonal resource use, and introduces the use of avian species as proxies for season, which will be focused on later in this chapter (section 4.7). This Early Bronze Age assemblage contained one ulna from a little auk. This is a winter visitor to the Scottish Islands, which can be found wintering in waters off of the Northern coast of the UK, having migrated from its Arctic breeding grounds (Pollock *et al.* 2000, 31 and 57; Stroud *et al.* 2001a, 437). The bone in question is surprisingly well preserved, however, since the species does not nest in the area and rarely comes ashore during its wintering

period it is unlikely to be intrusive (Pollock *et al.* 2000, 31 and 57). This particular specimen implies that the human population were making use of winter visitors as part of the small scale and opportunistic fowling conducted at this site. This species continues to be identified in small numbers at Late Bronze Age Cladh Hallan showing continued small scale use throughout the Bronze Age (Table 4.8). Beyond South Uist’s Bronze Age, the little auk was also identified at Iron Age Dun Vulcan with an unusually high six specimens present (this assemblage was dominated by auks). It was also identified at Norse Cille Pheadair, showing continued use of these small winter resources (but in this case as part of a larger and dual focused fowling economy).

Table 4.8: Little auk in South Uist by period

SITE NAME	LITTLE AUK NISP	ISLAND	PERIOD
Sligeanach	1	South Uist	Early Bronze Age
Cladh Hallan	1	South Uist	Late Bronze Age
Dun Vulcan	6	South Uist	Middle - Late Iron Age
Cille Pheadair	2	South Uist	Norse L10th/E11th - M-L 13th

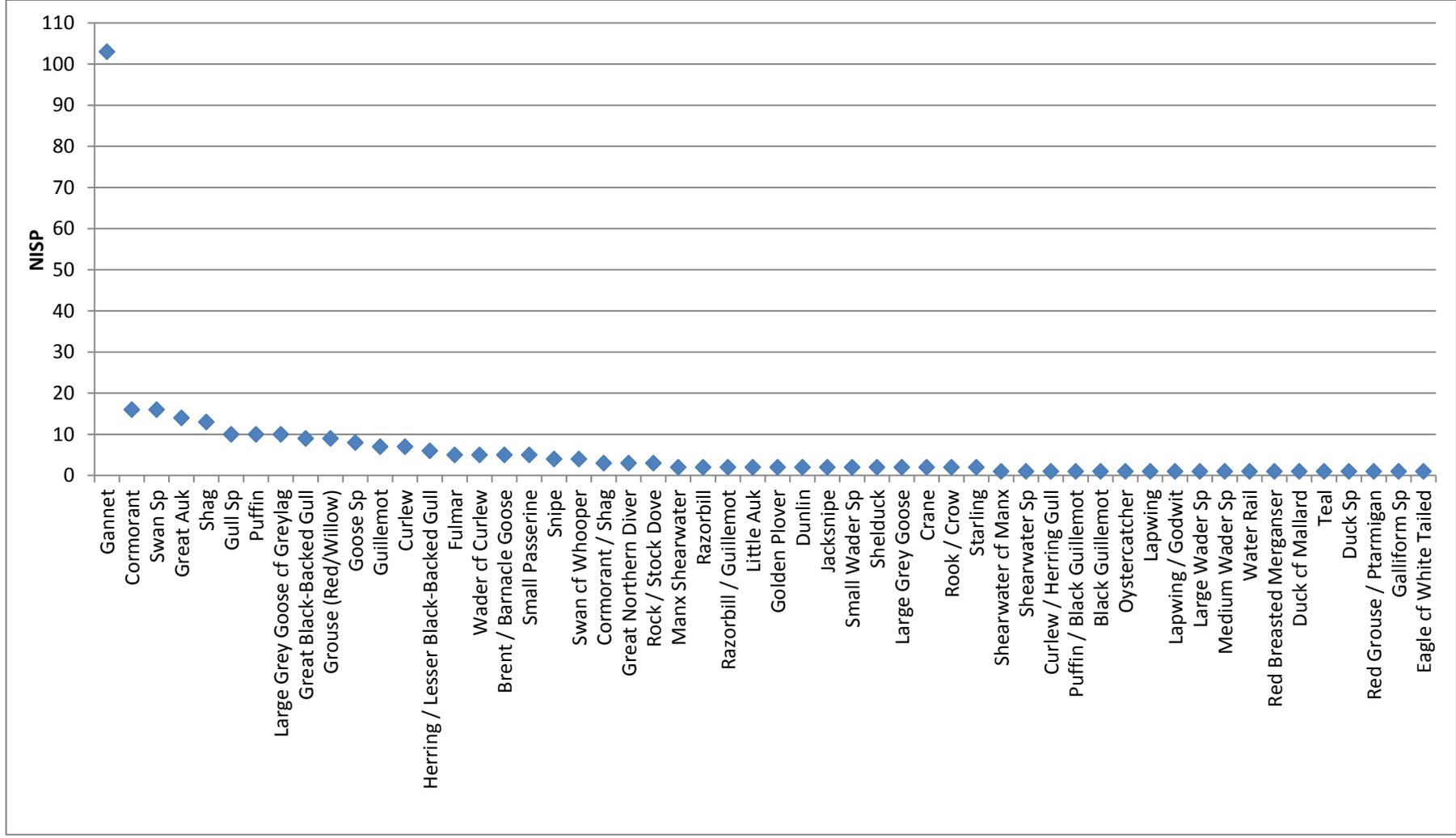
Returning to the Early Bronze Age, Sligeanach’s assemblage also contained Manx shearwater and a bone of herring/lesser black-backed gull. Manx shearwaters migrate away from Britain in the winter, and whereas some puffin winter in the waters surrounding Britain they become highly pelagic (moving further out to sea) and many also move to the South of the North Sea. This indicates the Early Bronze Age population was making use of these summer breeding birds such as Manx shearwater and puffin, probably from the burrow environment (where both these species nest). The Middle Bronze Age features at Cladh Hallan (site phases 4-7) produced 15 avian bones which gave a NISP of six. Of these a large grey goose and a butchered curlew/oystercatcher were recovered from the Middle Bronze Age house. A pit

produced a diverse assemblage of eight fragments including a gannet, a large grey goose, a medium wader and a probable great northern diver. Other structures produced five fragments, only one of which was identifiable as a great northern diver, suggesting exploitation of winter visitors.

The majority of South Uist's Bronze Age data comes from the Late Bronze Age Phases of Cladh Hallan. While caution must be adequately employed in heavily using one site for the recreation of an entire period on South Uist, its size and diversity provides a vital and valuable insight into Bronze Age avian resource use within this specific location. There are at least 34 species at Late Bronze Age Cladh Hallan, with more species likely to be present but not identified to taxon. As mentioned earlier in this chapter, seabirds formed a sizable proportion of the Bronze Age remains, and of these larger birds were highly represented and would have provided more dietary input per kill. One species in particular was prominent: the gannet (Figure 4.22).

At late Bronze Age Cladh Hallan gannet made up nearly one third of the NISP, and a partial skeleton was present (which exhibited butchery). Even when this skeleton is excluded from the NISP gannet was still the most numerous species accounting for over a fifth of the avian remains. Gannet was also present within earlier Middle Bronze Age Cladh Hallan, but absent from Early Bronze Age Sligeanach, perhaps indicating site specific fowling choices. Continuation of exploitation strategies between the Early and Late Bronze Age can be seen through the enduring presence of puffin, herring/lesser black backed gull, little auk and Manx shearwater in both assemblages, showing repeated capture.

Figure 4.22: Species abundances for Bronze Age South Uist (by NISP)



For the Late Bronze Age assemblage the MNI in general reflected the NISP, with the gannet again being prominent (see Appendix Table A4.7). The red grouse has a disproportionately high MNI of five for the nine bones present, implying that the bones recovered probably only represent a very small proportion of original avian assemblage and that a myriad of factors have influenced survival. This could also suggest that these earliest assemblages from South Uist have incurred a high degree of temporal degradation, perhaps more so than their later counterparts (see Appendix Tables A4.28 to A4.33 for Norse MNI/NISP).

Cormorant, shag and great auk were the next most frequent individual species for the Late Bronze Age assemblage, but made a much smaller contribution in terms of NISP than gannet, with the highest being 16 for cormorant (Appendix Table A4.6). Geese, gulls and swans also occurred commonly and provided a sizable contribution. Other seabirds including puffin, guillemot and fulmar were fairly numerous, as was the curlew (a wader), and red grouse (a land bird). However, many of the other species identified were sparsely represented with less than five fragments present. These minor species included winter visitors such as crane and great northern divers, waders such as golden plover and jack snipe, and also landbirds such as rook/crows and an eagle (*cf.* white tailed). As anticipated (considering the date) domestic birds were not present.

The Iron Age

The Iron Age dataset comes from 10 sites/period subdivisions, but only three of these have NISPs larger than 15, which limits analysis and the extent to which data can be examined by Early, Middle and Late Iron Age categories (again demonstrating the necessity of comparing with a larger body of data for further analysis, see Chapter

Five). In terms of numbers, the herring/lesser black back gull dominates the overall Iron Age assemblage, however this is almost entirely due to its extremely high representation at Bornais Mound 1 where it is dominant (Figures 4.23, 4.24 and Table A4.8). Whilst at Mid to Late Iron Age Dun Vulcan all gulls combined make up a sizable 13% of the NISP, gulls only make a modest contribution to the other Iron Age assemblages.

At Dun Vulcan (the largest Iron Age assemblage) there is a strong focus on members of the auk family including great auk, guillemot, puffin and razorbill. Great auk is the most commonly represented individual species at Dun Vulcan where it comprises 11% of the NISP, however by the latest Iron Age layers it has decreased (Cartledge and Grimbley 1999). The great auk occurs at 3 (30%) of the Iron Age sites. Auks make up a large proportion of the Iron Age remains and occur at 8 of the 10 sites (Figure 4.23 and Table A4.8). Only two tiny avian assemblages at Iron Age A'Cheardach Bheag and Late Iron Age A'Chearadch Mhor (NISPs of 2 and 1 respectively) did not produce auk bones.

Figure 4.23: Grouped main species for Iron Age (by NISP)

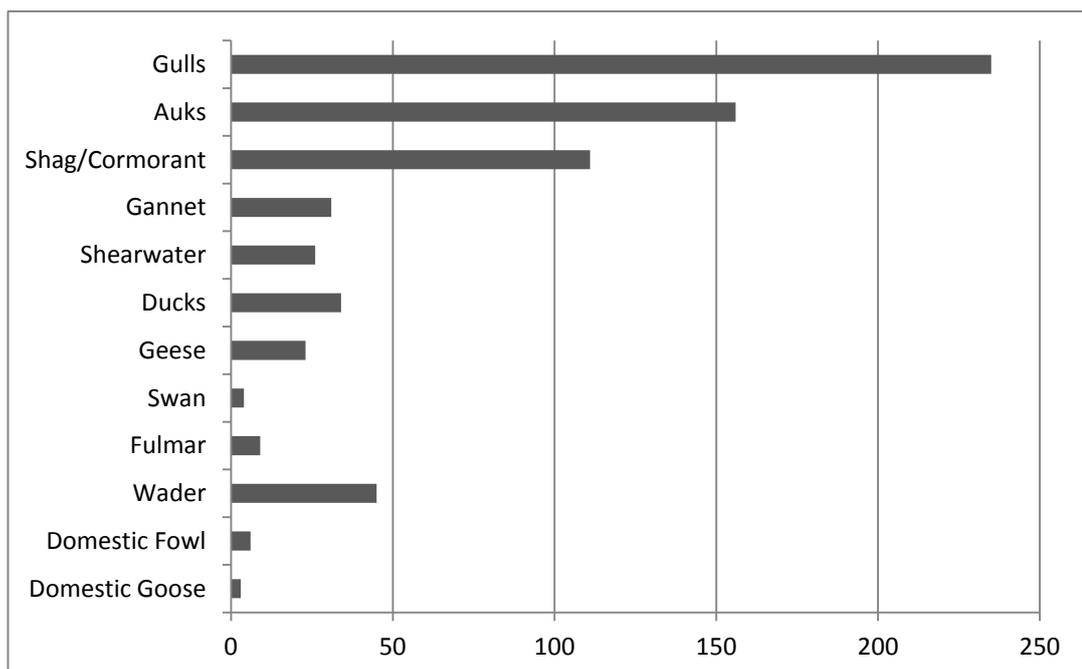
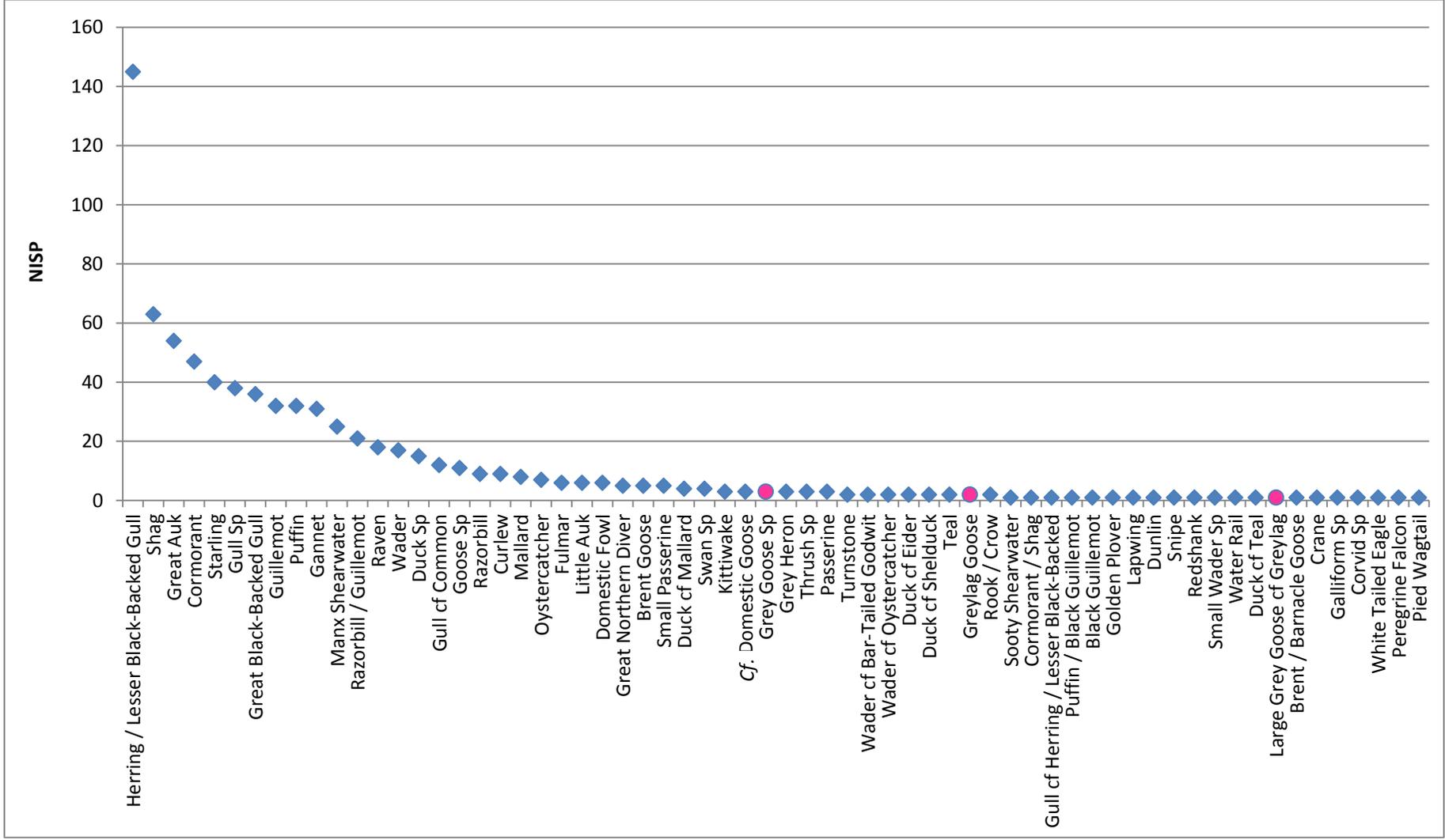


Figure 4.24: Species abundances for Iron Age South Uist (by NISP). ‘Circle’ entries indicate similar grey geese than could be classed together.



Although auks occur frequently there are differences in the auk family's representation and distribution at the Iron Age sites. Razorbill and guillemot only occur at Dun Vulcan (where they are highly represented making over 15% of the assemblage) with a single guillemot bone present at Early Iron Age Sligeanach. Both these species are cliff nesters who only come ashore to breed.

Shag, puffin and gannet occur at four sites, showing repetitive use of these resources through the regularity of their exploitation. After herring/lesser black-backed gulls the shag is the next most common Iron Age bird and, together with the cormorant, these resident *Phalacrocoracidae* form an important Iron Age resource. The gannet is another particularly interesting species. Within the Iron Age sites gannet (when not absent) seems either to be present in small numbers (indicating opportunistic capture, perhaps at sea) or they form a higher proportion of the remains which could imply that they were being more purposefully targeted and may infer fowling trips conducted to specific breeding grounds. For example, gannets at Iron Age Cladh Hallan and Bornais only make 2% of the NISP compared to Dun Vulcan where they form over 6%. At the very small A'Cheardach Mhor assemblage gannets form 25% of the NISP¹³. Notably (as explored above) Dun Vulcan also has a high number of razorbills and guillemots. This distinctive species makeup and their relative frequencies may therefore be a result of fowling activities that made high use of breeding seabirds, and which appears to have involved sourcing cliff/stac nesters from further afield.

At least 40 species are present in the overall Iron Age assemblage, of which 24 were seabirds or marine waders. This demonstrates that not only were the overall avian

¹³ The single identifiable bone from Late Iron Age A'Cheardach Mhor will be combined with the general Iron Age assemblage from this site for the rest of this Iron Age comparison, creating an overall NISP of 4.

frequencies heavily marine (as seen earlier in Figure 4.15), but also that the range of species exploited was strongly focused on sea and shore resources.

A similar range of key and supplementary species are used across the Iron Age assemblages, although as mentioned with different dominant species and frequencies across sites. However by the Late Iron Age we see the first (confident) occurrences of domestic birds South Uist (chicken and probable goose). These domesticates only occur in the latest Iron Age phases of Dun Vulcan (the Late Iron Age), but interestingly are not present at contemporary Bornais (Cartledge and Grimbley 1999, 283). This suggests that their adoption and use in South Uist was very site-specific, slow, small in scale and not universally applied. (Interaction between analysts for these key sites and their avian specialism make it unlikely that early domesticates were overlooked, see Table 4.1).

The lower represented species in the Iron Age include winter and passage visitors (such as the great northern diver and sooty shearwater), teal, grey heron crow/rook, several waders (such as golden plover, snipe, lapwing and redshank) and two raptors: the white-tailed eagle and the peregrine falcon. Crane was also represented by a single bone.

The Pre-Norse/Pictish Period

The very small Pre-Norse/Pictish assemblage shows that a range of species were occasionally exploited including gulls, geese, auks and waders (Table 4.9). The presence of white-tailed eagle shows an occasional interaction with raptors, even in this small dataset. The presence of a single Galliform *cf.* domestic fowl bone suggests that domesticates may have started to be used at Bornais (they were absent from this site's Late Iron Age material). The greylag/domestic goose hints that potentially domestic

geese had also expanded their presence on South Uist (however this specimen was too fragmentary to allow confident identification). If the potentially Pre-Norse/Pictish remains are also considered (Bornais Mound 2 Pre-Norse/Pictish/Norse), a very similar species patterning is present but with the addition of cormorant/shag and duck (NISPs of 1) (Appendix Table A4.9).

Table 4.9: Species Abundances for Pre-Norse/Pictish South Uist (by NISP).

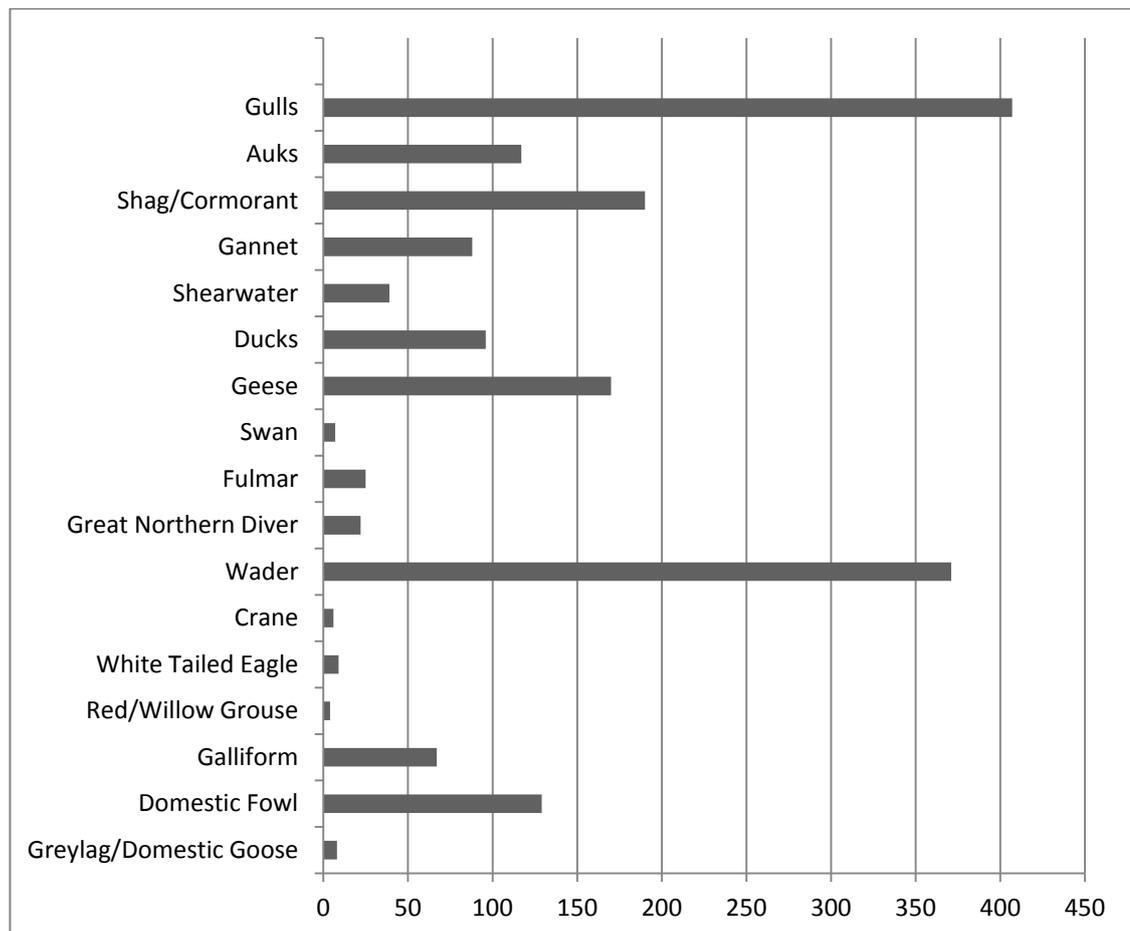
SITE NAME	Bornais M2 (PN/Pict)
GULL <i>CF.</i> COMMON	2
LARGE GREY GOOSE <i>CF.</i> GREYLAG	2
GREYLAG / DOMESTIC GOOSE	1
GUILLEMOT	1
PUFFIN	1
MANX SHEARWATER	1
WADER <i>CF.</i> SNIPE	1
SMALL WADER SP	1
GALLIFORM <i>CF.</i> DOMESTIC FOWL	1
WHITE TAILED EAGLE	1
SMALL PASSERINE <i>CF.</i> THRUSH	1

The Norse Period

The Norse period dataset derives from the four Bornais Mounds and Cille Pheadair, with 12 subdivisions. Overall in the Norse data the herring/lesser black-backed gull is dominant making up nearly 10% of the assemblage, and the category of ‘small wader sp’ also contributed a very large proportion of the remains (Figure 4.26(a) and Table A4.10). Additionally the cormorant and the great black-backed gull make up an important part of the fowling economy throughout the Early, Middle and Late phases (both forming nearly 7% of the overall Norse NISP). The great black-backed gull is present in all of the sites/subdivisions, and the cormorant in all but one. The shag and cormorant were clearly valued by the Norse population for exploitation (Figure 4.25).

For the first time on South Uist domestic fowl make a very sizable contribution to the avian economy. They form a greater proportion of the avian resources and produce their largest NISP in the Late Norse phases (Figures 4.20 and 4.21). The rise of domestic fowl would have changed human interaction with the wild resources to some degree. For example, if domesticates are providing a regular source of eggs, collection of wild eggs might become less prioritised, with fowling instead timed to collect young birds, or focused on different species (this theme will be developed further in Chapters Seven and Eight). A more regular use of landbirds is visible in the Norse assemblages, and while part of this is due to unidentifiable galliforms that may be domestic fowl, there is also a greater use of corvids and pigeons/doves.

Figure 4.25: Grouped main species for Norse Period (by NISP)



The gannet is also well represented making up over 4% of the overall Norse NISP. Interestingly, the gannet in terms of NISP contribution has quite a high occurrence in many of the site assemblages, frequently totalling over 5% of the assemblage NISP (see Table 4.10). In other instances it is absent or forms a very small part. For example, if the two largest Norse assemblages of Cille Pheadair and Bornais Middle Norse Mound 2 are compared, gannet makes up 5% of the NISP at the former and less than one percent at the latter (Table 4.10). This could suggest that gannet when targeted was captured in relatively large numbers, probably in concentrated episodes (i.e. a specific hunt). The small values could signify birds caught outside of breeding colonies, maybe at sea.

Table 4.10: Gannet as NISP and % NISP by site assemblage

	Bornais M1 (EN)	Bornais M2 (EN)	Bornais M2A (EN)	Bornais M1 (MN)	Bornais M3 (MN)	Bornais M2 (MN)	Bornais M2A (MN)	Bornais M3 (LN)	Bornais M2 (LN)	Bornais M2A (LN)	Bornais M2 (N)	Cille Pheadair (N)
Gannet NISP	0	1	6	7	0	3	2	3	9	21	4	32
Site NISP	17	65	154	51	9	514	51	46	171	195	77	645
% Site NISP	0	2	4	14	0	1	4	7	5	11	5	5

Species of the auk family are more sparsely represented in the Norse data (as a proportion of the overall fowling economy) than in the earlier periods, although they still make a sizable contribution (Figure 4.25). However the great auk is completely absent from the Norse remains which is particularly noticeable after its prominent role in Bronze and Iron Age fowling. This suggests over exploitation may have diminished and even eliminated great auks in the area.

Figure 4.26: Species abundances for Norse South Uist (by NISP). Only NISPs of three and above shown

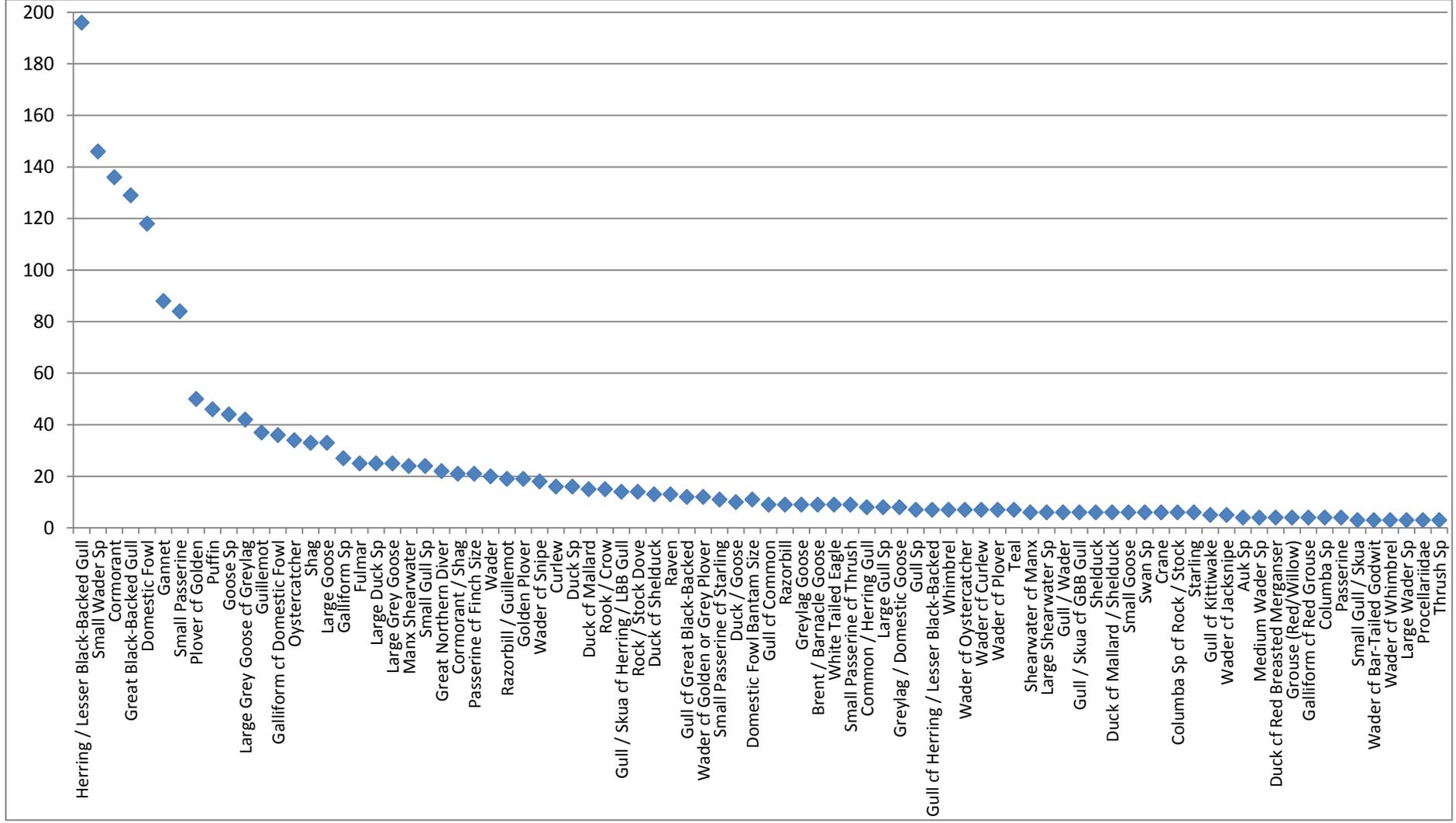
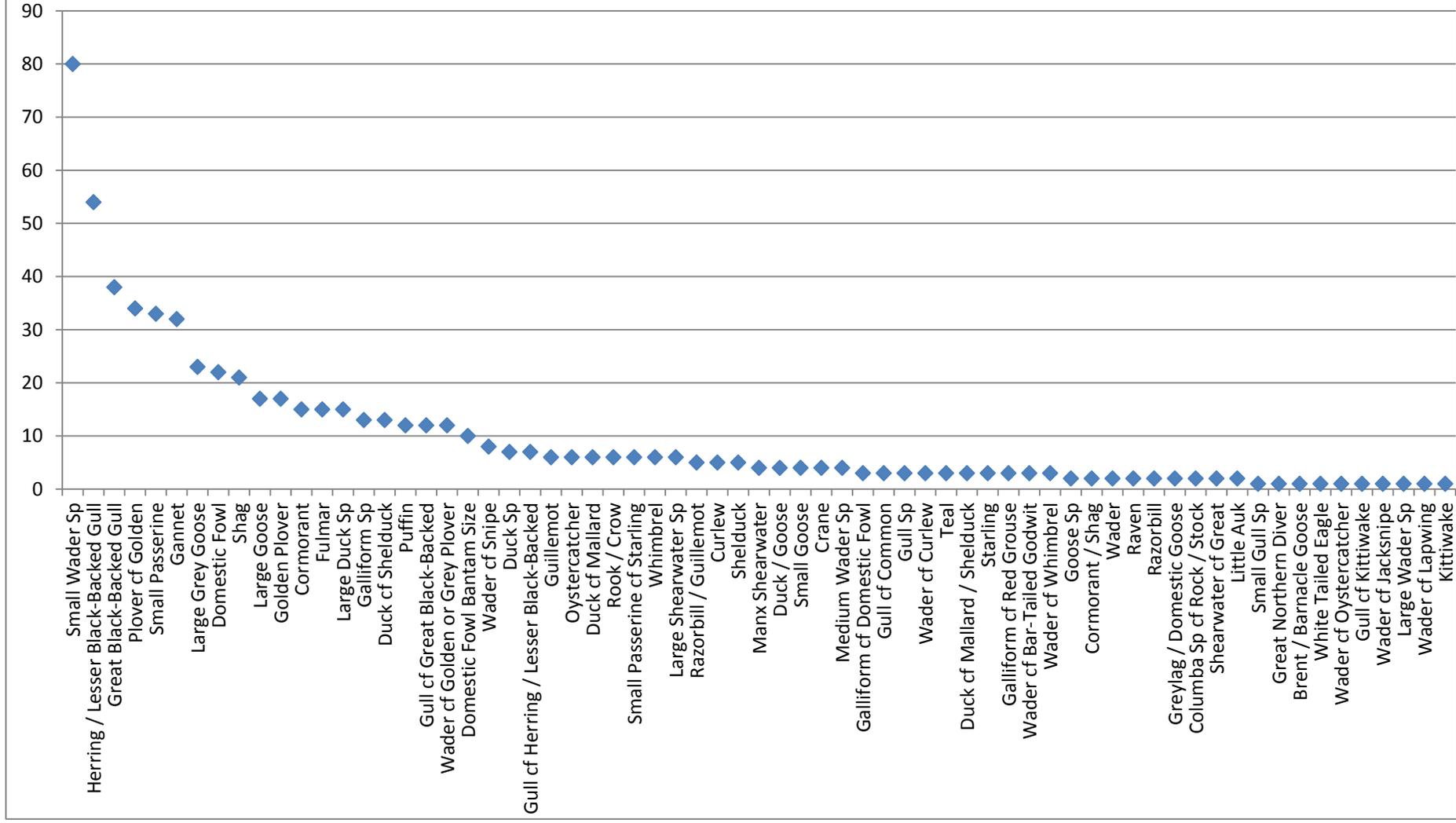


Figure 4.26a: Species abundances for Norse Cille Pheadair individually (by NISP).



Of the Anatidae (waterfowl), geese form a large part of the Norse remains. Black geese were not numerous, with the Brent/barnacle goose only represented by nine certain bones. However, some of the 'small goose' bones may belong to black geese. Seven of the Brent/barnacle goose bones came from the Middle and Late phases of Bornais Mound 2, perhaps indicating processing of a specific fowling catch at this area of the site. Grey geese were much more frequent with 'large grey geese' (the majority of which are *cf.* or confidently greylag) making up nearly 4% of the overall Norse NISP. It is possible and probable that some of the 'large grey geese' are domestic, and eight fragments were classed as greylag/domestic goose. Unfortunately the Bornais Mound 2, Bornais Mound 2A and Cille Pheadair assemblages were highly gnawed by carnivores, damaging many of the distinguishing features and preventing full metric analysis. It must also be remembered that wild and domestic populations might interbreed. Several species of duck were present including at least: teal, shelduck, eider, red-breasted merganser and probably mallard. Ducks (like geese) play an increased role in the Norse avian economy compared to the previous periods. Waders (as seen earlier in the chapter) are very abundant in the Norse period, and form a major part of the overall assemblage (Figure 4.25 and 4.26a).

Overall the Norse assemblage is very diverse with at least 45 species present, although its sample size is larger than earlier periods' (diversity often increases with sample size before plateauing, limited by an area's ecological range). A greater variety of waterfowl and waders are present, but a lower number of seabird species. The species represented by a relatively small NISP include crane, white-tailed sea eagle, short-eared owl, little auk and a range of probably underrepresented waders (species for which many bones may just have been classed as 'small wader') including snipe, turnstone and whimbrel.

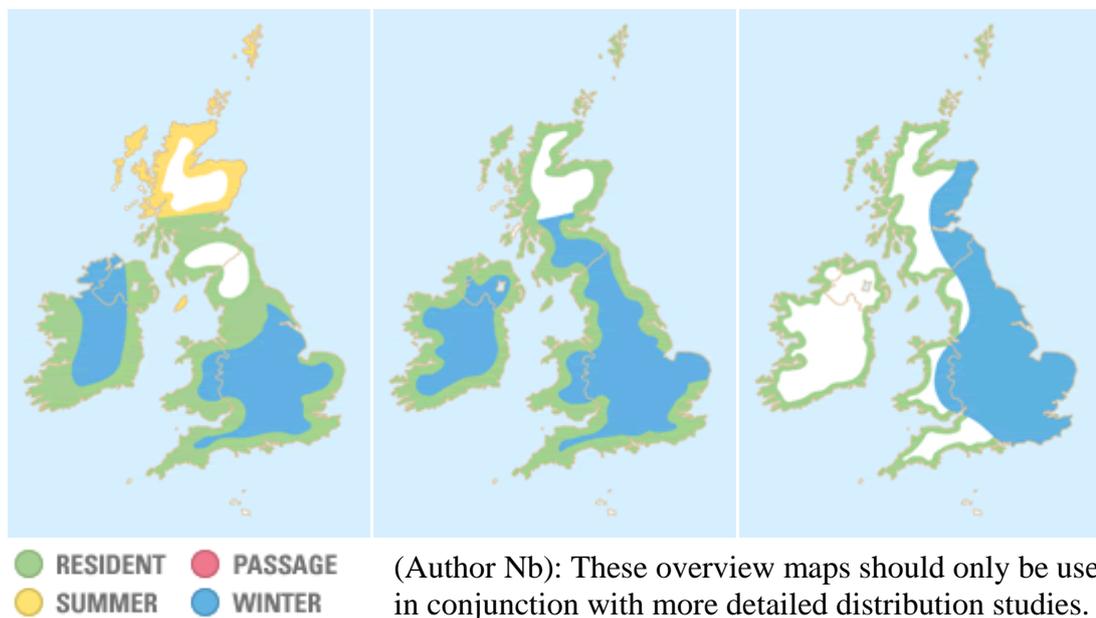
4.7 Change of Season Through Time

Having seen the species distribution through time and by site, the impact of birds in terms of seasonality can be considered and discussed further. As mentioned, due to the fluid nature of bird populations establishing seasonality is difficult. For instance, while a species might be resident in an area all year, it may spend much more time at sea during the winter months, meaning that exploitation is more likely to have occurred during the summer. As an example of this complexity some of the most common archaeological species are briefly considered. The herring and lesser black-backed gulls frequently overlap in their distribution and use of particular sites, and these two species are closely related. Zooarchaeologically they are classified/grouped together since they are very hard to separate morphologically on all but a few elements.

The lesser black-backed gull is generally present in mainland Scotland and the Scottish Isles as a summer breeder and is much less numerous than the herring gull. Unlike the herring gull the lesser black-back is highly migratory as winter approaches. However, resident lesser black-back gulls *are* present within Britain as a whole and other birds e.g. from Scandinavia move to Britain for the winter, confusing the overall season patterning (however these incoming winter visitors spend a large proportion of the time at sea) (Sterry *et al.* 2001; 120-121; Stroud *et al.* 2001a, 353-359; Webb *at al.* 1990, 179). Therefore, lesser black-backed gulls might be occurring in the Outer Hebrides year round, but this does not necessarily mean that it is the same population present. The herring gull on the other hand is more numerous than the lesser black-backed gull and spends more time in one location. However, they often spend more time at sea during the winter roaming widely, and as such may have been less targeted at this time, despite herring gull numbers increasing drastically during the winter months due to

incoming winter visitors (many of which gather further inland in England, Wales and Ireland) (see Figure 4.27). The resident great black-backed gull also experiences an influx of winter visitors, quadrupling its resident numbers. These visitors (today) cluster along the eastern seaboard lessening their impact on Hebridean populations (Sterry *et al.* 2001; 120-121; Stroud *et al.* 2001a, 353-359; Webb *et al.* 1990, 179; WWW16).

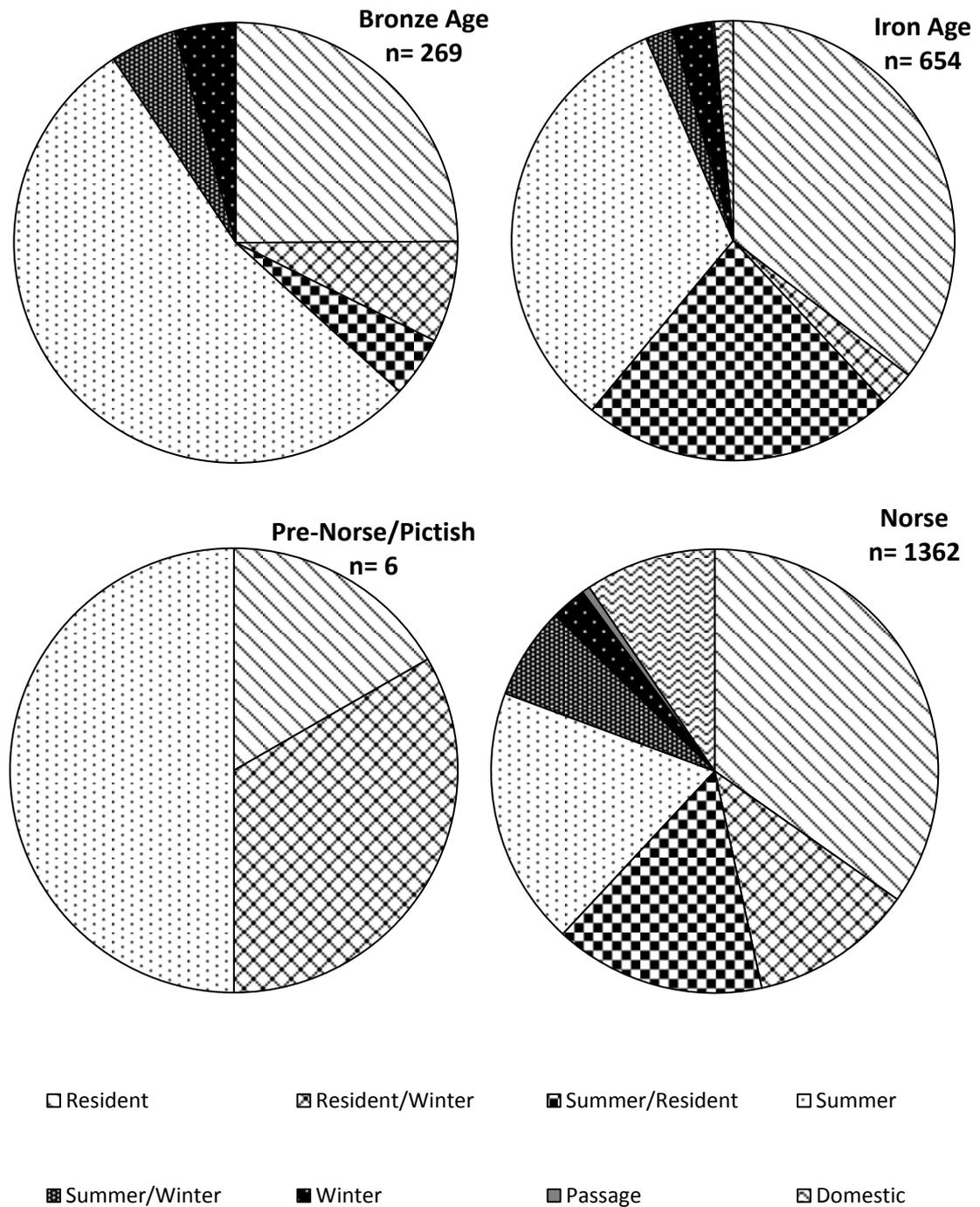
Figure 4.27: RSPB maps showing broad, general, modern distributions of lesser black-backed (left), herring (centre) and great black-backed gull (right) (from WWW16-18).



Furthermore, resident species such as the shag, cormorant and the great black-backed gull may have been captured during the summer breeding season. However, they could be exploited at multiple other points of the year and targeted during winter months when other species were absent. As such, the seasonal distributions presented here should be used with caution as they only give a broad overview of the windows of opportunity for fowling particular species and groups. Appendix Tables A4.11- A4.14 show seasonality definitions for each species based on modern distributions which, whilst exceedingly valuable, could vary from those in the past. Figure 4.28 presents the seasonal data for all species which could be assigned such. Identifications such as ‘shearwater sp.’, ‘plover’ and ‘small wader’ are not assigned to confident species, and are not included.

Winter and passage birds will be presented first since these can only be recognised by species identification. The resident birds and summer visitors will be presented last, since their use and timing can also be explored via medullary bone and juvenile remains; the evidence for which shall then be presented.

Figure 4.28: Seasonality based on species shown by NISP for each period



These seasonal distributions show that in all periods exclusively winter visitors make a relatively small contribution to the fowling economy overall, suggesting that they were used to supplement resources when necessary and available, and were less targeted than summer visitors. They range from 2.6% of the seasonable remains in the Norse period to 2.9% in the Iron Age and up to 4.5% in the Bronze Age. The Bronze Age winter visitors show a larger use of black geese, great northern diver and (the probably winter) curlew which together total 4.7% of the total period NISP (compared to Iron Age 2.6% Norse 2.4%). The curlew (which occurs repeatedly archaeologically – see Tables A4.15 to A4.18) is classified as ‘summer/winter’ since its breeding presence varies between islands. However, today it mainly moves to the Outer Hebrides for the winter having generally bred at more inland locations. They are then joined by winter migrants from Scandinavia, particularly Finland and Sweden, suggesting that concentrations of these wintering birds may have been a valuable winter resource for the islanders (Best and Cartledge In Press; Burton and Fuller 1999, 18; Heinzel *et al.* 1992: 138; Hull 2001, 175-6; Stroud *et al.* 2001a, 312-315). Little Auk is present from the Bronze Age to the Norse period (as seen in Table 4.8). Winter visiting waders such as the turnstone (Iron Age and Norse) and Jack snipe (Bronze Age) are also represented in small numbers. The wintering whooper swan was identified from one bone at Middle Norse Bornais Mound 2, and 4 ‘swan *cf.* whooper’ were present at Late Bronze Age Cladh Hallan (Appendix Tables A4.15 and A4.18). Only the furcula and sternum of whooper are securely distinctive to distinguish it from the resident mute swan, meaning that it may be underrepresented (Serjeantson 2009, 75).

The winter fowling contribution therefore appears to be small. However, it must be remembered that this is the minimum representation of birds caught through winter

fowling. The ‘Summer/Winter’ and ‘Resident/Winter’ categories mainly refer to species whose populations are notably increased or replaced by the arrival of wintering birds from other locations. When these are also considered a possible dual-focused fowling economy can be seen, particularly in the Norse period, where these make up 21% of the seasonable NISP (compared to 7% in the Iron Age and 17% in the Bronze Age). For example, while breeding colonies of seabirds might be targeted in summer, wintering flocks of (e.g.) waders and geese could also be targeted in winter. The particularly high Norse value in part reflects the increased proportion of waders and waterfowl in this period.

For example, plovers were notably abundant in the Cille Pheadair assemblage, mainly the golden plover. Today the British summer breeding population of golden plovers is swollen in winter by the arrival of birds from Scandinavia, Iceland and western Siberia (Byrkjedal and Thompson 1998; Hull 2001: 164). The wintering populations form dense flocks and move in these tight clusters. This behaviour would prove favourable for netting, implying that this resource could also have been targeted in the winter. One plover at Cille Pheader was *cf.* grey plover. The grey plover only winters in Britain, also indicating capture during these colder months. However today they do not winter in the Scottish Islands, suggesting either an extended past distribution, or the capture of a vagrant bird (Davidson *et al.* 1991; Moser 1988; Stroud *et al.* 2001a, 260; Tubbs 1991).

Passage birds make up a minute overall contribution, and are only present in the Iron Age and Norse assemblages. In South Uist’s archaeology they are represented by sooty and great shearwater. However, their contribution is likely to be underrepresented. Many birds passing through the area on their migration routes belong to species that

also have British populations. With these species already assumed present in the Scottish Islands the passage birds would not be separable from them. Consider for example the complicated redshank. Redshanks are resident to the Outer Hebrides, but large numbers from the Eastern Atlantic Flyway population also pass through Britain on migration to warmer climes, and some of these foreign redshanks winter in Britain (Stroud *et al.* 2001, 322). Britain also has a summer population that then migrates for the winter (moving to other locations both within Britain and further afield) (Cayford and Waters 1996, 7-17; Stroud *et al.* 2001a, 4 and 19-325). The presence of passage birds at all shows that a wide range of avian resources were being used and may even suggest capture from the air or at sea, since these birds are less likely to spend much time on land, and some might not even alight there. It also infers that passing birds from other species would have been captured too, whether zooarchaeology can identify them or not (see crane discussion below in Juvenile Remains).

The contribution made by summer visitors (including summer visitors to land) forms a sizable proportion of the overall fowling economy in the Bronze Age (54%), Iron Age (33%) and Pre-Norse/Pictish (50%) assemblage (Figure 4.28 and Appendix Tables and Figures A4.11 to A4.14). Their contribution is somewhat lessened in the Norse period in terms of percentage, falling to 19%. This reflects both the increased diversity and different species focus of the Norse fowling profile, and highlights that percentage wise the wild species are now in ‘competition’ with a much larger domestic population. If the domesticates are removed from the calculation summer birds still only form 21% of the seasonable NISP. Although birds that are exclusively summer visitors form an important part of South Uist’s fowling profile, it is again important to consider that the summer breeding season would have also been an important time for exploitation of

resident species. The 'Summer/Resident' category (which contains the herring/lesser black-backed gull, teal, snipe etc.), shows that summer fowling is likely to have had a higher input than is initially apparent (Figure 4.28 and Tables A4.15 to A4.18).

Following on from this point, the resident birds make up a large proportion of the avian fowling strategies in all periods (Figure 4.28 and Tables A4.15 to A4.18). The shag and cormorant are important species within this category, as is the great black-backed gull. Grouse, teal and several waders also make a repeated contribution. Resident birds comprise 25% of the seasonable NISP in the Bronze Age, 36% in the Iron Age and 35% in the Norse period. In the small Pre-Norse/Pictish assemblage resident species only make up 17% of the birds, but when the '*cf.* resident' birds are included this rises to 36% (see Appendix Figure A4.13). This sizable use of resident birds is to be expected as these species present the longest and often most repeatable window of opportunity for exploitation. Their resident status would have also allowed a familiarity to be developed with particular species, and consequently greater understanding of their behaviour and movements. Their large presence in the assemblage does not contradict or undermine the importance of season specific fowling episodes (i.e. in the summer breeding months), but instead shows that resources may have been repeatedly exploited in different ways dependent on the time of year. For example, certain species (i.e. of gulls and waterfowl) may have been targeted during the moult when their ability to fly is diminished making them vulnerable (Harris 1971, 118; Serjeantson 2009, 237). The moult generally occurs post breeding in very late summer and autumn (Harris 1971, 113-114; Heubeck 1993, 77). As such a flock could be exploited for flightless pre-fledge young birds during the breeding season, and then flight impaired adult birds during the moult.

Avian distributions are often complex, may have multiple populations of one species even within one small geographic region, and are responsive to outside stimuli. Consequently it can be difficult to accurately infer seasonality purely based on indirect species ecology. Furthermore, modern distributions are only useful up to a point for aiding reconstruction of past populations, since although birds are constrained by certain ecological niches, some changes may have occurred. Whilst we can not be entirely confident that present distributions apply to the past, examining them alongside species specific needs, and other lines of evidence, such as historical accounts, helps to refine or validate the data. To further support or refute this seasonality (particularly for complex species) it is also important to consider other zooarchaeological data which inform upon seasonality more directly. This focuses on the presence of young birds, medullary bone and of eggshell. The latter of these shall be considered separately in Chapter Seven.

Juvenile Remains

Juvenile bone was recovered from all three of the Bronze Age sites. The identifiable young formed 7% of the total Bronze Age NISP, while all juveniles (including unidentifiable ones) also formed 7% of the entire avian assemblage. Since juveniles may be underrepresented through poor preservation, these percentages indicate that young birds made meaningful contribution to the overall avian assemblage, but that their role was not overly dominating. At Early Bronze Age Sligeanach a subadult Manx shearwater and an immature/subadult shearwater *cf.* Manx were identified. Additionally, one 'auk *cf.* puffin' was possibly juvenile. This suggests that birds were taken from the burrow-nesting environment. A single unidentifiable juvenile bird was present at Middle Bronze Age Cladh Hallan, which could show some exploitation of avian resources during the breeding season.

At Late Bronze Age Cladh Hallan a range of juvenile species were present, including the resident shag. This reveals that some shags were exploited during the summer months despite being present year-round (Table 4.11). Only one certain juvenile gannet is present but even this suggests some capture at a breeding site. It is also butchered suggesting food processing. Of particular note is the juvenile great auk, indicating capture during its vulnerable breeding period and implying that nesting was occurring in the vicinity. This specimen is butchered, showing direct human interaction with this now extinct bird and its role in subsistence. Young birds were probably targeted on and around the nest; therefore Bronze Age fowling were accessing freshwater environments, the machair, coastlines/beaches, rocky shores and seemingly cliff locations.

Table 4.11: Juvenile birds from Late Bronze Age Cladh Hallan (by frequency and ID)

Species	Very Young	Immature	Subadult	Possible Sub Adult
Large Wader <i>cf.</i> Curlew		3		
Razorbill / Guillemot		2		
Shag			1	1
Duck		1		
Fulmar		1		
Gannet			1	
Goose		1		
Great Auk		1		
Guillemot		1		
Gull		1		
Puffin		1		
Shag / Cormorant		1		
Snipe		1		
<i>cf.</i> Gannet		1		
<i>cf.</i> Smew		1	1	
Very / Large Bird		4		
Medium / Large Bird		2		
Large Bird		3		
Bird		1		

In the Iron Age juvenile bird bones assignable to species only formed a tiny 0.4% of the period NISP (Table 4.12)¹⁴. This low use of juveniles in part seems to be an accurate reflection of Iron Age bird use, however there is also a lack of information from several

¹⁴ Juveniles were not given here as % of entire Iron Age avian assemblage since overall assemblage size is not attainable for some of the sites.

of the sites, which may bias the dataset. While no juveniles were present at (the fully recorded) Hornish Point and Sligeanach, the occurrence of young birds is completely unknown for Dun Vulcan, A'Cheardach Mhor and A'Cheardach Bheag, since no mention of the presence or absence of juveniles could be ascertained. Only partial information is present for Bornais Mound 1 and Cill Donnain, implying that more juveniles could have been present¹⁵. The small juvenile assemblage suggests that great auk were still breeding on or in the vicinity of South Uist in the Late Iron Age, despite its overall numbers having diminished. Juvenile gannets may continue to provide some input at Cladh Hallan during the Iron Age, and an unidentifiable galliform from Askernish could show capture of young landbirds.

Table 4.12: Juvenile birds from Iron Age South Uist by site and species.

SITE NAME	PERIOD	ALL RECORDED?	SPECIES	FREQUENCY	ELEMENT
Cladh Hallan	Early Iron Age	Yes	<i>cf.</i> Gannet	1	Tibiotarsus
Cladh Hallan	Early Iron Age	Yes	Tiny Bird	1	Tibiotarsus
Bornais Mound 1	Late Iron Age	No	Great Auk	1	Tarsometatarsus
Cill Donnain	Iron Age	No	Unidentified	1	Unidentified
Askernish	Iron Age	Yes	Galliform Sp	1	Tibiotarsus

Within the small Pre-Norse/Pictish assemblage (assemblage size 36, NISP 13) three juvenile bones are present. One of these was identifiable as an immature 'galliform *cf.* domestic' suggesting that breeding domesticates were present in this period. As such juveniles make 8% of the Pre-Norse/Pictish avian assemblage and the single identifiable specimen represents 8% of the NISP. While small sample size is clearly a factor, juveniles appear to have been regularly used.

¹⁵ For Bornais Mound 1 Judith Cartledge's death resulted in the loss of this information, and some of her paper records. Although Dale Serjeantson corrected and reported upon the Mound 1 data some aging (and taphonomic) data was unrecoverable.

The large Norse assemblage(s) provide a valuable insight into the exploitation of young birds on South Uist and seasonal activities. Juveniles occur at every site and in all but one of the period subdivisions. The identifiable juveniles form 6% of the Norse NISP, showing that young birds played a moderate but relatively important role in the overall fowling economy and avian husbandry of this period¹⁶. The small Bornais Mound 1 assemblage produced juvenile domestic fowl and raven whilst Bornais Mound 3 contained one juvenile cormorant.

At Cille Pheadair 41 juvenile bones were recorded making up 3% of the entire avian assemblage (including unidentifiable fragments). A further 26 fragments (25 identifiable) were identified as probable sub-adults but could not be conclusively recorded as such due to their poor condition. Of the 41 certain juveniles, 30 were identifiable and constituted 5% of the overall NISP from Cille Pheadair. If the probable sub-adults are included the identifiable juveniles rise to a prominent 9% of the NISP.

The Bornais Mound 2 and 2A assemblages produced 254 juvenile birds which made up 8% of their entire avian assemblage (including unidentifiable specimens). Of these 95 were identifiable, forming 8% of the NISP. A further 27 probable sub-adults were present of which 24 were identifiable. If the probable sub-adults are included the identifiable juveniles constitute a high 10% of the NISP. Cille Pheadair and Bornais Mounds 2 and 2A show a wide range of juvenile birds being exploited (Table 4.13).

¹⁶ Juveniles are not given here as % of entire Norse avian assemblage since overall assemblage size is not attainable for Bornais Mounds 1 and 3.

Table 4.13: Juveniles by age stage: Very Young, Immature, Subadult, Probable Subadult.

Species	Cille Pheadair				Bornais Mound 2				Bornais Mound 2A			
	VY	IM	SA	PSA	VY	IM	SA	PSA	VY	IM	SA	PSA
Fulmar			3									
Great Black Back Gull		1		3		1	2	1				
Gull <i>cf.</i> Great Black Back		2										
Herring / Lesser Black Back Gull		1		1		2	3	2		1		2
Common Gull							1					
Gull <i>cf.</i> Kittiwake							1					
Gull <i>cf.</i> Small Gull					1					16		
Cormorant				2				1				
Shag										1		
Gannet				1		4	1	2		4	2	3
Seabird <i>cf.</i> Gannet				1						1		1
Razorbill			1									
Guillemot				2				3				
Puffin						1				1		
Manx Shearwater		1		2		2	2			1		2
Shearwater Sp. <i>cf.</i> Manx						1				3		
Large Shearwater <i>cf.</i> Great Shearwater				1								
Seabird <i>cf.</i> Shearwater						1						
Charadriiform						4	1					
Golden Plover		1										
Plover <i>cf.</i> Golden		1										
Wader <i>cf.</i> Golden or Grey Plover		1		1		1					1	
Oyster Catcher				1			1					
Wader <i>cf.</i> Oystercatcher							1					
Wader <i>cf.</i> Woodcock								1				
Small Wader		1	1	5		3	1					
Medium Wader			1									
Large Grey Goose Anser Sp.			2				1					
Anatidae <i>cf.</i> Black Goose										2		
Small Goose				1								
Large Goose Sp.								1				
Waterfowl <i>cf.</i> goose								2				
Merganser <i>cf.</i> Red-Breasted						1						
Duck <i>cf.</i> Goldeneye							1					
Waterfowl <i>cf.</i> Teal						1						
Large Duck Sp.		1		1		1						
Duck Sp.		2		1								
Waterfowl <i>cf.</i> Large Duck sp.			1									
Domestic Fowl				1			2	1				
Domestic Fowl Bantum Size		1										
Galliform <i>cf.</i> Domestic Fowl	2				2	6	1	1		2		
Galliform		5				1						
Landbird <i>cf.</i> Galliform		1							1			
Common Crane						1						
Eagle Sp. <i>cf.</i> White-Tailed Eagle						1						
Crow/Rook										1		
Small Passerine <i>cf.</i> thrush							2					
Small Passerine				1		1		1				

Table 4.13 shows that in the Norse period summer visitors and resident wild species were targeted during the breeding season. This is demonstrated by the presence of skeletally young birds; particularly the ‘very young’ and ‘immature’ age stages (Cohen and Serjeantson 1996, 7-8). The juvenile material suggests that resident species such as the shag, geese and multiple gulls were exploited during the nesting season despite being present at other points of the year (extending and supporting the species based seasonality profiles explored above). The sub-adult and ‘probable sub-adult’ bones could represent capture of youngsters at the end of the nesting period around the time of fledging and/or the capture of birds still in the breeding area at or after closure of the nesting season. Interestingly at these sites the cormorant is only represented by ‘possibly subadult’ bones, illustrating that they were captured from the nest at a late stage of their juvenile development, or perhaps even just after they had fledged. Cormorants are higher altricial birds meaning they remain on the nest for a long period of time and their skeleton ossifies fully soon after fledging at about 70 days old (de France 2005, 1131-1135; Serjeantson 2009, 11-12 and 36-38). This could indicate that the human population knew that these young resident birds would remain in the area rather than moving further out to sea to continue maturation (like young guillemots) or make their first migration on fledging (Nelson 1980, 112-11; Serjeantson 2009; 11-12).

Bornais Mound 2A produced 16 bones from an individual ‘gull *cf.* small gull’, providing more evidence to support the proposition that some gull populations bred on South Uist. Immature great black-backed gull and herring/lesser black-backed gull were present at both Cille Pheadair and Bornais, showing capture around the summer.

Juvenile gannets are well represented at Bornais and are very informative. All of the

juvenile gannets come from the Late Norse periods of Mound 2 and 2A (see Appendix Table A4.20). (The MNIs of the juveniles and their age stages prove that multiple individuals are present). The probable sub-adults are also from the Late Norse phases, except for one Middle Norse example. These young birds therefore come from assemblages that had a large proportion of gannet bones (11% Mound 2A and 5% Mound 2, see Table 4.10 above), and the young specimens constitute 21% and 29% of these gannet remains respectively. This again implies that where gannet bones are numerous breeding colonies were being targeted. These immature and sub-adult gannet bones show that larger juveniles were being taken (probably approaching fledging) and imply fowling episodes beyond South Uist involving movement about the seascape (see discussion below). The additional ‘probable sub-adult’ bones also support these points.

Juveniles from other cliff nesting species such as guillemot and razorbill were also present in the Norse data. Meanwhile immature puffins suggest capture from burrow habitats, usually dug in grassy slopes, sandy mounds or soft cliff tops. In the context of South Uist this could reflect breeding on the machair dunes or similar vicinity, although they do not do so today (see Chapter Eight for discussion). They do breed on the more southerly Outer Hebridean islands of Mingulay and Berneray (Buxton 1995, 14; Stroud *et al.* 2001a, 400).

As explored via the NISP, waders formed a sizable part of the Norse Cille Pheadair assemblage. Within this were bones from immature ‘golden plover’ and ‘plover *cf.* golden’ suggesting again that some of these waders were captured from breeding sites, despite the adult plovers being regarded as nervous on the nest (Byrkjedal and Thompson 1998; Hull 2001: 164). This provides further evidence to support that these

resources were targeted at multiple points of the year: during breeding in summer and flocking in winter.

Of particular importance and rarity is the unfused proximal tarsometatarsus from an immature common crane, which was verging toward the ‘very young’ category. The crane is a species which became extinct within Britain around the 17th Century and then reoccupied a small area of England in the 1980s, however it is thought to have had a wider past distribution (Boisseau and Yalden 1998, 482-500; Stroud *et al.* 2001a, 436). These birds would have moved through Britain on their winter passage and evidence suggests that they bred more widely in the past (Albarella and Thomas 2002, 23-25; Cartledge and Serjeantson 2012). This specimen helps to prove that cranes were breeding in Britain as far North as the Outer Hebrides during the Norse period. These birds (although described by some as tough, unpleasant eating), are large and provide enough meat to feed several people (Albarella and Thomas 2002, 23; Serjeantson 2009, 231). Young birds are more easily digested (Albarella and Thomas 2002, 23). A distal tibiotarsus of a *cf.* crane at nestling age was also present at Medieval Frobost, showing that these birds may have continued breeding on South Uist into the recent past. This is the latest temporal example from the Scottish Island material. Cranes would have been targeted for their size and possibly their rarity and symbolic associations (see individual species discussion in Chapter Five section 5.5 for more discussion).

Also notable is the immature eagle tarsometatarsus. This young bird is less likely to have been killed in order to protect livestock and may show that these raptors were intentionally targeted, perhaps for ritual reasons or feather use.

Juvenile domesticates imply slaughter of selected young birds for human consumption as part of the management of this resource (Serjeantson 1998, 30-3; Serjeantson 2009, 35 and 281).

Breeding Females: Medullary Bone as a Snapshot in Time

The juvenile bird bone provides strong evidence for the use of breeding/nesting bird populations. Most species (and particularly altricial birds) have reached skeletally adult size and have only small traces of immaturity remaining by the time of fledging, although there is margin for variation (de France 2005, 1131-1135; Serjeantson 2009, 36-38). However, due to the lack of research into the exact timings of avian bone ossification for different species, some of these birds may have been captured after fledging, particularly if they remained in the area, while others may have been targeted at sea if they moved away from the land (Cohen and Serjeantson 1996, 7-8; Ricklefs 1968, 419-451; Ricklefs 1973 177-201; Serjeantson 2009, 12 and 38). Fortunately the species based season data and the juvenile data can be used in conjunction with medullary bone, which pinpoints breeding females providing evidence for human-avian interactions during the mating and nesting periods (as outlined in Chapter Two).

Table 4.14 presents all available medullary bone data for South Uist, (recorded following Lentacker and Van Neer 1996: see Table A4.21 for phase, element and extent of fill data). The earliest example comes from Pre-Norse/Pictish Bornais Mound 2 and is a small wader, again supporting that these versatile birds were exploited during the breeding season by South Uist's inhabitants. All other medullary bearing bones come from Norse sites (namely Cille Pheadair and Bornais Mounds 2 and 2A – both novel analyses). While this may partially be a result of a failure to identify it, for most of the

South Uist assemblages this is not likely to be the case. Having completed work initially started by Judith Cartledge, the author of this thesis knows that Judith was competent in medullary bone identification, ruling out misidentification or lack of observation for Dun Vulcan and Bornais Mounds 1 and 3.

Table 4.14: South Uist medullary bone by site and then species frequency

PERIOD	SITE	SPECIES	FREQUENCY
Early Norse	Bornais M2A	Domestic Fowl	7
Early Norse	Bornais M2A	Galliform <i>cf.</i> Domestic Fowl	1
Early Norse	Bornais M2A	<i>cf.</i> Wader	1
Late Norse	Bornais M2A	<i>cf.</i> Galliform	1
Late Norse	Bornais M2A	Very / Large Bird	1
Late Norse	Bornais M2	Domestic Fowl	9
Late Norse	Bornais M2	Galliform <i>cf.</i> Domestic Fowl	3
Early Norse	Bornais M2	Puffin	1
Middle Norse	Bornais M2	Duck <i>cf.</i> Red-Breasted Merganser	1
Early Norse	Bornais M2	Medium + Bird	1
Middle Norse	Bornais M2	Bird	1
Middle Norse	Bornais M2	Very / Large Bird	1
Pre-Norse/Pictish	Bornais M2	Small Wader	1
Norse	Cille Pheadair	Domestic Fowl	2
Norse	Cille Pheadair	Herring / lesser black backed gull	2
Norse	Cille Pheadair	Domestic Fowl Bantam Size	1
Norse	Cille Pheadair	Duck / Goose	1
Norse	Cille Pheadair	Gannet	1
Norse	Cille Pheadair	Large Duck Sp	1

Medullary bone is believed to have been overlooked by the analysts of Cill Donnain and the A'Cheardach assemblages. However, the growth of a captive repeatedly laying domestic fowl population in the Norse period naturally increases the likelihood of medullary bone being present in these assemblages and goes some way to explaining its higher occurrence at Cille Pheadair and Bornais. The greater size of the overall Norse assemblage also provides more opportunities for a specimen containing medullary to be present. Its absence from Bronze Age Cladh Hallan (analysed by this author) provides evidence for its absence in even relatively large assemblages. Its absence from the

Bronze and Iron Age assemblages could in fact reflect a different timing focus for fowling. This highlights the problems of data intercomparability when different categories and degrees of information are recorded, whilst also illustrating the limitations of only using fragmented material. It furthermore emphasises the need to consider what seasonal information may not have been recorded for other assemblages, particularly when this material is considered alongside the wider dataset from the Western and Northern Isles.

Domestic fowl accounted for 16 out of 28 specimens with medullary bone from Norse Bornais Mounds 2 and 2A, and a further 4 fragments were identified as ‘Galliform *cf.* domestic fowl’. However, importantly several wild species were also represented: puffin, waders, and a duck *cf.* red-breasted merganser. This shows resident duck species being targeted at egg laying time from waterside nesting locations. This material reinforces the pattern of waders being captured during the summer, in addition to being a potentially important and valued winter resource. The laying puffin implies that burrow environments were being harvested.

At nearby Cille Pheadair chickens in lay are present, as are breeding females of duck, gannet and herring/lesser black-backed gull. The gannet again demonstrates capture in summer probably around a breeding colony, rather than being caught at sea at another point of the year. The laying gull also suggests that these birds may have been breeding on South Uist in the past, potentially on the machair, and again could have been captured at multiple points of the year. Both of these Norse sites show that a diverse range of avian resources were used in this particular season, but that they were part of a year-round fowling calendar. A singular male domestic fowl was identified at Cille

Pheadair and at Bornais Mound 2 by the tarsometatarsus spur¹⁷, with another possible example from Mound 2A via the presence of a spur scar. This could indicate that male numbers were purposefully kept low, with young males being killed for meat pre spur growth when non-sexable, whilst females were raised for egg laying.

When a site produces both young birds and medullary bone from a species (e.g. Bornais Mound 2 puffin) it could indicate that fowlers were targeting them more than once during the breeding season; from pre-lay to fledging. This evidence could even suggest that the birds were breeding close to the site facilitating easy repeated exploitation. However lay variation times between individuals within a single species must be considered (e.g. resulting from relay potential, late arrival etc.).

4.8 A Taphonomic Picture

The avian assemblages from South Uist exhibit a wide range of taphonomic features. The presence of butchery and burning can inform upon human modification of the birds whilst gnawing and digestion marks can help to reconstruct other processes altering the avian remains following death (alteration by animal agents is explored in Chapter 5).

Butchery and Worked Bone

No burning or butchery was identified on the Early Bronze Age material. In the Middle Bronze age assemblage butchery was present on bones of ‘very large bird’, a curlew/oystercatcher and a great northern diver - the latter demonstrating use of winter resources. The unidentifiable fragment from a ‘very large bird’ was worked into a

¹⁷ (but as mentioned this is not always restricted to males and can occasionally occur in females not all males will have a visible spur).

probable bead, showing that even in small avian assemblages interaction with these resources could extend beyond food (Figure 4.29).



Figure 4.29: Worked bone from Middle Bronze Age Cladh Hallan: probable bead (Photo by the author)

The larger Late Bronze Age assemblage from Cladh Hallan provides more opportunities to examine human processing of the avian resources. Butchery of some description occurred on a high proportion (19%) of the Late Bronze Age material (see Table 4.15). Knife cuts were present on 52 fragments, 24 were worked, and four specimens were worked and had separate knife marks (Table A4.22). This quantity of worked bird bone is unusual when compared to analogous sites; only six other worked specimens are present/recorded on South Uist: one from Iron Age Dun Vulcan, another from Norse Cille Pheadair and four from Norse Bornais Mound 2 (Tables A4.24 to A4.27). The 28 worked bones from Late Bronze Age Cladh Hallan could therefore suggest a degree of resource maximisation or a unique material culture, allowing a further insight into avian-human relationships.

Of the worked bones 22 were awl-like points, mainly made from the wing bones of large birds including gannet, gulls, shag and cormorant (Figure 4.30). These points varied in form, (some thin and sharp, others broader and less pointed) suggesting multiple uses for these similar looking items. Some exhibited use wear polish. Other worked specimens included a complete swan humerus with extensive polish on the shaft. This may have been a prepared shaft which was never completed or used, or an item that obtained its polish during use.

Figure 4.30: Worked gannet ulna point / awl-like implement (top) with close-up of point (bottom). From Late Bronze Age Cladh Hallan (Photo by the author).



The butchery marks show that a wide range of species were being processed for food. Cut marks occur predominantly on seabirds, but also on waders, waterfowl, and landbirds (Table A4.22). Many birds visiting land to breed in the summer months display butchery including the great auk and the gannet, which unsurprisingly was the

most butchered bird (due to its high NISP and large size). Residents such as the cormorant were also being prepared for consumption. Birds were being processed year-round with cuts occurring on the winter visiting great northern diver bones. A butchered crane humerus shows use of rare species, while cuts on puffin and curlew bones demonstrate processing of smaller birds.

Table 4.15: Identifiable and total butchered bones as % of assemblage and NISP

Site	Total Fragments Butchered	Number of Total Identified to species	Additional Possible Butchery	All Butchered as % Assemblage	ID Butchered as % NISP
Cladh Hallan (LBA)	80	59	8	18	19
Cladh Hallan (EIA)	3	3	4	6	7
Cille Pheadair (N)	55	54	13	4	8
Bornais M2 (N)	75	59	12	3	7
Bornais M2A (N)	41	37	7	5	9

The Early Iron Age data from Cladh Hallan contained fewer butchered bones, but cuts still occurred on 6% of the assemblage. Interestingly no worked bones were present, highlighting the unusual nature of the Late Bronze Age assemblage. Great northern diver was again butchered. The butchery marks suggest that birds were processed for a range of products, with knife cuts on the proximal phalanx of the major digit of a crow/rook indicative of feather removal (Serjeantson 2009, 138; Powell pers.comm). This specimen also demonstrates that the corvid bones were anthropogenic in origin. Two possible cuts were identified on a pair of starling wings, implying that some of the small passerines at the site could also be anthropogenic in origin.

Unfortunately only partial evidence is available for most of the Iron Age assemblages, preventing assessment of its overall frequency. Butchery was recorded at Hornish Point and here the only butchered bones were a great auk coracoid and tibiotarsus, showing

preparation of this large bird. At Iron Age Bornais Mound 1 a crane, great auk and cormorant were butchered, but this is a minimum representation (see footnote 6 and Table A4.24). One worked specimen is referred to at Dun Vulcan but for this site, and the A'Cheardach assemblages, butchery information was not available. In the small South Uist Pre-Norse/Pictish dataset there is evidence for butchery on a large grey goose.

Again the larger Norse assemblages from Cille Pheadair and Bornais Mound 2 and 2A provide good resolution. Butchery occurs on between 3 and 4% of the assemblages, and cuts occur on between 7 and 9% of the identifiable bones (Table 4.15). Although lower than the exceptional Cladh Hallan, this value is still high compared with both the mammalian assemblages and the typical butchery frequencies for comparable avian assemblages (around or less than 5%, [Cartledge and Serjeantson 2012]). Butchery occurred most frequently on large birds, but not exclusively. It was present on seabirds, domesticates, waterfowl, landbirds and some waders with both winter and summer visitors showing evidence of processing. Furthermore, Bornais produced a series of butchered white-tailed eagle elements; the Early Norse phases of Mound 2A produced a talon with cuts on the proximal articulation and the Middle Norse assemblage from Mound 2 exhibited cuts on another three elements (talon, humerus, tibiotarsus and coracoid). However, smaller birds were also butchered: at Cille Pheadair wing bones from smaller birds such as the puffin, Manx shearwater and plover displayed cuts, suggesting pre-consumption processing and maybe the removal of wings.

Again there is evidence for small passerine butchery, with one cut small passerine sternum, showing that at least some of the passerines were anthropogenic in origin, and

that the inhabitants of Cille Pheadair were making use of less obvious resources when available. At Cille Pheadair the single worked bone was an awl-like implement similar to those found at Cladh Hallan, fashioned from a proximal shag ulna. The four worked specimens from Bornais Mounds 2 and 2A were shaped and some displayed use-wear, but were too fragmentary for further analysis. They may too have been parts from an awl-like implement.

Cuts occur on the ends and shafts of bones at these sites; showing that butchery was used for disarticulation and meat removal (Coy 1989; Serjeantson 2009: 131-4).

Burnt Bone

Only a very small proportion of the South Uist bird bone was burnt. At Bornais Mound 1 scorching was recorded on 6 bones from the Late Iron Age and one from the Norse period. This is the only site for which any burning evidence was given, excluding those analysed by the author. Late Bronze Age Cladh Hallan produced 7 burnt bones (6 identifiable) making up 2% of the assemblage and NISP respectively. At Cille Pheadair only 11 bird bones were burnt (all identifiable), totalling 1% of the identifiable assemblage. Within Norse Bornais burning occurred on less than 1% of the Mound 2A bones, and on only 1% of the Mound 2 remains (but on 2% of the NISP). This low (but expected and comparable) frequency shows that cooking rarely left marks upon the bones, and also implies that any bones discarded into the fire were entirely destroyed (Cartledge and Serjeantson 2012, 298).

4.9 Meat Weight

Meat weight was calculated for Cille Pheadair and Bornais by MNI using the Smith Proxy outlined in Chapter Three, section 3.3.3. Even when using this broad proxy, not every species' contribution could be calculated. Consequently the values produced are generalised and an absolute minimum. Seabirds are an important dietary contribution in terms of fat and overall calories. At Cille Pheadair the gulls and geese¹⁸ make a sizable contribution (Appendix Table A4.34). Overall the Cille Pheadair birds produced a minimum of 29kg of fat, 22kg of protein and 346484kcal. Taking a modern dietary need of 2000kcal a day as an approximation, the Cille Pheadair birds would have provided a minimum of 173 days of subsistence for an individual. At Bornais Mound 2 and 2A gannet, cormorant, geese and gulls were major dietary contributors (Table A4.35). Overall the Bornais birds produced a minimum of 38kg of protein, 40kg of fat and 514178kcal; an approximate minimum of 257 days of subsistence. Gannet, despite having a comparatively small bone representation, makes a substantial dietary input at both sites, demonstrating the importance of these large seabirds. Shag and cormorant also make a sizable contribution, indicating the value of these resident birds. Although these dietary inputs may seem very small considering the time covered, they are greatly minimised by preservation, recovery and quantification, and consequently demonstrate how much more birds could have provided.

¹⁸ As mentioned in Chapter Three section 3.3.3, the wild geese are considered here by wetland proxy, but this may make them slightly over-represented, whereas the proxy will probably underestimate particularly fat/oily seabirds such as the fulmar or young gannets.

4.10 Discussion – Context and Continuation

The importance of the novel analyses conducted by the author of this thesis is clear. No Bronze Age avian data would have been present on South Uist without these analyses which provided information for the Early, Middle and Late Bronze Age. Without these the only Norse data on South Uist would have been the small Early Norse assemblage from Bornais Mound 1 (NISP 17), and those from Middle and Late Norse Bornais Mound 3 (NISP of 9 and 46 respectively). As such many of the important changes in fowling exhibited in this period would not have been visible, and comparison of this island with other Scottish Island and wider island world data would have been limited at this fascinating and transitional point of the past.

The avian bone material shows human populations making use of the variety of wild avian resources supported by their environmental setting to supplement their domestic mammals and other wild food sources. This is reflected in the species diversity of the assemblages showing the importance of location in fowling choices and species availability.

Data exploration must now be extended to the other Scottish Islands to examine location specific fowling and to broaden our understanding of the wider context in which the South Uist fowling occurred. For example, it has been seen that gannets play a substantial role in several of the South Uist assemblages, particularly Cladh Hallan. However, today there is no suitable habitat on South Uist for cliff nesting seabirds that only come to land to breed, such as the gannet, razorbill and guillemot (Cartledge and Serjeantson 2012, 227; Serjeantson 2001, 44 and 46-48). Despite this gannets were also

prominent at Norse Cille Pheadair, some of the Bornais assemblages, and at Iron Age Dun Vulcan (guillemot, another cliff nester, was also very numerous at the latter) (Cartledge and Grimbley 1999, 283-287). The high proportion of gannets at Cladh Hallan suggests a number of possible scenarios: either that the surrounding environment was different enough to support them, that they bred more widely in the past, that the birds were caught at sea, or that they were captured from breeding colonies beyond the immediate vicinity of Cladh Hallan. Sites with only a few gannet bones could suggest a small population breeding locally, however at sites where gannets are dominant or very numerous, trips may have been made to catch them at breeding colonies further afield. The juvenile gannet at Cladh Hallan does suggest capture at a breeding site, as does the medullary bone bearing female from Cille Pheadair (Best and Mulville 2013, 422-423). As such it can be proposed that the presence of gannet in an assemblage on South Uist is dependent on that particular population engaging in fowling trips that ventured beyond the immediate vicinity of the site. Evidence for fowling beyond South Uist makes comparison with the wider island landscape essential to contextualise this resource use. If these birds were not present on South Uist, where were they being acquired from, and what human activities would this infer?

As previously mentioned avian populations can be very responsive to small changes in the conditions around them. Birds may winter in an area one year but not the next due to e.g. food availability. Or, a generally non-migratory population may move to milder areas during a particularly harsh winter (Stroud *et al.* 2001a, 293). It is therefore vital to conduct broader scale avian analysis to understand this avian movement and the impact such fluidity might have had on fowling populations.

This chapter has highlighted avian introductions and extinctions. Although frequent in the earlier periods, no great auk bones were recovered from the Norse sites on South Uist, showing a decline in the numbers of this vulnerable seabird in this particular location, whose demise must now be traced further afield. The rise in prominence of domestic fowl in the Norse period also needs to be contextualised further to examine its spread and uptake.

4.11 Closing Summary

The importance of being able to compare avian material within its local context and with data from further afield has been made vitally clear by this case study. Although the intentionally restricted area of this case study has allowed for deeper comparative investigation, its extent is limited by location. This particular chapter has only considered one modernly defined island that is situated within a larger island area ('The Uists') which is in turn part of the geologically classified island landscape of the Outer Hebrides. The contents of this chapter will therefore now be contextualised and expanded with wider avian archaeological data for the Scottish Islands temporally and geographically.

CHAPTER FIVE

RESULTS

Crossing Time and Space: Temporal and Geographical

Analysis of the Avian Dataset



5.0 Introduction

This chapter outlines and explores the results of collating and analysing extant and novel data from avian assemblages across the Scottish Isles. This data analysis and initial interpretation will facilitate further discussion within the later discussion and conclusion chapters. Firstly within this chapter the bird remains will be briefly considered as part of the wider faunal assemblages by their specific locations and time periods in order to determine general patterns of bird use and overall role through time and area. Having established the avian resources' contribution to the wider resource base the avian assemblages will then be considered independently.

As with the South Uist case study the birds will first be considered by broad taxonomic groupings by period and place. Following this, avian material will be explored using species groupings by region and period to highlight change, continuity and character. At this point key and rare species will be considered individually to facilitate in-depth understanding of complex patterns of avian resource use through time and location. The seasonal, age, and sex data shall then be considered, to complement and develop the species data, followed by taxonomic investigation of the material. Finally the dietary input of the bird resources is calculated for the small amount of data where this is possible in order to present a more tangible and comprehensive picture of the bird remains as food.

5.1 The Material

In total 206 sites and period subdivisions (i.e. Iron Age Phase, Norse Phase) were collated and brought together (Table 5.1). Of these 82 were from the Outer Hebrides, 18 from the Inner Hebrides, 76 from Orkney and 22 from Shetland. A small number of comparable sites from coastal mainland locations were also considered (8). Not all of these sites produced avian material; some were under analysis with full data currently unavailable and at others the avian bone information was recorded in such a way that no or very little data could be extracted (See Appendix Table A5.1). Other sites produced small assemblages, but within which there were no identifiable bones. For instance, at Viking/Early Norse Rosinish on Benbecula in the Outer Hebrides only four bird bones were produced, of which none were identifiable. However even in cases such as these which have no species data the null NISP can be used in the class comparison. Even the non-productive sites remained valuable for assessing the impact of bone survival and recovery.

Usable, identified-to-species avian remains were reported upon/available from 156 sites, and these form the main focus of this chapter. The favourable preservation conditions created by the machair on the Inner and Outer Hebrides have clearly benefited the bone survival and recovery of bone from the archaeological sites in these locations, and as such they produce some of the largest avian assemblages (see Appendix Table A5.1). The same good preservation conditions of alkaline shell sand can also be anthropogenically created or accentuated (Bartosiewicz 2012, 49), for example in midden situations the mass accumulation of marine shells (largely limpets) can effectively buffer the acidity of the soil and reduce osseous degradation within this

preservative pocket (Bonsall et al 1994 90-103; Russell 1992, 34). Such conditions have provided some of the earliest remains in the Scottish Islands on Oronsay and Skye (as discussed in Chapter Two), and for recently excavated Mesolithic West Voe on Shetland (Melton and Nicholson 2007, 94-100). Although material from the newly discovered Mesolithic sites such as West Voe (Shetland), Northton (Harris), Bagh an Teampuill (Harris) and Traigh na Beirgh (Lewis) is under analysis and not incorporated fully into this work, the Inner Hebridean and mainland sites considered here present an exciting insight into what can be hypothesised for these early prehistoric sites (Church *et al.* 2011; Church *et al.* 2011a; Gregory *et al.* 2005, 944-950).

5.2 Interclass Comparisons: The Wider Faunal Assemblage

This section presents birds alongside the mammalian and fish data. Despite the many quantification issues facing interclass comparisons, examining the bone material remains valuable for investigating resource use. However shellfish with their bivalve or gastropod status are hard to compare by NISP with any notion of dietary significance remaining visible. Therefore they are not discussed in this chapter but this material is included in Table A5.1, and will be briefly mentioned in Chapter Six alongside the Faroese and Icelandic material which frequently incorporates shellfish data¹⁹. As has already been seen in Chapter Four, birds in general make up a small proportion of the wider faunal assemblage, although in island and coastal settings their use is often heightened. This largely holds true for the majority of sites in the Northern and Western Isles. However, there are some period and site specific variations from this norm, which are explored in this section.

¹⁹ For more information on the shellfish contingent of the Scottish Island faunal economy see Jennifer Jones and Matthew Law's forthcoming PhDs.

Table 5.1: Sites shown by island, period and bird, mammal and fish bone analyst (See Appendix Table A5.1 for class NISPs).

SITE NAME	ISLAND	ISLAND GROUP	Bird	Mammal	Fish
Dunan Ruadh (M/LIA)	Pabbay	OH	Cartledge 2000	Mulville and Ingrem 2000;	Mulville and Ingrem 2000a
Sheader (IA)	Sandray	OH			
Mingulay (IA)	Mingulay	OH			
Rosinish (Beak)	Benbecula	OH	Serjeantson 1984		
Rosinish (MIA)	Benbecula	OH			
Rosinish (Vik/N)	Benbecula	OH			
Rough Island 41B (LIA)	Shiant Isles	OH	Julia Best (Best and Mulville 2010)	Madgwick and Mulville 2005	
Rough Island 41B (N/EMed)	Shiant Isles	OH			
Rough Island Sheiling 41B (PMed)	Shiant Isles	OH			
Quoygrew (Med/PMed)	Westray	OR	Harland 2006 (ID by Briscoe and O'Connor); Harland <i>et al.</i> 2012	Harland 2006; Harland 2012	Harland 2006; Harland and Barret 2012
Sollas wheelhouse A (IA)	North Uist	OH	Finlay 1984 and 1991		
Sollas wheel house B Midden (IA)	North Uist	OH			
Sollas wheel house B (IA)	North Uist	OH			
Sollas Post-Wheelhouse B Refill (LIA)	North Uist	OH			
Udal (Neo)	North Uist	OH	Finlay 1984		
Udal (Beak)	North Uist	OH			
Udal (EBA)	North Uist	OH			
Udal (LBA)	North Uist	OH			
Udal (EIA)	North Uist	OH			
Udal (MIA)	North Uist	OH			
Udal XI XIII (M/LIA)	North Uist	OH			
Udal Ixc X (Vik)	North Uist	OH			
Udal VII IX (N)	North Uist	OH	Serjeantson n.d.		
Udal II VI (LMed/PMed)	North Uist	OH			
Dun Bharabhat Cnip (E/MIA)	Lewis	OH	Harding and Dixon 2001		
Bostadh (LIA)	Lewis	OH	O'Sullivan 1997; Thoms 2003	Thoms 2003	
Bostadh (N)	Lewis	OH	Thoms 2003		
Beirgh (M/LIA)	Lewis	OH	Thoms 2003		
Cnip (MIA)	Lewis	OH	Hamilton-Dyer 2006	McCormick 2006	Cerón-Carrasco 2006
An Corran (Mes)	Skye	IH	Bartosiewicz 2012		
Knap of Howar (Neo)	Papa Westray	OR	Bramwell 1983	Noddle 1983	Wheeler 1983
Cnoc Coig (Mes)	Oronsay	IH	Nolan 1987; Grigson pers. comm.	Nolan 1987; Mellars 1987	

Caisteal nan Gillean (Mes)	Oronsay	IH	Grieve 1885; Grieve 1883	Mellars 1987	
Cnoc Sligeach (Mes)	Oronsay	IH	Bishop 1913; Mellars 1987	Mellars 1987	
Priory Midden (Mes)	Oronsay	IH	Mellars 1987		
North of Reilig Odhrain (LIA)	Iona	IH	Barber 1981 (ID by Maliepaard)	McCormick 1981	
Iona Abby / Monastery (EMed)	Iona	IH	Bramwell 1981	Noddle 1981	Wheeler 1981
Bay of Moaness (BA)	Rousay	OR	Mainland 2005		
Ardnave (BA)	Islay	IH	Bramwell 1983a; Harman 1983	Harman 1983	
Dun Cul Bhuirg (MIA)	Iona	IH	Bramwell 1981	Noddle 1981a	
Machrins (LIA)	Colonsay	IH	Harman 1981		
Dun Mor Vaul (EIA)	Tiree	IH			
Dun Mor Vaul (MIA)	Tiree	IH	Bramwell 1974	Noddle 1974	
Dun Mor Vaul (IA/Later)	Tiree	IH			
Jarlshof Tr 1 (LN/EBA)	Mainland	SH	Nicholson 2005; Dockrill and Bond 2009	Dockrill and Bond 2009	Nicholson 2005; Dockrill and Bond 2009
Kilellan Farm (EBA)	Islay	IH	Serjeantson <i>et al.</i> 2005		
Kilellan Farm (MIA)	Islay	IH			
King's cave (Mes/Med)	Jura	IH	Brothwell <i>et al.</i> 1981; Cowles 1978	Jewell <i>et al.</i> 1978	
Dun Ardtreck (M/LIA)	Skye	IH		Noddle 2000	
Scatness (IA)	Mainland	SH	O'Sullivan <i>et al.</i> 1995		
East Shore Broch (MIA)	Mainland	SH	Carter <i>et al.</i> 1995		
Site 22 Sands of Breckon (EIA)	Yell	SH	Halpin 1996		
Scalloway Castle (LMed/PMed)	Mainland	SH	Smith and Hodgson 1983		
Scord of Brouster (LNeo)	Mainland	SH	Noddle 1986		
Scalloway (MIA)	Mainland	SH	O'Sullivan 1998a	O'Sullivan 1998	Cerón-Carrasco 1998
Point of Cott (Neo)	Westray	OR	Harman 1997a	Halpin 1997	Coy and Hamilton-Dyer 1997
Quanterness cairn (Neo)	Mainland	OR	Bramwell 1979	Clutton-Brock 1979	Wheeler 1979
Pierowall Quarry Cain (LNeo)	Westray	OR			
Pierowall Quarry Platform/Structure (LNeo)	Westray	OR	Clarke 1984	McCormick 1984	Swinney 1984
Pierowall Quarry (EIA)	Westray	OR			
Howe (Neo)	Mainland	OR			
Howe (EIA, MIA and LIA)	Mainland	OR	Bramwell 1994	Smith 1994	Locker 1994
Howe (M/LIA)	Mainland	OR			
Howe (IA/PMed)	Mainland	OR			
Kirkwall Mounthoolie lane (LMed/PMed)	Mainland	OR			
Kirkwall 57 Albert street (LMed)	Mainland	OR	Hodgson and Jones 1982		
Kirkwall Gunn's Close (LMed)	Mainland	OR			
Point of Buckquoy (LNeo/EBA)	Mainland	OR	Rackham and Nicholson 1989		

Point of Buckquoy (Area 6) (EBA)	Mainland	OR	Rackham <i>et al.</i> 1989a		
Point of Buckquoy (Cuttings 5 and 6) (MBA)	Mainland	OR	Rackham <i>et al.</i> 1989b		
Buckquoy (PN/Pict)	Mainland	OR	Bramwell 1976	Noddle 1976	Wheeler 1976
Buckquoy (E/MN)	Mainland	OR			
Brough Road (areas 1, 2 and 3) (LIA/N)	Mainland	OR	Allison 1989; Rackham <i>et al.</i> 1989		
Brough of Deerness (LN/EMed)	Mainland	OR	Rackham 1986		
Isbister (Neo)	South Ronaldsay	OR	Bramwell 1983b; Jones 1998; Pitts 2006	Barker 1983	Colley 1983
Isbister (BA)	South Ronaldsay	OR			
Links of Noltland (Neo)	Westray	OR	Armour-Chelu 1985	Armour-Chelu 1992	
Warebeth Broch (MIA)	Mainland	OR	Sellar 1989		
Room 5 Clifftop Brough of Birsay (PN/Pict)	Brough of Birsay	OR	Sellar 1982		
Room 5 Clifftop Brough of Birsay (N)	Brough of Birsay	OR			
Earl's Palace (LMed)	Mainland	OR	Paterson 1998		
Crosskirk Broch (IA)	Mainland	Mainland	Clarke and Howdle 1984	Macartney 1984	
Newark Bay (N)	Mainland	OR	Harland 2001; Harland 2006		
Newark Bay (LM)	Mainland	OR			
Tofts Ness 1 & 2 (Neo)	Sanday	OR			
Tofts Ness 3 (EBA)	Sanday	OR	Serjeantson 2007a	Nicholson and Davies 2007	Nicholson 2007a
Tofts Ness 4 (LBA)	Sanday	OR			
Tofts Ness Phases 5 & 6 (IA)	Sanday	OR			
Tuquoy (N)	Westray	OR	Hamilton-Dyer 1991		
Tuquoy (LN/Med/PMed)	Westray	OR			
Ceardach Ruadh Baile Sear (M/LIA)	Baile Sear	OH	Serjeantson 2003	Halstead 2003	Jones 2003
Sloc Sabhaid Baile Sear (MIA)	Baile Sear	OH	Julia Best Unpublished	Freke 2010	
Barnhouse (Neo)	Orkney Mainland	OR	Richards 2005		
Buckquoy (EN)	Mainland	OR	Bramwell 1976	Noddle 1976	Wheeler 1976
Foshigarry (M/LIA)	North Uist	OH	Hallén 1994		
Bac Mhic Connain (IA)	North Uist	OH			
Skara Brae (Neo)	Mainland	OR	Eastham and ap Gwynn 1997	Noddle In Mulville 2010	
Pool (Neo)	Sanday	OR			
Pool (IA)	Sanday	OR			
Pool (LIA)	Sanday	OR	Serjeantson 2007	Bond 2007	Nicholson 2007
Pool (LIA/Vik)	Sanday	OR			
Pool (N)	Sanday	OR			
Saevar Howe (EN)	Mainland	OR	Rowley-Conwy 1983		
Earl's Bu (LN)	Mainland	OR	Mainland 1995		
Sand (Mes)	Inner Sound	IH	Parks and Barrett 2009		

Gurness (IA)	Mainland	OR		Bramwell 1987a	
Eilean Domnhuill Loch Olabhat (Neo)	North Uist	OH		Hallén n.d.	
Bruach a Tuath (MIA)	Benbecula	OH		Finlay 1984	
Skaill Deerness (IA)	Mainland	OR			
Skaill Deerness (Vik)	Mainland	OR	Allison 1997	Noddle 1997	Nicholson 1997
Skaill Deerness (Med)	Mainland	OR			
Skaill Deerness (LBA)	Mainland	OR		Noddle 1997	
Quoygrew Farm Midden ii (EN)	Westray	OR			
Quoygrew Farm Midden iii (M/LN)	Westray	OR	Harland 2006 (ID's by Briscoe and O'Connor);	Harland 2006; Harland 2012	Harland 2006; Harland and
Quoygrew Fish Midden 2 (M/LN)	Westray	OR	Harland <i>et al.</i> 2012		Barrett 2012
The Biggings (EN)	Papa Stour	SH		Crawford and Ballin-Smith	1999
Milla Skerra Sandwick (IA)	Unst	SH		Smith 2008	
Northton (LNeo)	Harris	OH			
Northton (Beak)	Harris	OH			
Northton (Beak)	Harris	OH	Julia Best	Finlay 1984	
Northton (IA)	Harris	OH			
Northton (IA)	Harris	OH			
Carding Mill Bay I (ENeo)	Mainland	Mainland		Hamilton-Dyer and	McCormick 1993
Carding Mill Bay II (Mes/Neo)	Mainland	Mainland		Bartosiewicz <i>et al.</i> 2010	
Bu (EIA)	Mainland	OR		Bramwell 1987	Noddle 1987
Scalloway (LIA)	Mainland	SH		O'Sullivan 1998a	O'Sullivan 1998
Scalloway (IA)	Mainland	SH		O'Sullivan 1998a	O'Sullivan 1998
Jarlshof (LBA/EIA)	Mainland	SH			
Jarlshof (M/LIA)	Mainland	SH		Platt 1933a; Platt 1934a;	Platt 1956
Jarlshof (N)	Mainland	SH			
Holm of Papa Westray (Neo)	Holm of Papa	OR		Harman 2009; Ritchie 2009	
Broch of Ayre (MIA)	Mainland	OR		Graeme 1914	
Midhowe Broch (MIA)	Rousay	OR		Platt 1933	
Midhowe Cairn (Neo)	Rousay	OR		Platt 1934	
Mine Howe (IA)	Mainland	OR		Mainland and Ewens 2005	
West Voe (Mes)	Mainland	SH		Melton and Nicholson 2004;	Melton and Nicholson 2007
Old Scatness (IA)	Mainland	SH			Bond <i>et al.</i> 2005.
Old Scatness (PN/Pict)	Mainland	SH			
Old Scatness (Vik/EN)	Mainland	SH	Nicholson 2010	Cussans and Bond 2010	Nicholson 2010a
Old Scatness (LN)	Mainland	SH			
Saevar Howe (LIA/PN/Pict)	Mainland	OR		Rowley-Conwy 1983	
Sandwick North (E/MN)	Unst	Shetland			

Sandwick North (M/LN)	Unst	Shetland	Barrett and Oltmann; Harland 2006		
Sandwick North (LN)	Unst	Shetland			
Robert's Haven (E/ELN)	Mainland	Mainland	Harland 2006 from Parks pers.comm.		
Robert's Haven (LN/Med)	Mainland	Mainland			
St Boniface's Church (IA)	Papa Westray	OR	Hamilton-Dyer 1998	McCormick 1998	
St Magnus' Kirk Birsay (N)	Mainland	OR	Rackham <i>et al.</i> 1996		
Beachview Burnside (LE/LN)	Mainland	OR	Rackham <i>et al.</i> 1996a		
Beachview Studio Site (E/LN)	Mainland	OR	Rackham <i>et al.</i> 1996b		
Brough Road Cairn Area 1 (IA/PN/Pict)	Mainland	OR	Rackham <i>et al.</i> 1989		
St Kilda Black House G (PMed)	Hirta St Kilda	OH			
St Kilda Black House 8 (PMed)	Hirta St Kilda	OH	Harman 1996		
St Kilda Black House 6 (PMed)	Hirta St Kilda	OH			
St Kilda Black House 8 (Med)	Hirta St Kilda	OH			
Knowe of Yarso (Neo)	Rousay	OR	Platt 1935		
Blackhammer (Neo)	Rousay	OR	Platt 1937		
Calf of Eday (IA)	Calf of Eday	OR	Platt 1937a		
Knowe of Ramsay (Neo)	Rousay	OR	Platt 1936		
Freswick Links (LIA/Med)	Mainland	Mainland	Allison 1995	Gidney 1995	Jones 1995
Freswick Links (LIA/Vik)	Mainland	Mainland			
Freswick Links (N)	Mainland	Mainland			
Cladh Hallan (BA/IA)	South Uist	OH	Best and Mulville 2013; Best and Powell Prep	Mulville In Prep	Ingrem In Prep
Bornais Mound 1 (LIA/Norse)	South Uist	OH	Cartledge and Serjeantson 2012	Mulville and Powell 2012	Ingrem 2012
Bornais Mound 2 and Mound 2A (N)	South Uist	OH	Best In Prep.	Mulville and Powell In Prep.	Ingrem In Prep(a)
Bornais Mound 3 (N)	South Uist	OH	Cartledge 2005	Mulville 2005	Ingrem 2005
Cille Pheadair (N)	South Uist	OH	Best and Cartledge In Press	Mulville In Press	Ingrem In Press
Dun Vulcan (IA)	South Uist	OH	Cartledge and Grimby 1999	Mulville 1999	Cerón-Carrasco and Pearson
A' Cheardach Mhor and Bheag (IA)	South Uist	OH	Finlay 1984		
Hornish Point	South Uist	OH	Serjeantson 2003	Halstead 2003	Jones 2002
Cill Donnain	South Uist	OH	ul Haq & Ingrem		Unpublished data
Askernish	South Uist	OH	Best Unpublished	Mulville and Madgwick	2012b
Frobost and Sligeanach	South Uist	OH	Best Unpublished	Mulville and Madgwick	2012 and 2012a
HI15 A Blackhouse (IA)	Shiant Isles	OH			
HI15 A Blackhouse (Med/PMed)	Shiant Isles	OH			
HI15 C Winnowing Barn (PMed)	Shiant Isles	OH	Assessment Madgwick and		Mulville 2005
HI15 E and F Enclosure (PMed)	Shiant Isles	OH			
HI15 G External Area (IA)	Shiant Isles	OH			
HI15B Midden (PMed)	Shiant Isles	OH	Julia Best (Best and Mulville 2010)		

Mammals and Birds

When the avian bones are considered as a proportion of the combined mammalian and avian remains it is clear that avian use varies by period and location. As discussed in Chapter Four birds in Britain and Scotland typically constitute between 2-5% of the combined mammal and avian NISP, and although many of the South Uist avian remains form between 1-5% of the NISP, several exhibited higher than average bird use. This higher use of birds continues to be represented in the wider Scottish Island assemblages which have an overall average of 13% based on 154 Hebridean and Northern Isles assemblages, which had both mammalian and avian data. This comparatively high proportion of birds is partially a reflection of unusual avian-dominated sites, including tombs such as Neolithic Isbister (Orkney), hunter-gatherer sites such as Mesolithic Sand (Inner Sound/Inner Hebrides²⁰) and historically documented fowling community locations such as Iron Age to Post-Medieval sites on St Kilda and the Shiant Isles. Sites with high bird use occur across the Scottish Islands and as such the average birds as a proportion of the avian/mammalian NISP was high for each separate island group (Table 5.2). The 'low' value of Shetland appears to be in part a reflection of the small number of bone assemblages preserved/available and also the degradation of bird bones in its acidic soil compared to mammals (Davidson and Carter 2003, 53-61; Dry and Robertson 1982). This demonstrates that whilst in many sites birds formed only a small part of the faunal remains, in some settings they were exceedingly prominent and also

²⁰ In this thesis the site of Sand has been placed with the Inner Hebridean data. Today the site is located in the Applecross region of the Inner Sound, and would technically be a mainland coastal site. However, the Inner Sound presents an extremely complex picture of relative sea level change, with the potential of submerged sites along the Applecross coastline (Wickham-Jones and Dawson 2006, 43-44). Its place within this landscape and its relation to other areas of the Inner Hebridean landscape is thus unknown, for example its relationship to the nearby Eilean Mòr which is considered an Inner Hebridean island. The very small Mesolithic dataset (within which only An Corran and Cnoc Coig are recently analysed assemblages), also makes Sand's inclusion valuable. See: Ballantyne and Dawson 2003; Cressey *et al.* 2010; Dawson 2009; Selby and Smith 2006; Smith *et al.* 2011; Wickham-Jones and Dawson 2006.

reveals that this prominence arose from a diverse range of stimuli including subsistence to ritual burial.

Table 5.2: Average proportion of birds as % of the avian/mammal NISP by Island

	Number of Sites	Average %
Inner Hebrides	16	14
Outer Hebrides	67	13
Orkney	56	15
Shetland	14	8

When examined by period it can be seen that the Mesolithic and Medieval/Post-Medieval assemblages have a large avian constituent, both as a whole and at multiple individual sites (Table 5.3 and Figures 5.1 and 5.2). For the latter (and particularly in the Outer Hebrides) sites from St Kilda and the Shiant Isles display strong individual avian use (Figure 5.3) (Best and Mulville 2010).

Table 5.3: Average proportion of birds as % of the avian/mammal NISP, by island group and phase. N/P = None Present.

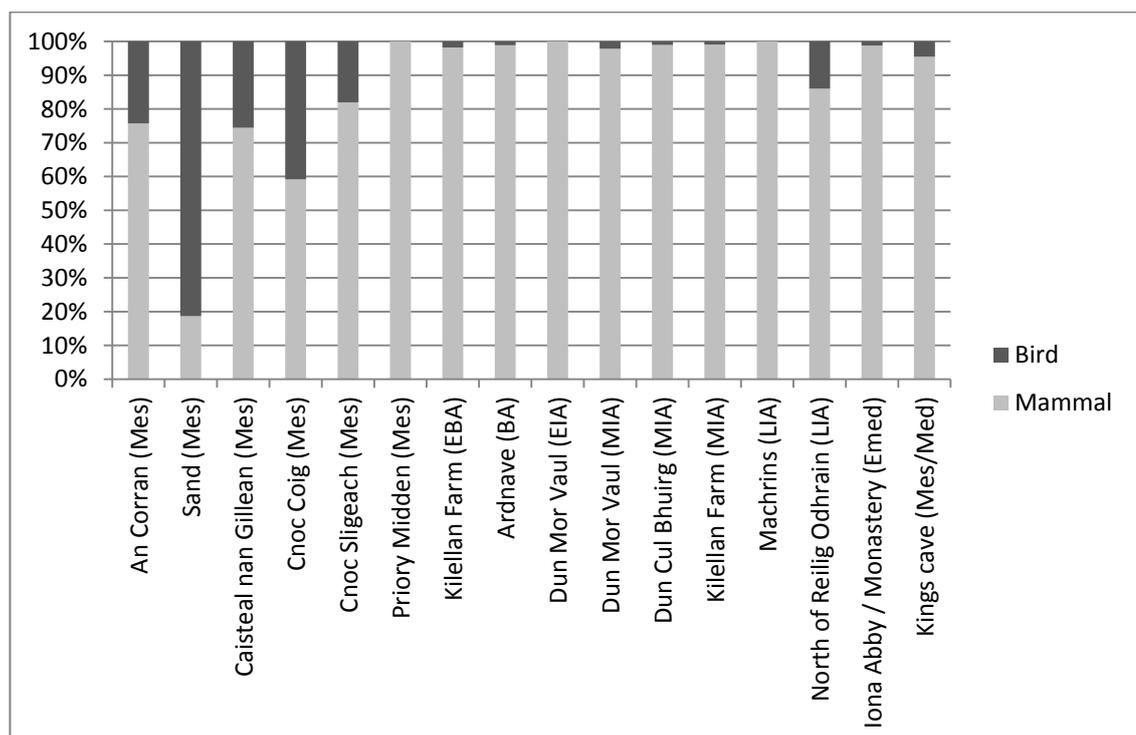
	All Islands		Inner Hebrides		Outer Hebrides		Orkney		Shetland	
	No.	%	No.	%	No.	%	No.	%	No.	%
Mesolithic	6	33	6	32	N/P	N/P	N/P	N/P	N/P	N/P
Neolithic	14	7	N/P	N/P	2	2	11	9	1	0
Bronze Age	18	11	2	1	9	4	7	24	N/P	N/P
Iron Age	54	8	6	3	30	6	14	13	4	8
Pre-Norse/Pictish	4	4	N/P	N/P	1	3	2	4	1	5
Norse	36	12	N/P	N/P	17	11	13	13	6	11
Med / Post-Med	15	38	1	1	8	56	5	25	1	3

Mesolithic: Hebrides and Northern Isles

The Mesolithic has an extremely high proportion of avian remains which frequently make up between twenty to eighty percent of the combined avian/mammal bones. This is particularly visible in the Inner Hebrides, which has the largest number of Mesolithic sites excavated, where all but one site displays this pattern. The exception is the small assemblage from Priory Midden on Oronsay which is not fully reported on and for

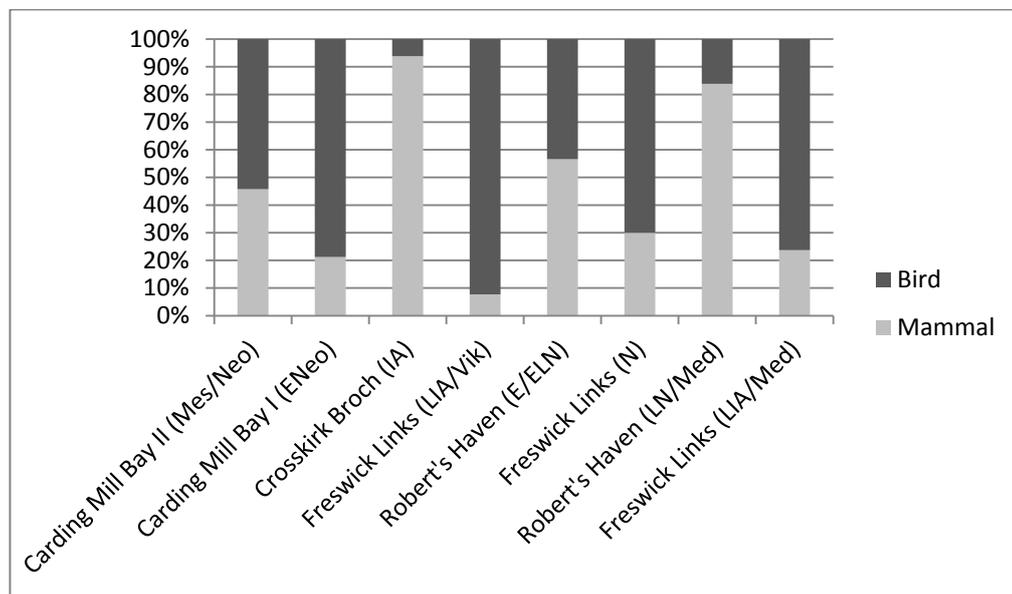
which only produced a mammalian NISP of 17 (See Appendix Table A5.1). Unfortunately the full dataset is not yet available for the only non-Hebridean Mesolithic site of West Voe (Shetland), but seabirds appear to be very numerous (shag in particular) as do seals which together make up nearly 100% of the faunal assemblage (see Melton and Nicholson 2007, 94-100). This would suggest that the Shetland Mesolithic avian resource use broadly follows the form of avian resource use documented in the Inner Hebrides, being large in scale compared to mammals and exhibiting a seabird focus. Prior to domestic livestock introduction in the Neolithic the mammalian resources in these locations were exceedingly limited, necessitating greater reliance upon sea mammals, fish and birds. However it is important to recognise that all of the Mesolithic assemblages are from shell middens; as such this similar site type may be the reason for the similar faunal profile identified here, whilst other Mesolithic sites could present a different picture. Unfortunately, without more data collection and analysis this cannot be resolved at present.

Figure 5.1: Birds as a percentage of the avian and mammal NISP – Inner Hebrides



The high use of birds exhibited in the Scottish Island Mesolithic assemblages is also visible at the comparable mainland site of Carding Mill Bay at Oban (Figure 5.2). At this shell midden site birds again form over half of the combined avian/mammalian NISP, and this use continues into the Early Neolithic period where birds form nearly 80%. However, unlike the Scottish Island examples these small mainland assemblages contain a number of small passerines which may be intrusive.

Figure 5.2: Birds as % avian and mammal NISP Comparable Mainland Sites



Hebrides Neolithic and Bronze Age

The Neolithic in the Hebrides is represented by very few assemblages with a small avian presence whilst in the Beaker and Bronze Age the birds typically form between 1 and 5% of the NISP, but reach between 5 and 10% at a quarter of the sites.

Hebrides Iron Age

Similar to the pattern seen on South Uist (Chapter Four) birds form a low proportion of the combined avian/ mammalian remains in many of the individual Iron Age assemblages in the rest of the Inner and Outer Hebrides. Within the Iron Age Hebridean

data there are a few notable exceptions where birds form over 5% of the avian/mammalian NISP, including Dun Vulcan and Bornais Mound 1. These also include an Iron Age roundhouse deposit from the isolated Shiant Isles (where birds constitute a staggering 90% of the combined NISP), and also sites on the southerly Barra Islands of Pabbay and Mingulay (13 and 18% respectively). Mingulay and the Shiants in particular hold (and have held) large colonies of breeding seabirds (Buxton 1995, 14; Stroud *et al.* 2001a). The only other Iron Age site with a high proportion of birds is Sollas on North Uist (highlighted by stripes on Figure 5.3). In this particular phase of the site only partial quantification was given for the mammalian bones since it comprised at least 88 individuals, mainly from animal burials (Finlay 1984, 58-77). As such, whilst incomplete data would normally be excluded graphically, it is retained here for comparison with the other phases of this site when bearing this in consideration. The bird remains contain at least 15 individuals (and species) which form around a sixth of the total individual animals, allowing them to be compared to the limited mammalian material and making their inclusion worthwhile.

Hebrides Norse Period

Within the Outer Hebrides as a whole there is a statistically significant increase of birds as a proportion of the combined mammalian and avian assemblage in the Norse Period, compared to the Iron Age (p-value is 0.0072. The result is significant at 95% confidence, see Test 5.1). This trend, identified on South Uist, is also present on other sites such as the Udal on North Uist, and within the Northern Isles. Unfortunately there was no Norse material available from the Inner Hebrides for wider consideration of this trend.

Figure 5.3: Birds as a percentage of the avian and mammal NISP – Outer Hebrides

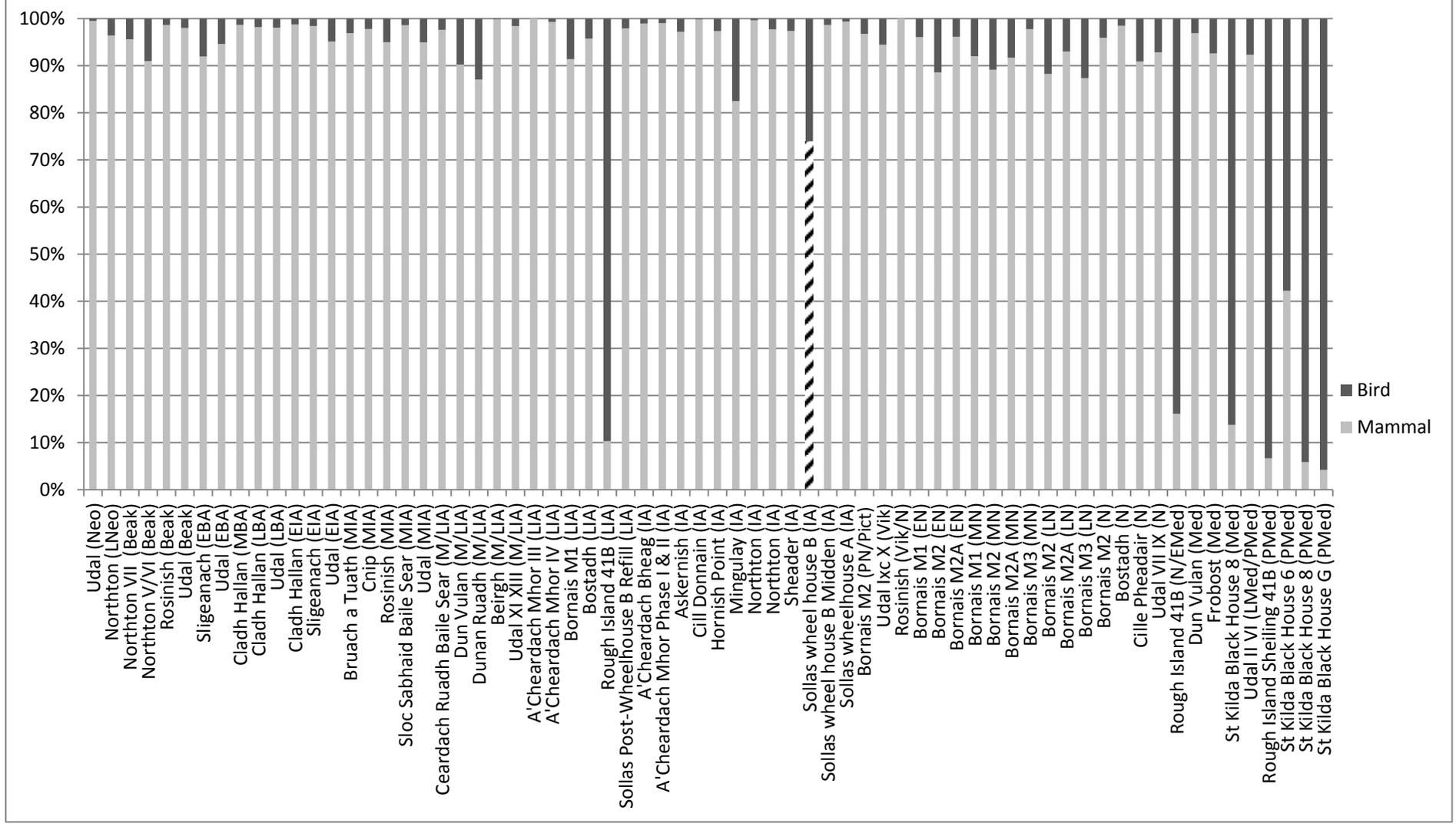
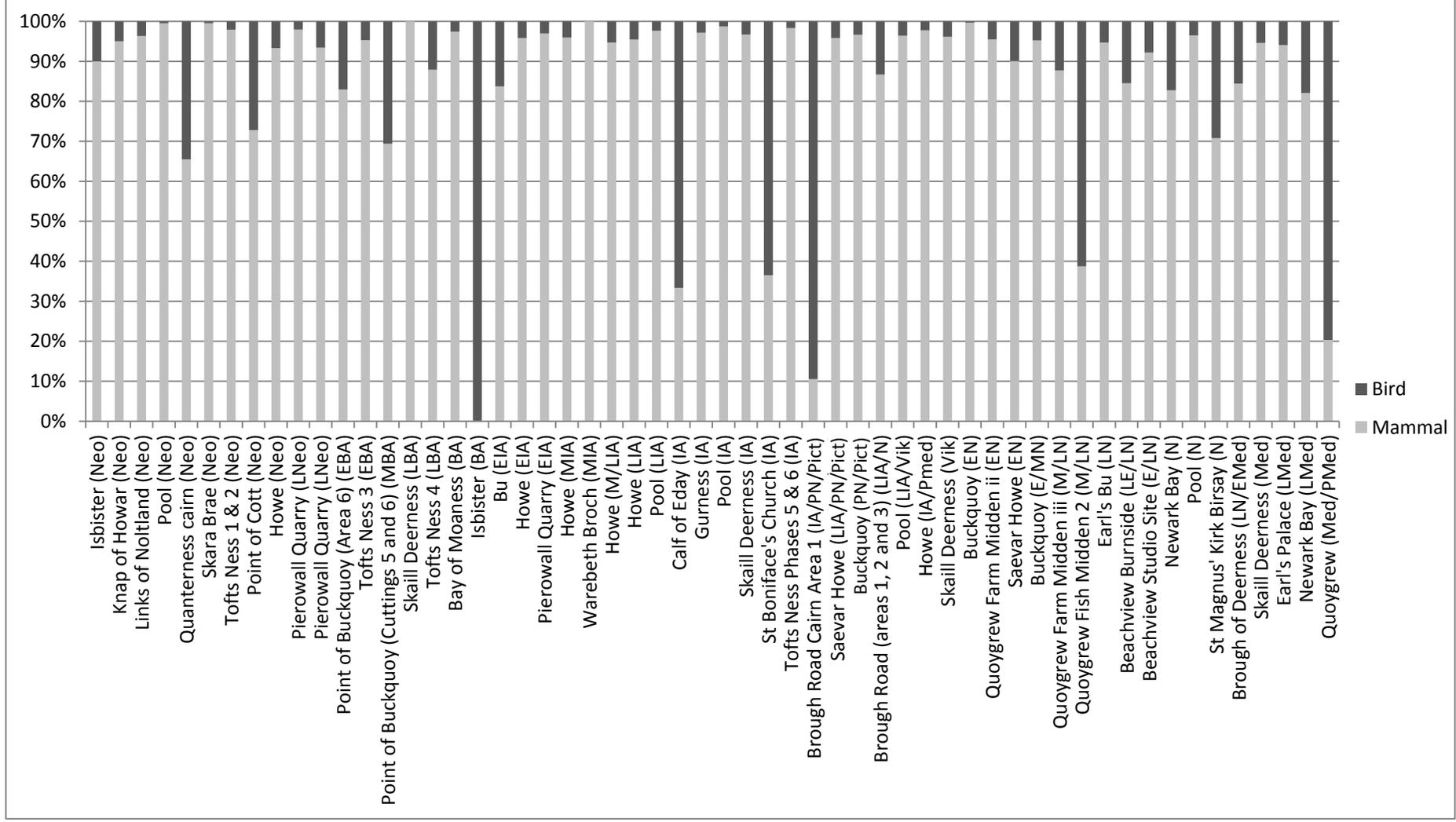


Figure 5.4: Birds as a percentage of the avian and mammal NISP – Orkney



Northern Isles

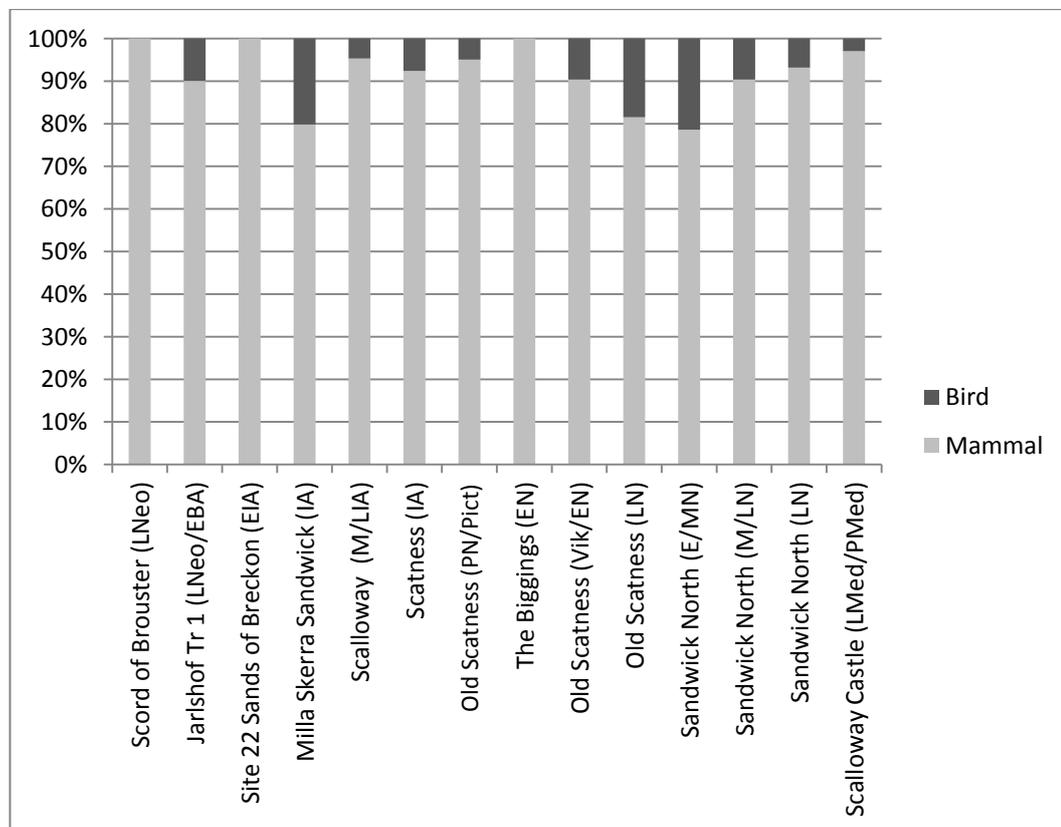
The Northern Isles present a slightly different overall picture. Orkney in particular shows a higher but frequently inconsistent use of the bird remains. The Neolithic and Bronze Age on Orkney are interesting in the duality of their profiles. Whilst at many sites birds form only a small proportion of the faunal assemblage, within tomb structures such as Quanterness, Point of Cott and Isbister a concentrated and different use of avian resources can be seen, with them forming around thirty percent of the combined NISP. In addition to the data shown in Figure 5.4, the avian material is currently under analysis but unavailable for the Holm of Papa Westray, where again birds were recovered and well preserved. In addition at the Midhowe Cairn (Platt 1934, 348-350) (which has no full quantification), birds are purported to be “both varied and more numerous than either sheep or pig”. These prehistoric sites indicate that the manner of bird use was varied and flexible, with some contexts favouring increased avian input, perhaps for ritual and not just dietary significance (this is explored further via species below).

The Norse period on Orkney, as in the Western Isles, again exhibited a more consistently high level of avian use; however the dominance of birds in some of the individual Iron Age assemblages masks this general increase. For example, at the Calf of Eday birds form nearly two thirds of the combined NISP and are a very important faunal resource at this site (Platt 1937a, 153-154). Thus the increase in overall use in the Norse period falls just short of statistical significance (p value is 0.05227 at 95% confidence see Test 5.2). However Figure 5.4 shows that a much larger proportion of the Norse sites have birds forming over 5% of the combined mammalian and avian remains than is the case in the Iron Age. Within the Norse data Quoygrew exhibits

exceptionally high avian use in the Fish mound (over 60% of the combined mammalian/avian NISP), but only between 5 and 12% of the Farm Mound indicating differential resource processing and deposition.

Within the few Shetland sites birds form a lower overall average of the combined NISP (Figure 5.5) but constitute a fifth of the remains at three sites, demonstrating a small but relatively consistent use of the avian resources. The three sites without bird bone had very small mammalian bone assemblages and do not appear to have favoured bird preservation, with overall poor bone condition (see Appendix Table A5.1). The Scord of Brouster, for example, had very acidic soil conditions, detrimental to bone survival (Noddle 1986, 132).

Figure 5.5: Birds as a percentage of the avian and mammal NISP - Shetland



Mammals, Fish and Birds

As seen in Chapter Four seabirds and other marine resources play an important role in the avian and overall economy of the Scottish Islands. When the fish remains from the Scottish Islands are also considered it can be seen that birds continue to form a small but larger than average proportion of the faunal assemblage in a range of sites and periods. As mentioned in Chapter Four, birds typically form between 2-5% of the combined mammal and avian assemblages from Britain/Scotland (Cartledge and Serjeantson 2012, 342). However in the Scottish Island sites considered here (those where all three classes had data available), birds form over 5% of the combined mammalian, avian *and* fish NISP at a third of the sites, and over 20% at a sixth of them (Table 5.4). This demonstrates that in these locations birds can have a sizable role at particular sites.

Table 5.4: Number of sites per range (birds as % of mammal/fish/avian NISP)

Range	Frequency
Below 5%	87
5-10 %	20
Above 10 %	20

Figure 5.6 illustrates that birds continue to form a substantial part of this wider faunal assemblage at the Inner Hebridean Mesolithic sites. However, it is also clear that fish are very dominant in these locations. As such the avian representation (whilst important) is heightened in the mammalian/avian comparison due to the lack of mammalian taxa. Birds, fish and sea mammals therefore were important in Mesolithic subsistence (Richards and Mellars 1998, 178-184). This is also visible at the comparable mainland site of Carding Mill Bay where fish form 70-80% of the NISP (Figure 5.7). The small number of sites from the Inner Hebrides also indicate that from the Bronze Age fish were not excessively exploited in this location and domestic mammals were the key subsistence product.

In the majority of periods and sites fish overall display a higher NISP than birds (Figures 5.6-5.10). However in the Neolithic, particularly in the Northern Isles, birds frequently display higher usage than fish (Figure 5.9). Both birds and fish made a small contribution in the single Neolithic assemblage from the Outer Hebrides with all three classes present (Udal) (Figure 5.8). This reflects a partial move away from fish use in the Neolithic (Schulting and Richards 2002, 147-189; Richards and Hedges 1999, 893-896). Both bird and fish use are varied in the Bronze Age and Iron Age in both island groups, with birds forming a greater proportion of the remains than fish at some sites, and vice versa at others (Figures 5.6-5.10). In all of the island groups fish can be seen to increase in the Norse period, often forming a large proportion of the overall NISP. This corresponds with the increased avian resource use previously identified, illustrating that the Norse populations were making use of a diverse resource base for subsistence and trade which incorporated fish and birds and relied less exclusively on mammalian taxa. An increase in the trade of fish in the Norse period is one contributing factor in their rise (Barrett 1997, 616-635; Barrett *et al.* 2001, 145- 154)

Figure 5.6: Birds as % of combined Avian, Mammal and Fish NISP – Inner Hebrides

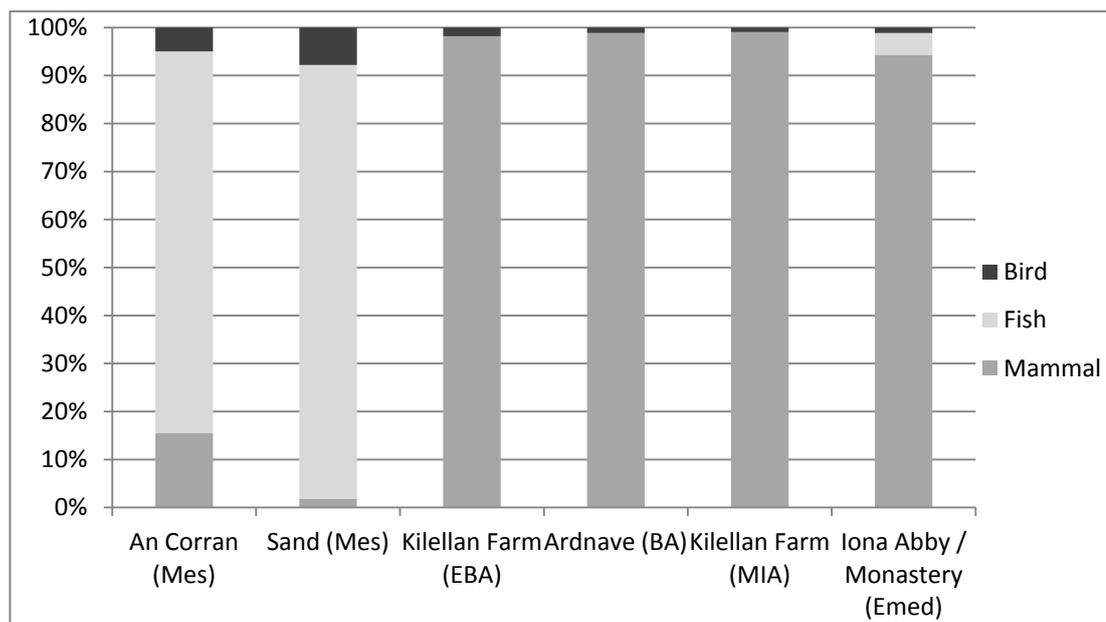
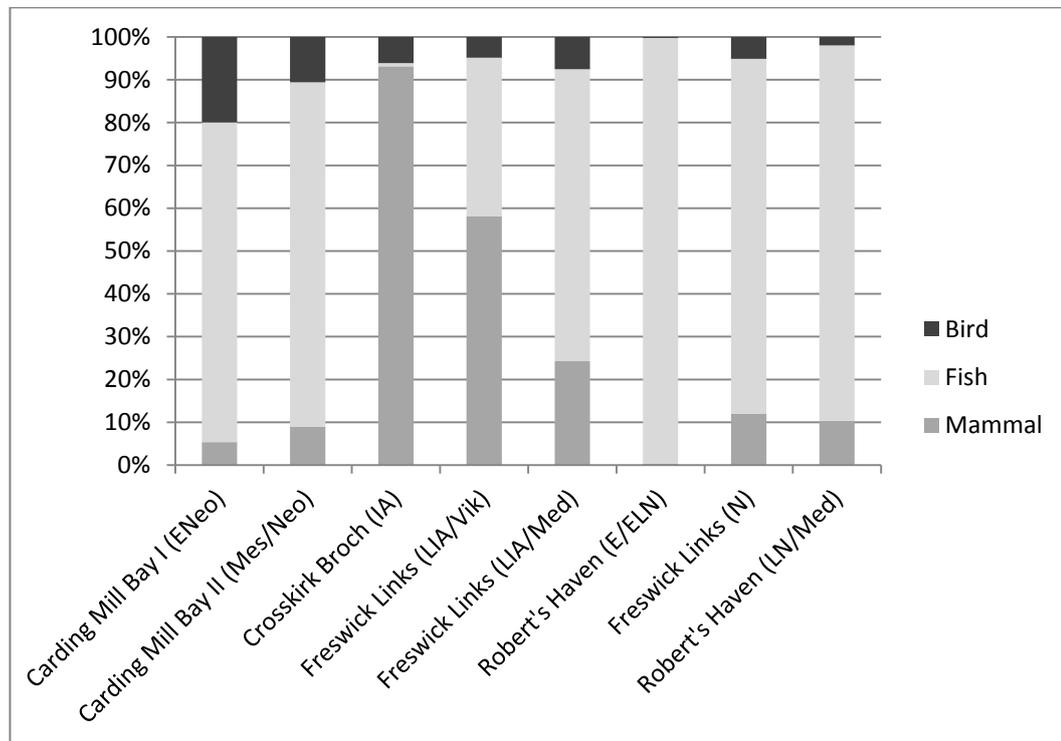


Figure 5.7: Birds as % of combined Avian, Mammal and Fish NISP – Comparable

Mainland Sites



Two sites which displayed the strongest avian dominance when examined as a proportion of the combined avian and mammalian NISP came from excavations on the Shiant Isles and St Kilda. These two geographically isolated island groups continue to have a very large avian contribution within the mammal/avian/fish assemblage forming between 55 and 95%, with little to no fish remains. The Iron Age and Post-Medieval Shiant sites from Rough Island 41B produced no or one fish bone (Figure 5.8). The Norse/Early Medieval phase of this site produced 10 fish bone fragments but these have not been identified and as such cannot be included. However this phase only produced avian and mammalian NISPs of 26 and 5 respectively suggesting that fishing may have been more practised during the Norse use of this island.

In the 1830s written sources suggest that the inhabitants of the Shiant Isles only occasionally supplemented their diet with fish (Hunter 1976; Nicholson 2002, 265). The sea around the Shiants is often unpredictable and treacherous; making fishing a relatively labour intensive pursuit (Madgwick and Mulville 2005). In the late 16th and 17th centuries the St Kildans are recorded as not doing much fishing, and in the 19th century it is documented that they did not fish (although they were later encouraged to do so by outsiders as a remedy for any economic difficulties), and that they did not much like it as a food (Anon 1595; Harman 1997, 225-226; Kearton 1898,70; Maclean 1992, 106-109; MacCulloch 1824, 184; Martin 1749,16-17; Sands 1878, 39). In Post-Medieval St Kilda what little fishing that was conducted usually formed part payment of rent. There is no good landing place for securing a fishing craft, and so sea fishing was both treacherous and labour intensive, although some may have been caught from the rocks (Harman 1997, 225). Such factors may go some way to explaining the low levels of fish in the Shiant and St Kilda assemblages, as may the prolific numbers of birds in these locations. As such the role of birds here is clear in its importance and overall dominance of the subsistence economy.

The prominence of avian resources on the Shiant Isles is also visible in the avian assemblages in Figure 5.11 which have only undergone assessment to date (Madgwick and Mulville, 2005). Birds continue to dominate the combined avian/mammal/fish NISP, particularly in the HI15B midden which produced over 5200 bird bones. Fish play a very limited role (see Appendix Figure A5.11).

Figure 5.9: Birds as % of combined Avian, Mammal and Fish NISP – Orkney

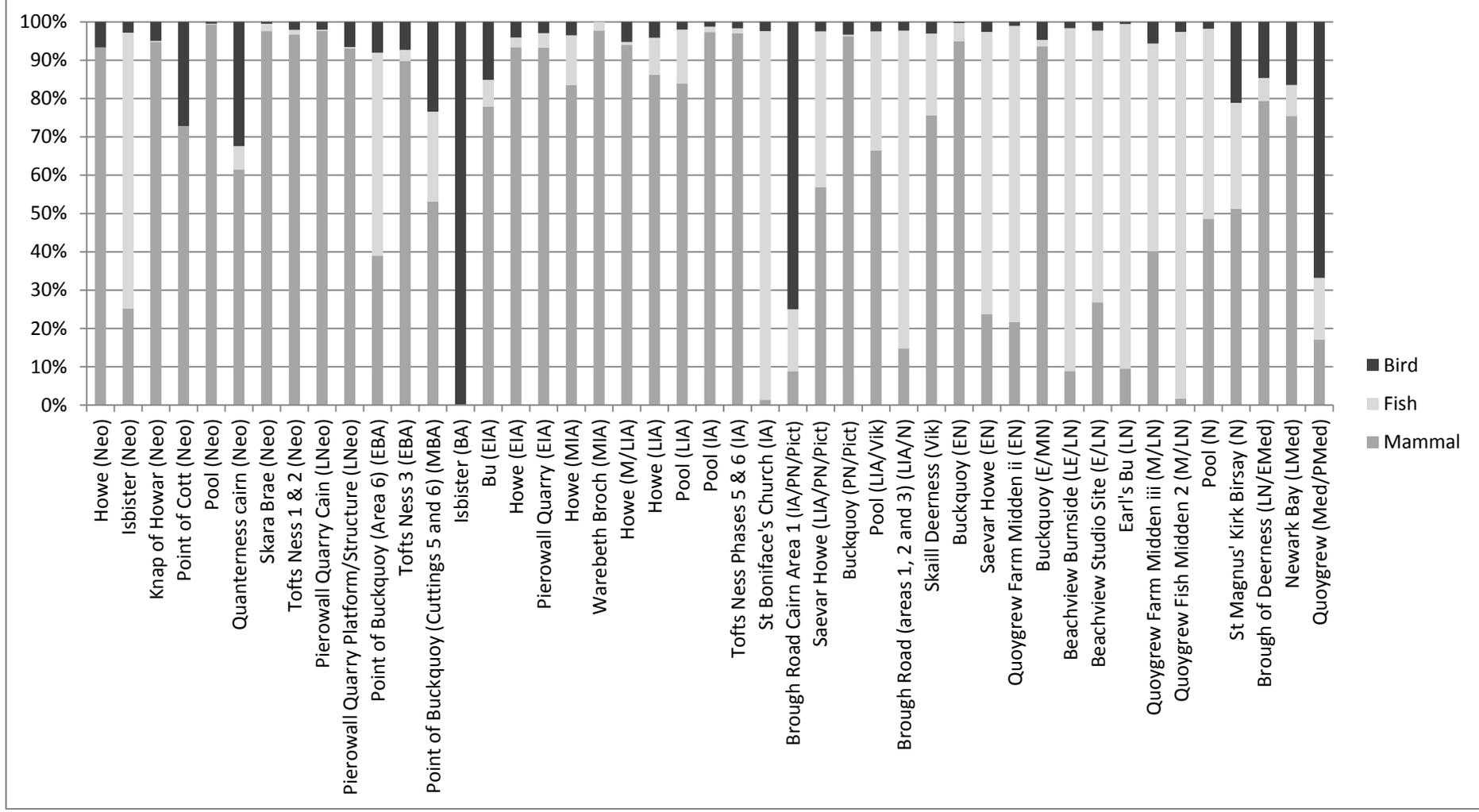


Figure 5.10: Birds as % of combined Avian, Mammal and Fish NISP – Shetland

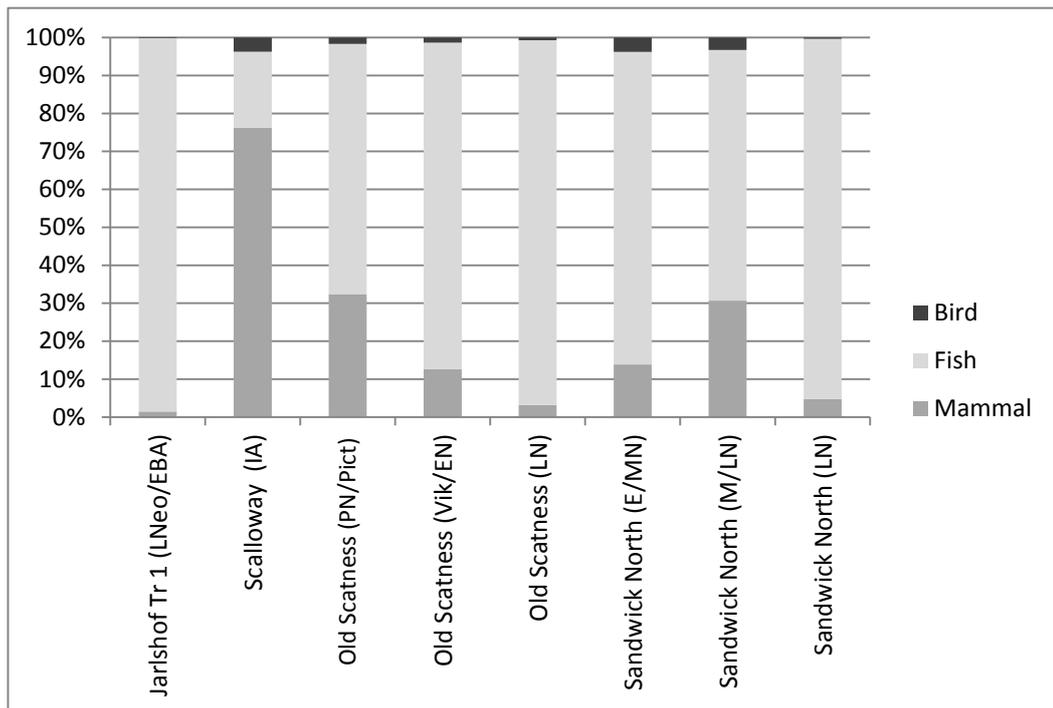
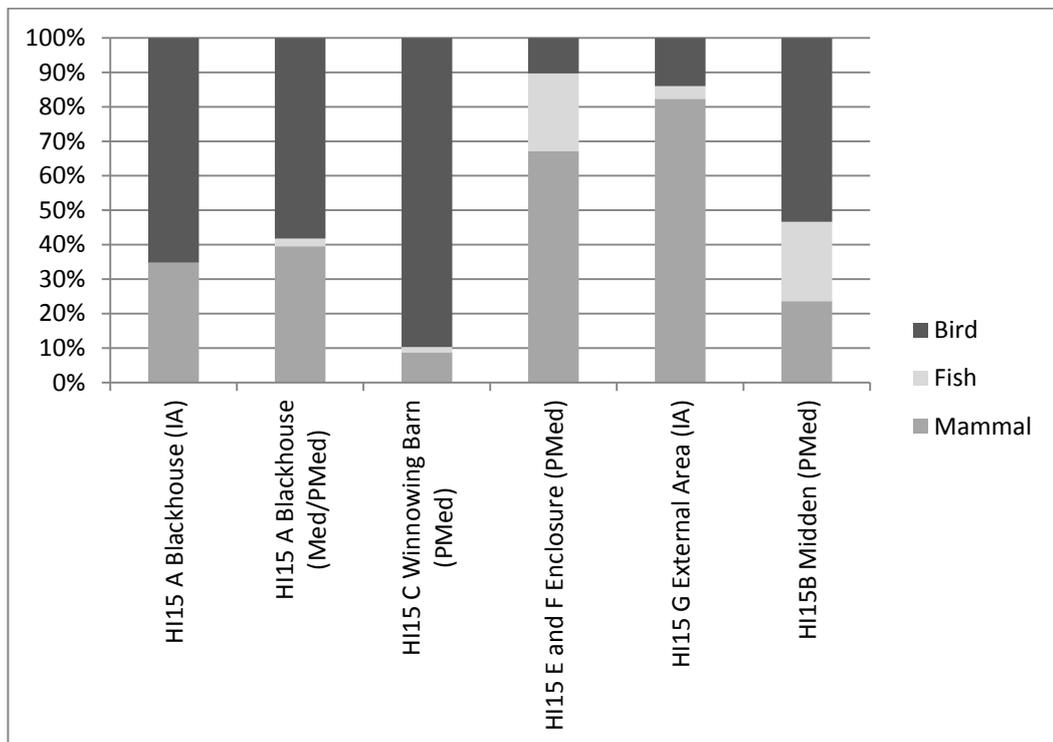


Figure 5.11: Birds as % of combined Avian, Mammal and Fish Assemblages from assessed sites on the Shiant Isles



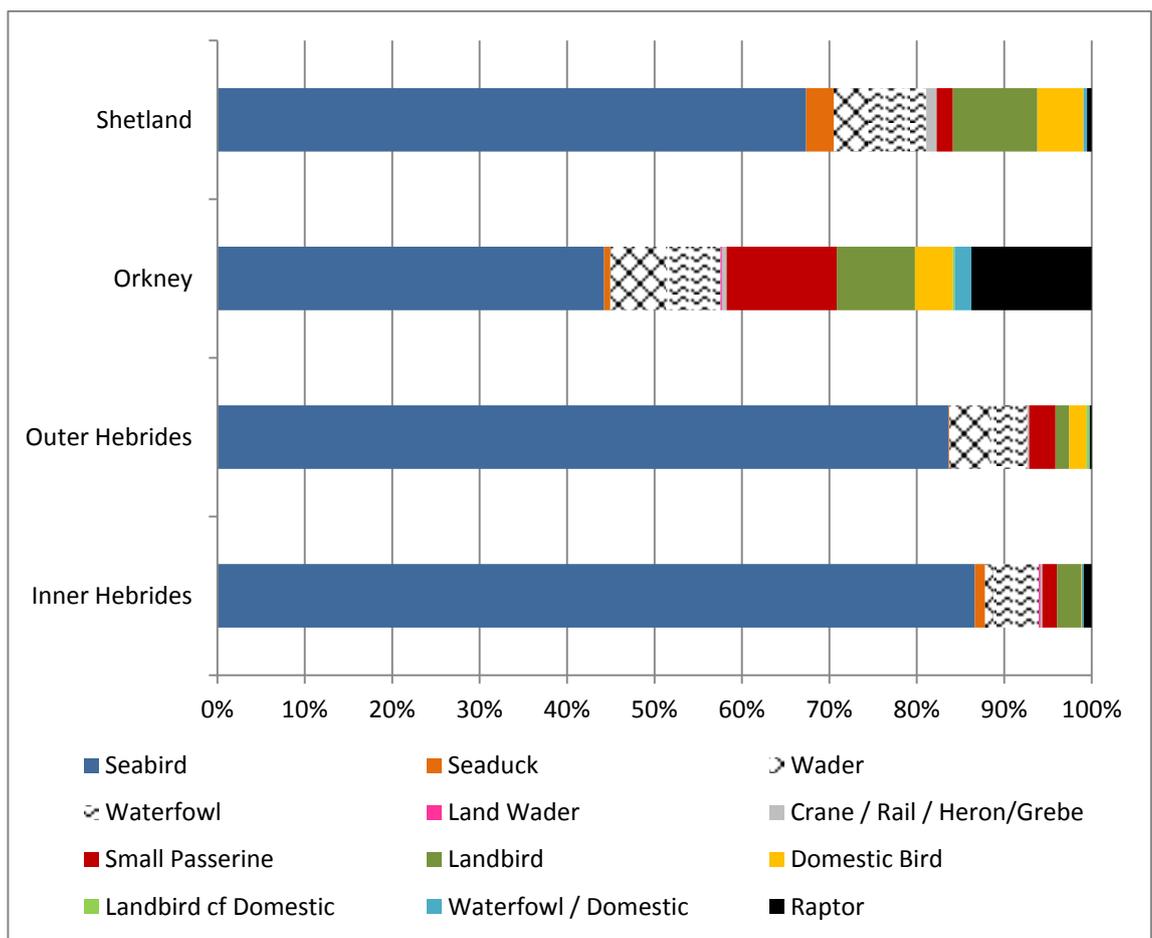
5.3 The Avian Assemblage by Broad Taxonomic Grouping

In this section the birds are presented by broad taxonomic grouping. Firstly they are presented by island (with all periods combined) in order to investigate location specific factors and ecological trends. They are then presented by period considering the Hebrides and Northern Isles separately²¹.

Birds by Location

When the birds are considered in broad taxonomic groups by island it is demonstrated that in each location seabirds are the largest individual component overall (Figure 5.12 and Table 5.5).

Figure 5.12: Avian groupings as a % of NISP shown by geographical island group



²¹ The periods are not presented by Inner Hebrides, Outer Hebrides, Orkney and Shetland due to the small number of sites from the first and last, and the lack of period representation in some settings (Table A5.1)

Table 5.5: Avian taxonomic category by NISP for each geographical island group

Type	Inner Hebrides	Outer Hebrides	Orkney	Shetland
Seabird	1706	9211	3475	509
Seaduck	23	10	57	24
Wader	19	510	500	30
Waterfowl	102	472	490	50
Land Wader	4	3	13	
Crane / Rail / Heron/Grebe	4	20	41	9
Small Passerine	33	332	991	14
Landbird	55	172	702	73
Domestic Bird	1	216	340	40
Landbird <i>cf.</i> Domestic		37	17	
Waterfowl / Domestic	4	6	151	3
Raptor	18	24	1080	4

Orkney has the lowest proportion of seabirds in its overall NISP, and is the only location in which seabirds do not form over 50% of the NISP. Raptors play a particularly prominent role in the Orcadian avian data, with small passerines also being prolific. Both Orkney and Shetland have a large landbird component in comparison to the Outer Hebrides, which could indicate that the landscape of these islands contained more habitats for species such as the red grouse, or that they were specifically chosen for capture. Raptors unusually form over ten percent of the avian NISP in Orkney, stemming partially from their inclusion in tomb sites such as the aforementioned Isbister: Tomb of the Eagles.

Waterfowl and waders play a moderate but fairly consistent role in all locations, although the Inner Hebrides have a lower number of wader species. Seaducks occur more frequently on Shetland than the other island groupings, again indicating a diverse Northern Isles avian resource use. Domestic birds are a small overall component, but as was seen in Chapter Four, their importance is very period specific and will be explored further below.

The Inner and Outer Hebrides exhibit the greatest seabird use. For the Inner Hebrides this is partially a result of the Mesolithic shell mounds, and in the Outer Hebrides this is in part due to the large seabird use on Medieval/Post-Medieval St Kilda. However this seabird dominance was seen in all periods on South Uist (Chapter Four) and continues to be seen temporally across the Outer Hebrides (Figure 5.13).

Birds by Period – Across Time

Hebrides

When the avian categories are examined by time and island group it can be seen that in all periods seabirds are the largest individual contributor for the Hebridean sites (Figure 5.13 and 5.14, and Table A5.2). Waders and waterfowl are next commonly exploited.

Figure 5.13: Avian groupings as a % of NISP shown by period - Hebrides

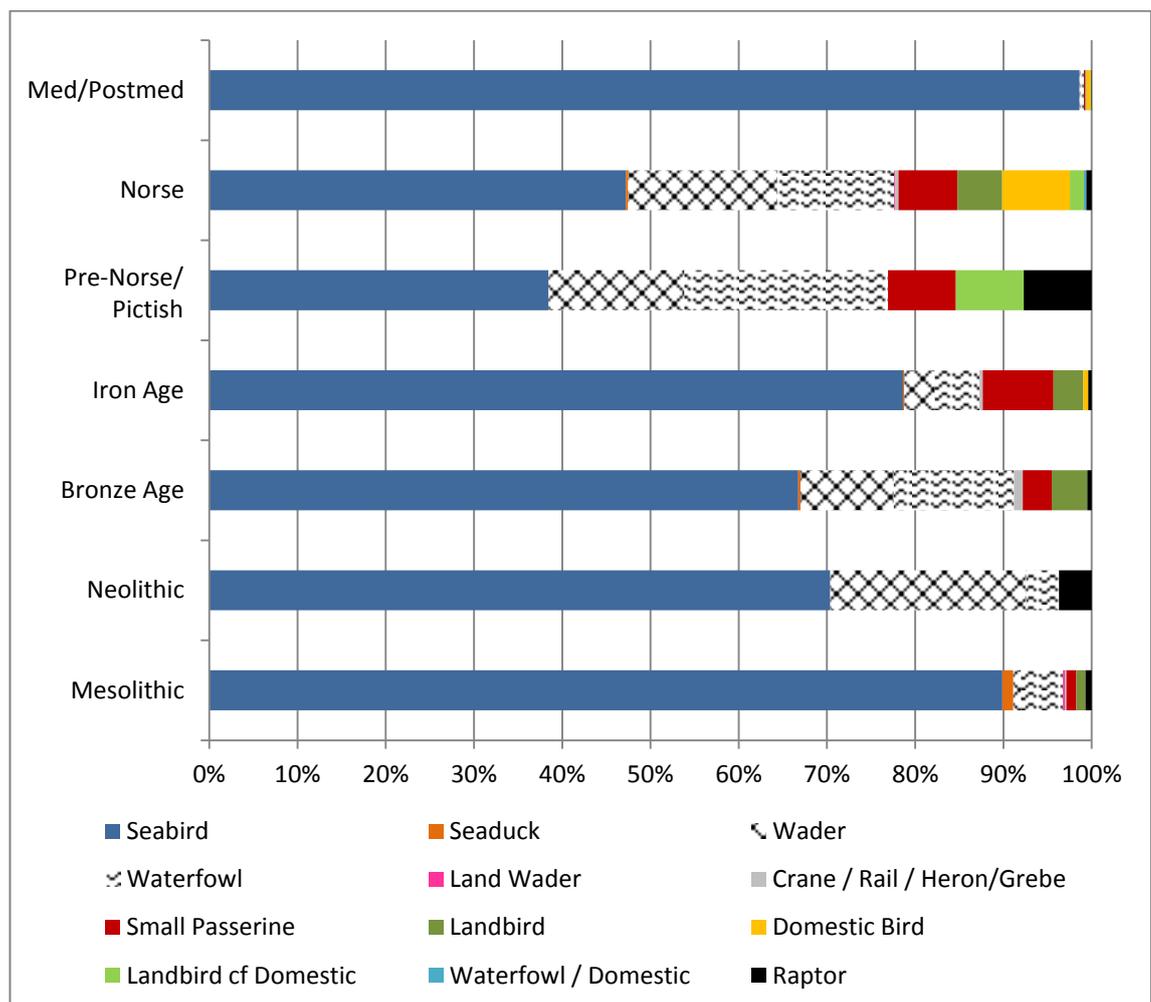
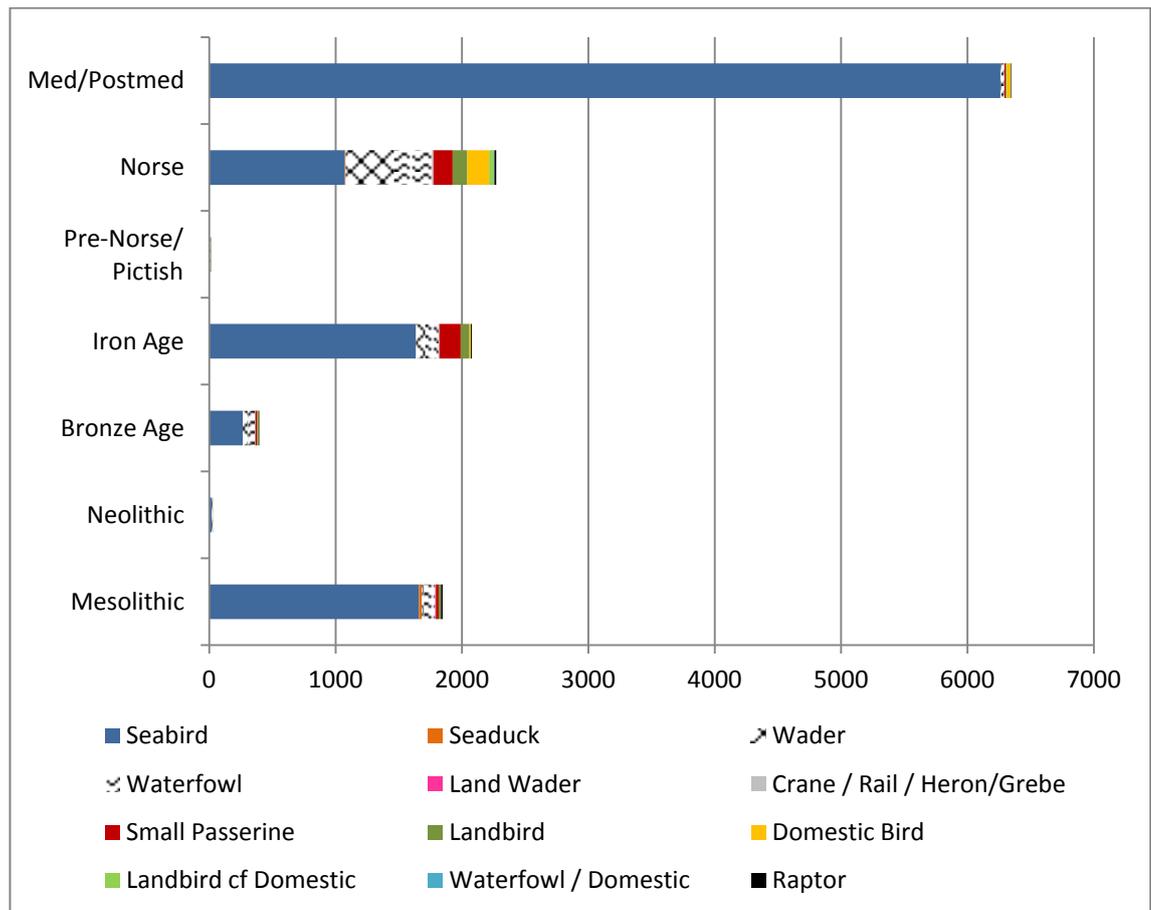


Figure 5.14: Avian groupings by NISP shown by period - Hebrides



The Mesolithic (which displayed a high use of birds as part of the wider faunal assemblage) exhibits a strongly focused use of seabirds, followed by a much smaller waterbird contribution. Interestingly, this is the only period (except for the Medieval/Post-Medieval) in which waders play a very minimalistic role. These often hard-to-catch birds (as was suggested in Chapter Four) may have been opportunistic winter catches of flocking populations, or breeding pairs in summer. Their low occurrence in the hunter-gatherer Mesolithic period indicates that these populations were specifically targeting seabirds in concentrated fowling events, rather than supplementing the diet ad-hoc with opportunistically captured birds. The Neolithic in the Hebrides is only represented by a small assemblage from three sites: Udal, Eilean Domnhuill Loch Olabhat and Northton (the latter of which was reanalysed by the

author). However, they show a continued use of seabirds and marine waders alongside occasional capture of waterfowl and raptors. In the Hebridean Bronze Age seabirds again form over two thirds of the NISP, but in this period waterbirds play a moderate but greater role than in the preceding periods, particularly at Cladh Hallan on South Uist and Udal on North Uist. The assemblages from Rosinish on Benbecula and Northton on Harris are heavily dominated by seabirds, indicating landscape specific fowling choices.

Avian use in the Hebridean Iron Age is mainly focused on seabirds which form nearly eighty percent of the NISP. This trend was visible in the South Uist case study, but is also clearly visible at a wide range of other Hebridean sites such as Sollas and Udal on North Uist, at Cnip, Bostadh and Beirgh on Lewis, Dunan Ruadh on Pabbay, and at Northton on Harris. It is also particularly prominent in the Iron Age roundhouse from the Shiant Isles (Rough Island 41B), where the entire assemblage is seabirds. The small scale Late Iron Age introduction of domesticates identified on South Uist is also visible at Late Iron Age Udal on North Uist (chicken, identified by Dale Serjeantson) and possibly at Middle Iron Age Dun Mor Vault on Tiree (one greylag/domestic goose).

Unfortunately only four Hebridean Norse sites outside of South Uist had available bird bone data, and at one of these, Rosinish, none of the small assemblage was identifiable. Whilst the increase in domesticates and diversification of the fowling economy is visible at Udal on North Uist, seabirds constitute the entirety of the small Norse assemblages from Rough Island 41B from the Shiant Islands, and Bostadh on Lewis.

The Medieval and Post-Medieval sites were seen in the class comparisons to frequently exhibit high avian usage. Figures 5.13 and 5.14 also demonstrate that these are almost

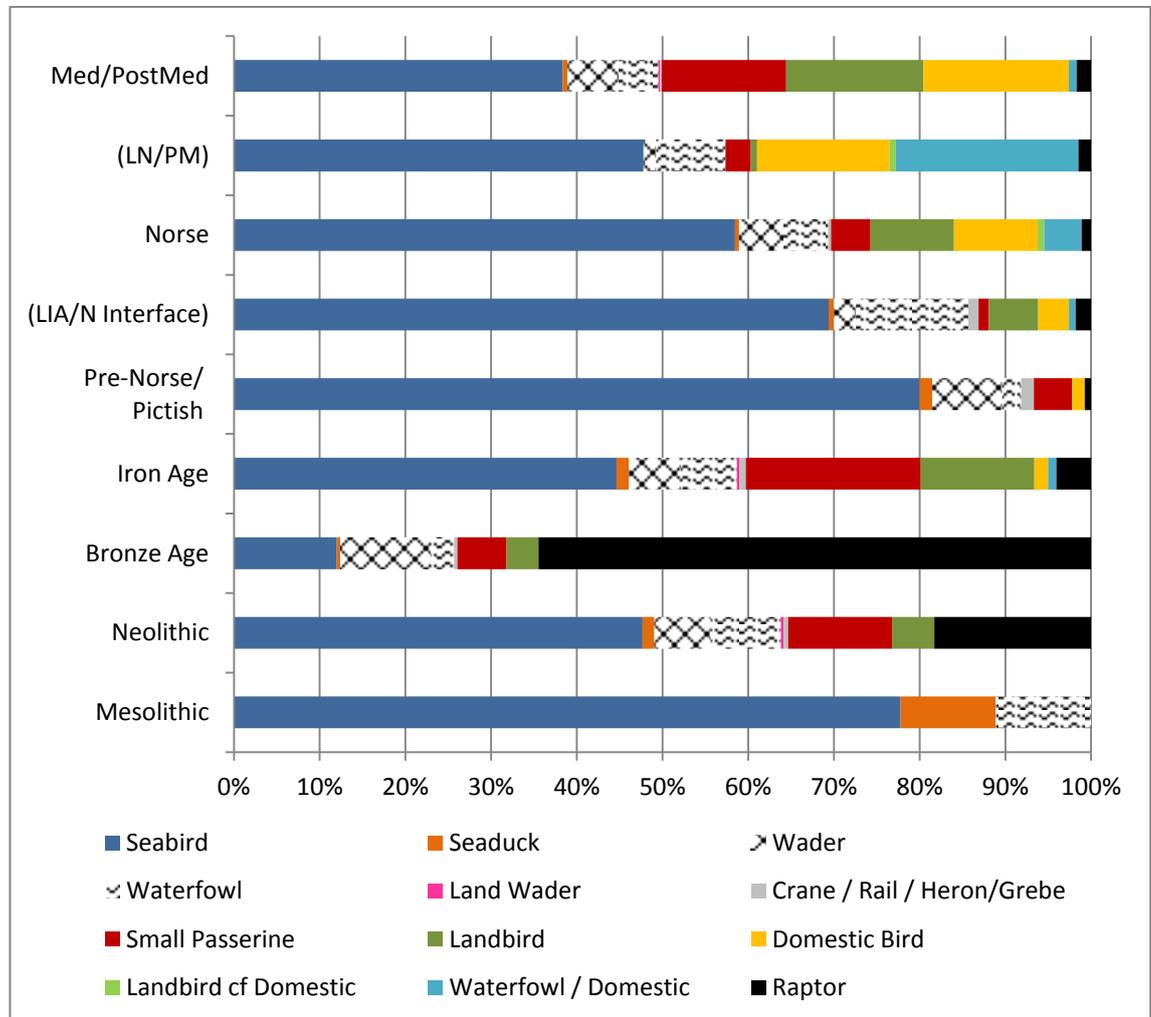
exclusively dominated by seabirds which form around 98% of the NISP. It is very important to stress here that these sites are the exception to the general rule. Whilst it has been possible to gather avian data from a wide and representative range of Mesolithic to Norse period sites (which is the key focus of this work), Post-Medieval/Modern sites rarely qualify for excavation and avian analysis unless they are exceptional. Both St Kilda and the Shiantis provide unusual examples of concentrated seabird colonies which continued interactions with human exploiters into the modern period on a relatively large scale. Although the avian resources continued to be important at Late Medieval and Post-Medieval Udal, they only formed around 7% of the avian/mammalian NISP and although seabirds dominated, waterfowl were also well represented. As researchers we are fortunate to be able to access avian data from the excavations of the 19th and Early 20th Century St Kildan houses since it presents an unparalleled opportunity to compare the archaeological bones with the historical accounts (this will be explored later in the chapter). Inclusion of these sites, although mostly atypical, is nonetheless very valuable.

The Northern Isles

The Northern Isles present a similar overall pattern of bird use but with some notable differences from the Hebrides (Figure 5.15 and 5.16 and Table A5.3). Seabirds are also the main avian resources captured in the Northern Isles and form the largest individual contribution in all but the Bronze Age. However, overall a higher diversity is visible in the Northern Isles data than in the Hebrides. The Mesolithic, which is only represented by preliminary data from West Voe, is highly comparable to the Hebrides, with seabirds being very dominant, followed by moderately small numbers of waterfowl and seaducks. Again this indicates that hunter-gatherer communities were maximising the

wild resources available at specific locations and points of the year, i.e. seabird colonies.

Figure 5.15: Avian groupings as a % of NISP shown by period – Northern Isles



The Neolithic and Bronze Age of the Northern Isles is starkly different to its Hebridean counterpart. On Orkney (and to an extent Shetland) the assemblages are much more diverse, and although seabirds form nearly half of the Neolithic birds, they are less prominent than in the preceding Mesolithic. There is also a large raptorial presence, forming nearly a sixth of the Neolithic NISP, and a comparatively large number of small passerines. The Northern Isles' Bronze Age displays a very low seabird component of under 15%, with a relatively high number of waders and an exceedingly large quantity of raptors which account for around two thirds of the NISP. This

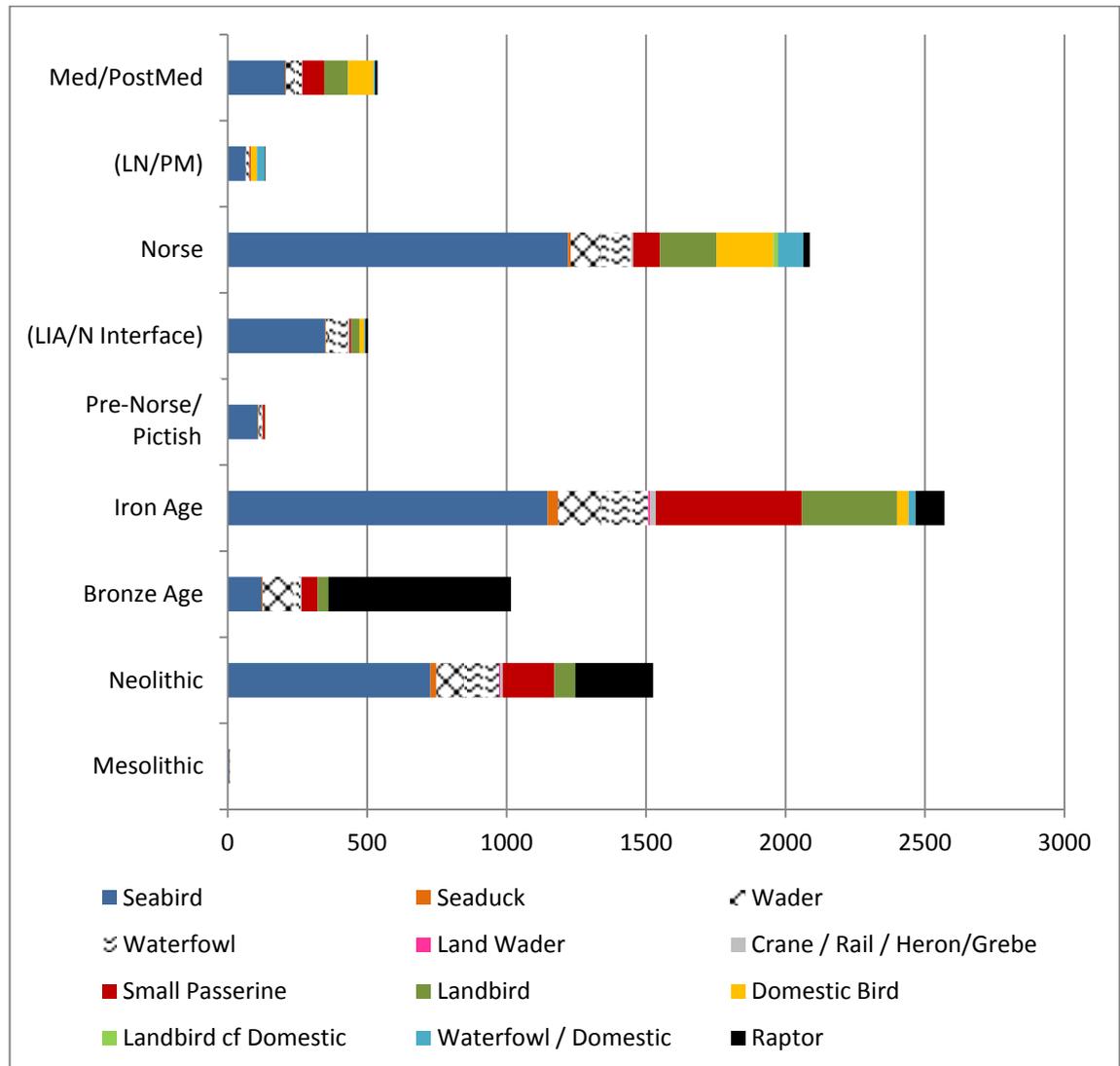
visibility of raptorial birds in the Neolithic and Bronze Age largely results from cairn/tomb sites which regularly feature inclusions of birds of prey. These structures also partially explain the relatively large small passerine presence which may represent natural deaths of birds using these structures both during and after the site's lifespan²². These concentrated ritual deposits are unlikely to be representative of subsistence practices, but reveal the multitude of situations and contexts in which birds were used and the range of reasons for which they were exploited.

However even if the 600+ Isbister eagle bones (which were deposited c.1000 years after construction [Pitts 2006, 86; Serjeantson 2010, 152]) are removed, seabirds still total less than 35% of the Bronze Age assemblage in the Northern Isles, with waders also playing an important role. However, the Bronze Age material from the Northern Isles is problematic to interpret. Bronze Age Phase Four at Tofts Ness produced a large number of waders which appear (from condition, location and make-up) to possibly have been accumulated by a non-human predator (Serjeantson 2007a, 223-226). This is in stark contrast to the Early Bronze Age Phase Three material from this site which shows a characteristically high use of seabirds, some waterfowl and waders. Within the material from Point of Buckquoy 'Area 6' and 'Cuttings 5 and 6', waders also formed over a third of the remains. However when the multiphase Late Neolithic/Early Bronze Age and Late Bronze Age/Early Iron Age material from Jarlshof is included (see Appendix Table A5.3, highlighted in grey), the key seabird species form the vast majority of the material. Therefore it is reasonable to suggest that although waders may have gained some importance in the Bronze Age, seabirds were still key among the avian resources.

²² Three intrusive domestic fowl were removed from the Neolithic Point of Cott NISP, however, the report is not detailed so potentially other intrusive birds may be present which cannot be excluded by species.

The Bronze Age in particular would benefit from more avian analysis and assemblages to help clarify the situation. The Hebrides are fortunate to have large assemblages from Cladh Hallan to help understand this period, which is less the case in the Northern Isles.

Figure 5.16: Avian groupings by NISP shown by period – Northern Isles



Seabirds remain important in the Iron Age, Pre-Norse/Pictish and Norse periods. The Iron Age is seabird dominant but also has a large small passerine presence, some of which probably represent natural deaths at sites such as Howe, where large numbers were present. Landbirds form a large 12% of the NISP, showing use of a wide resource base and multiple fowling landscapes (they occur in moderate amounts in all but the Mesolithic and Pre-Norse/Pictish material, and to a larger degree than in the Hebrides).

As in the Outer Hebrides, the Iron Age sees the first appearance of domestic fowl (at 8 sites/period sub divisions), and potentially domestic goose and duck (1 site each), in the Northern Isles²³. The majority come from the Late Iron Age or indefinable 'Iron Age' contexts. However there are five chicken bones and 1 *cf.* domestic goose from Middle Iron Age Howe, indicating a perhaps earlier than anticipated arrival of these birds on the islands in small quantities. There is also one domestic fowl bone from the Broch of Midhowe. Although stratigraphic information for this latter site's older excavation and bone report is limited, it too may originate from Middle rather than Later Iron Age deposits (Callander and Grant 1933, 444 – 516; Platt 1933, 514). This indicates that domesticates first appeared in the Northern Isles at high status sites such as these brochs. Prior to this research the author had entertained the hypothesis that domesticates may have taken longer to reach the Northern Isles, particularly if their spread originated from their increased presence in England during and after the Roman period. However, this does not appear to be the case, particularly as domestic fowl are present at Late Iron Age Scalloway on Shetland. Once established, domesticates appear to form a higher proportion of the avian resource base in the Northern Isles. For example, in the Norse period certain and probable domesticates combined form 15 compared to 9.5 percent of the NISP. In the Late Norse/Post-Medieval material from Tuquoy they form over a third of the remains, and in the Medieval/Post-Medieval period approximately a fifth of the NISP compared to one percent in the Hebridean comparable material.

Unlike the Hebrides, an increase in waders and waterfowl is not clearly seen during the Northern Isles Norse Period. Waders and waterfowl form a lower component than in the Hebrides, particularly in the Pre-Norse/Pictish and Norse data. Seabirds form a greater proportion of the Norse and Iron Age/Norse Interface (between 60-70% of the NISP)

²³ These domestic goose and duck identifications are from published data (not the author's own work). As no specific identification criteria were given the confidence of these identifications has been tempered.

than in the Hebrides. An increase in Norse fish was particularly visible in the Northern Isles perhaps indicating that continued high seabird use here is related to these activities.

5.4 Species Groups Distributions: Trends by Time and Space

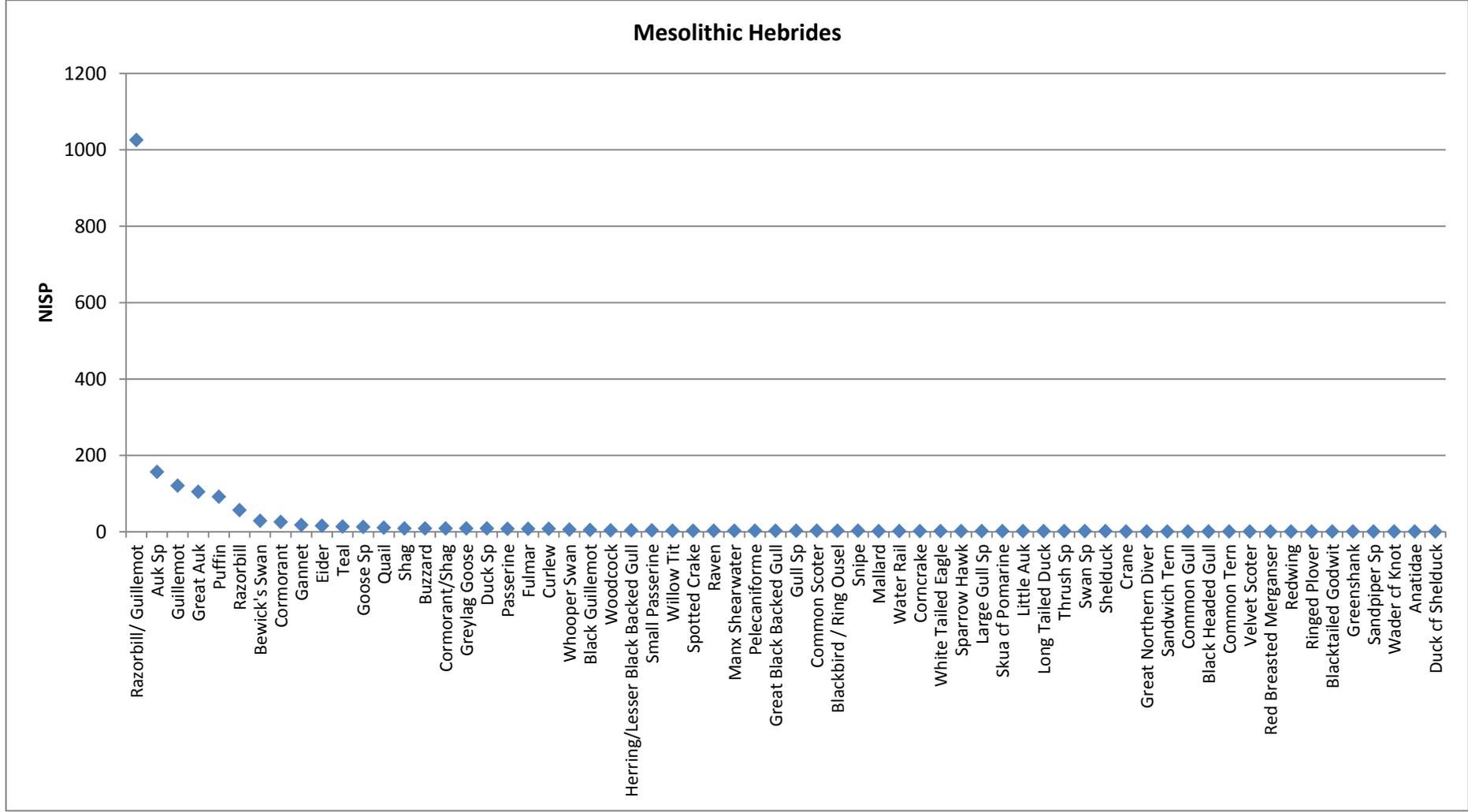
Mesolithic

Mesolithic fowling in the Hebrides was almost exclusively focused on auks in terms of quantity (Figures 5.17 and 5.18). The ill-fated great auk occurs in large numbers (Figure 5.17) and is the most regularly exploited bird species occurring at all of the Mesolithic sites, both in the five Hebridean sites and at West Voe on Shetland. Great auk was the most frequently occurring individual bird at Cnoc Coig accounting for 15% of the NISP. It was also regularly recovered at Caisteal nan Gillean. Guillemot and razorbill are the next most repeatedly captured in terms of the number of sites producing them (see Appendix Table A5.4). These auks were the most frequent Mesolithic birds in terms of NISP, both at Sand where they were very heavily targeted, but also at Cnoc Coig and potentially Caisteal nan Gillean (although Grieve’s antiquarian approach to the latter limits our full understanding of the site). The key auks exploited (the puffin, guillemot, razorbill and great auk) only come to land to breed, indicating concentrated fowling and certain points of the year. The puffin, a smaller auk, was also heavily exploited, and was the dominant species at An Corran on Skye where they formed two thirds of the NISP. In Shetland the shag was a primary resource (Table 5.6)

Table 5.6: Mesolithic Northern Isles – from West Voe Shetland

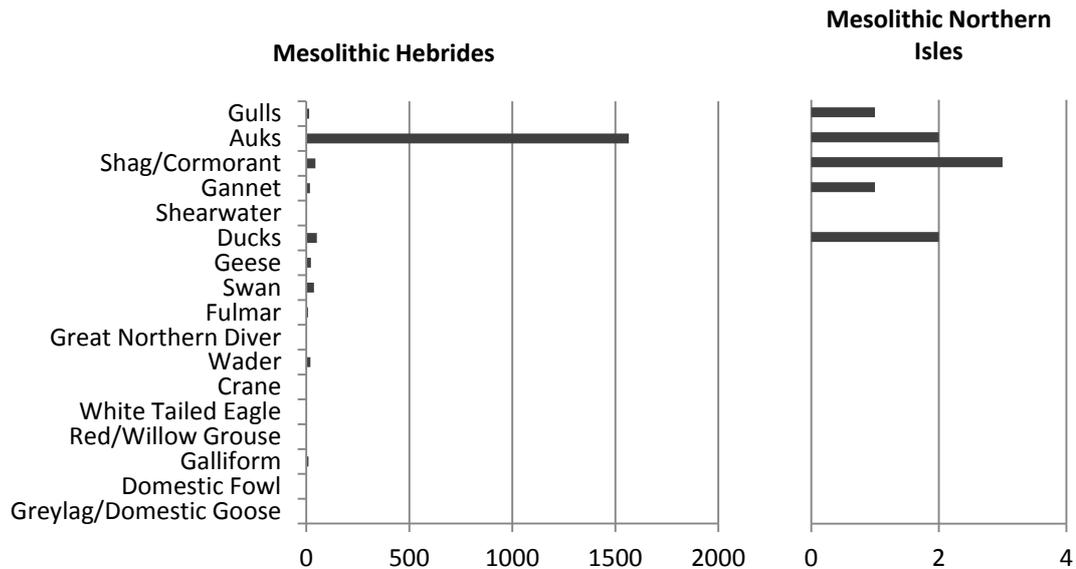
Species	NISP
Shag	2
Great Auk	1
Puffin	1
Cormorant	1
Gannet	1
Eider	1
Mallard	1
Gull <i>cf.</i> Great Black Backed	1

Figure 5.17: Species Abundances for Mesolithic Hebrides (by NISP)



The Mesolithic overall displayed a very strong focus on particular birds, largely the auk family, which dominate the assemblages. However the inhabitants of the Hebrides were occasionally making use of a wider range of species including other seabirds such as the gannet, and waterfowl including ducks, swans and geese.

Figure 5.18: Grouped main species for Mesolithic (NISP) by location (nb varied scales)



The Mesolithic assemblage contains at least 52 species, the majority of which come from Cnoc Coig. Whereas An Corran had a minimum of ten, and Sand six, Cnoc Coig has an unusually large range with at least 46 species present, including several duck species and a small number of waders (see Table A5.4). The Bewick's swan, a winter visitor, is also present at Cnoc Coig, however Nolan's 1986 spatial analysis suggests that this may be a natural inclusion into the midden area. Cnoc Coig produced two raptors; the sparrow hawk and the buzzard, indicating that Mesolithic fowlers were capturing species for more than purely food products. An Corran also produced raptor bones, in the form of the white-tailed eagle. Hunter-gatherer populations may have used such birds for a range of ritual or decorative purposes but in this context they would not have been killed to protect domestic livestock. Intentional control of these large raptors has been proposed for later farming societies since these birds can carry off young

lambs and domestic fowl (see section 5.5 for further discussion) (Lockie and Stephen 1959, 43-50). Unusually the only galliform present was quail. Quail is a migrant game bird that occasionally overshoots its breeding grounds and appears in Scotland (Šťastný 1995, 159; Sterry *et al.* 2001, 78). Its presence at Cnoc Coig could demonstrate that it was an opportunistically caught vagrant, or that it had a wider past range.

Neolithic

In the Neolithic wild avian resources are used for the first time alongside new domestic mammals and as such their role would have changed from the preceding Mesolithic period. The avian dataset shows continuity in the Hebrides with auks remaining one of the most commonly exploited bird groups (Figures 5.19 and 5.20). Waders such as the oystercatcher and snipe were also taken, suggesting that these species may have been occasional additions to the wider diet when they were encountered and available. A peregrine falcon tarsometatarsus was present in the Hebridean assemblages, again indicating that birds beyond the traditional food species were being taken. Significantly it was butchered, with repeated deep knife cuts providing evidence for anthropogenic exploitation.

The Northern Isles provide a much larger Neolithic avian dataset from a wide range of sites (Figures 5.19 and 5.21 and Table A5.5). However in this location the Neolithic assemblage appears to be split between the ritual and the dietary with a large number of raptors being identified alongside the continued use of key food species such as gulls and auks.

Figure 5.19: Grouped main species for Neolithic (NISP) by location (nb varied scales)

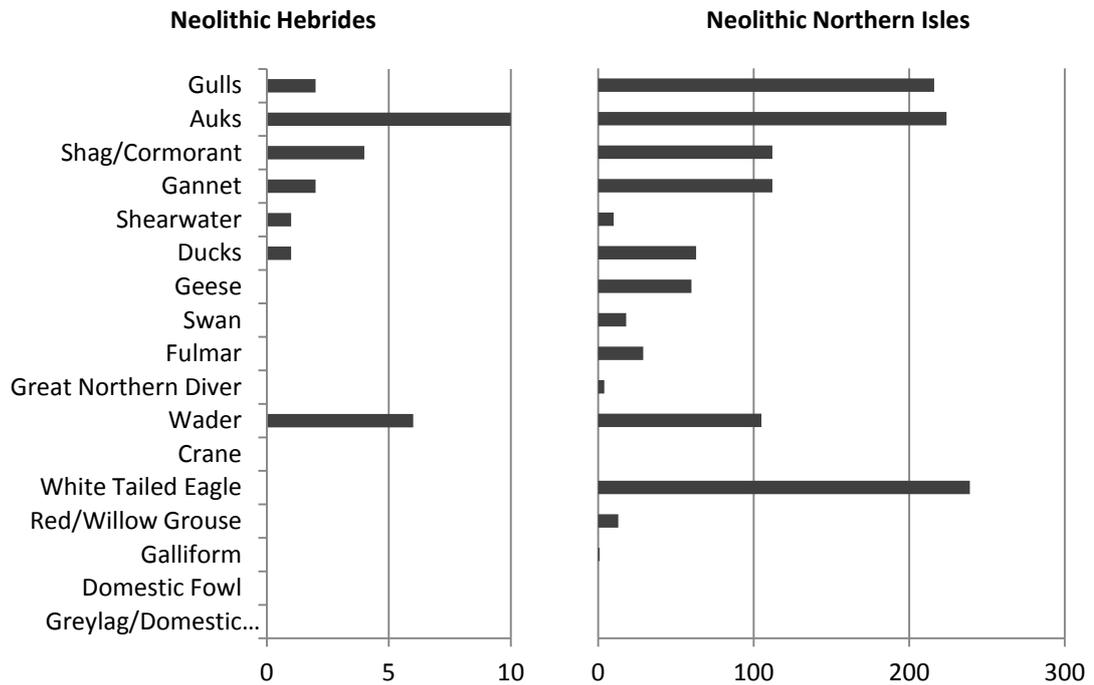
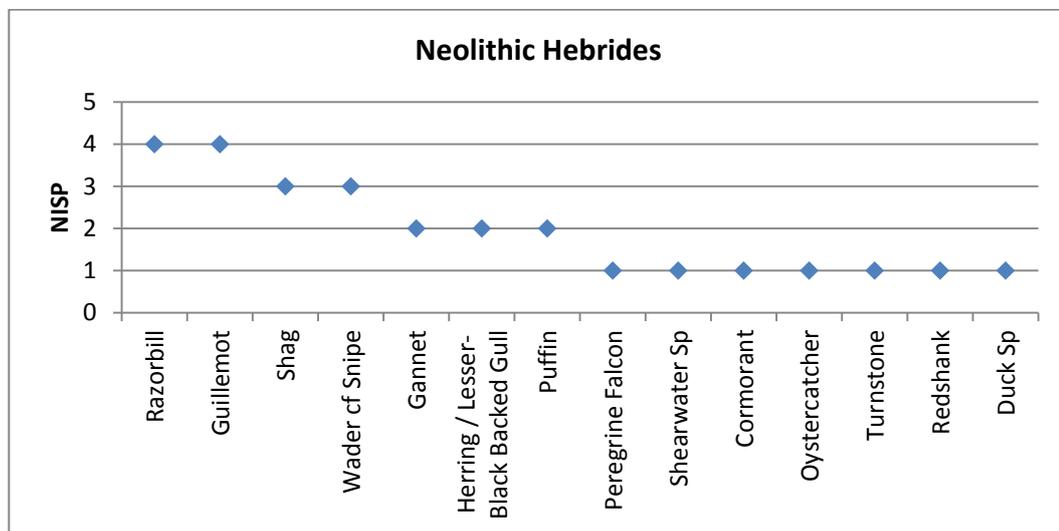


Figure 5.20: Species Abundances for Neolithic Hebrides (by NISP)



Within the non-raptorial assemblage from the Northern Isles a wide range of food species were used on a regular basis with various auks and gulls being the most common groupings (see Figure 5.19 Table A5.5). The gannet is the most frequently occurring individual species in terms of NISP (and also occurs at 11 of the 15 Northern

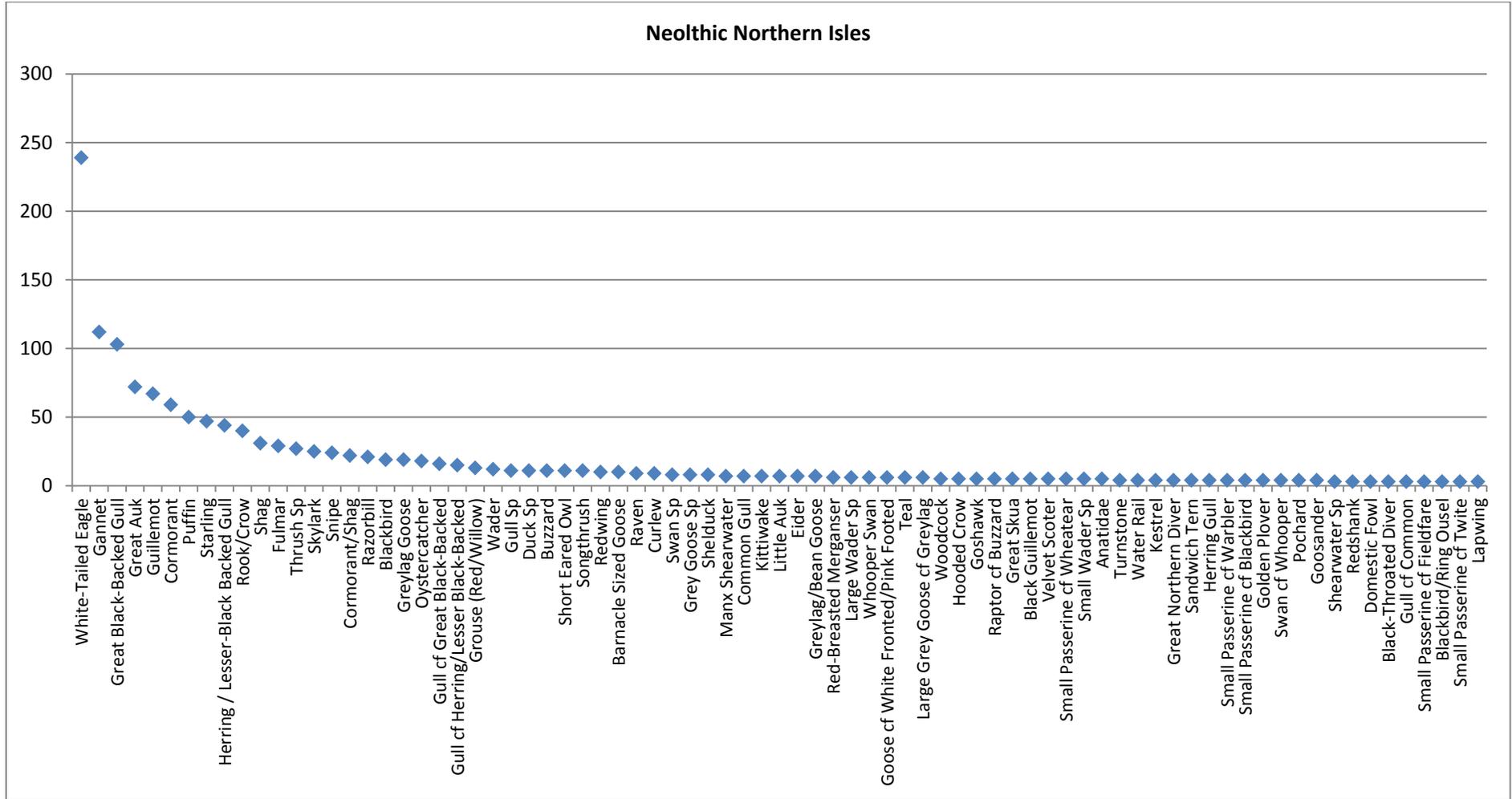
Isles sites), followed by great black-backed gull and great auk (Figure 5.21). The great auk is particularly well represented at Tofts Ness and Howe where it forms 11 and 15% of the NISP respectively. The shag and cormorant are also an important component of the Neolithic fowling economy, with a lower contribution from ducks and geese (Figure 5.19 and 5.21). Several duck species are represented incorporating both resident species (e.g. mallard or red-breasted merganser) and winter visitors (pochard or pintail). This shows repeated use of a familiar waterfowl resource at multiple points of the year but which targeted a range of species. (Seasonality will be explored more fully in section 5.6 below). Waders also make a sizable contribution, but this category contains many species exploited in small numbers including curlew, oystercatcher, plovers and shanks.

White-tailed eagle is the most commonly occurring bird in terms of NISP, with a large proportion of these (139) coming from the Point of Cott, Orkney where they represent at least eight individuals. Another 98 fragments were recovered from the settlement of Links of Noltland, with a single bone occurring in the small cairn assemblage from the Knowe of Ramsay. A specimen was also present at the Holm of Papa Westray cairn, but as mentioned the birds are not yet analysed for this site. The recurrent presence of these large raptors in the mortuary context is intriguing and suggests that these birds occupied a symbolic role in the avian-human relationships of these prehistoric island populations. The significance of this particular species is further heightened when one considers the deposition of between 10 to 20 birds at Bronze Age Isbister, some 1000 years after its Neolithic construction (represented by over 600 bones). The Neolithic Northern Isles assemblages also contained buzzard, goshawk, short-eared owl, barn owl, kestrel, peregrine falcon and a buzzard which was *cf.* rough-legged. Whilst some of these raptors may have entered the archaeological record non-anthropogenically (i.e. through

inhabiting/scavenging from a site at a time contemporary with its human occupants, or using an abandoned structure as a perch), the butchered falcon from the Outer Hebrides clearly demonstrates that Neolithic people were interacting with these predatory birds and processing them. Whether natural or anthropogenic, the remains reveal the range of predatory birds encountered within the Neolithic environment. These may have been captured for their feathers, symbolic associations, or in the case of larger eagles, to protect livestock. It would be interesting, should comparable assemblages become available from the Outer Hebrides to see if the same pattern of raptor use is present.

Overall, at least 75 species are represented in the combined Neolithic data, and this is a conservative calculation which excludes over-confident identification of for example small passerines in older analyses. This is exceptionally diverse and probably reflects both a varied and wide use of birds for food and ritual purposes, and that some of the sites, such as cairns, may have provided habitat for birds like the starling and thrushes. Minor species include the great northern diver, red-throated diver, black-throated diver, grebes, terns and skuas: these were exploited in small numbers but would still have been a valuable dietary addition. This diversity of species may indicate opportunistic capture of many birds to supplement the diet, particularly since many are represented by only a couple of bones. This pattern of bird use suggests that with the development of agriculture less exclusive attention was placed on specific species targeted fowling trips, and instead indicates a wider use of the avian resource base as an additional and prolific food source which could be taken as needed and when the farming calendar allowed, whilst potentially also forming a buffer for failed crops and livestock. This is explored further in the seasonal profiles outlined in Figure 5.39.

Figure 5.21: Species Abundances for Neolithic Northern Isles (by NISP) (Only NISPs of 3 and higher are shown)



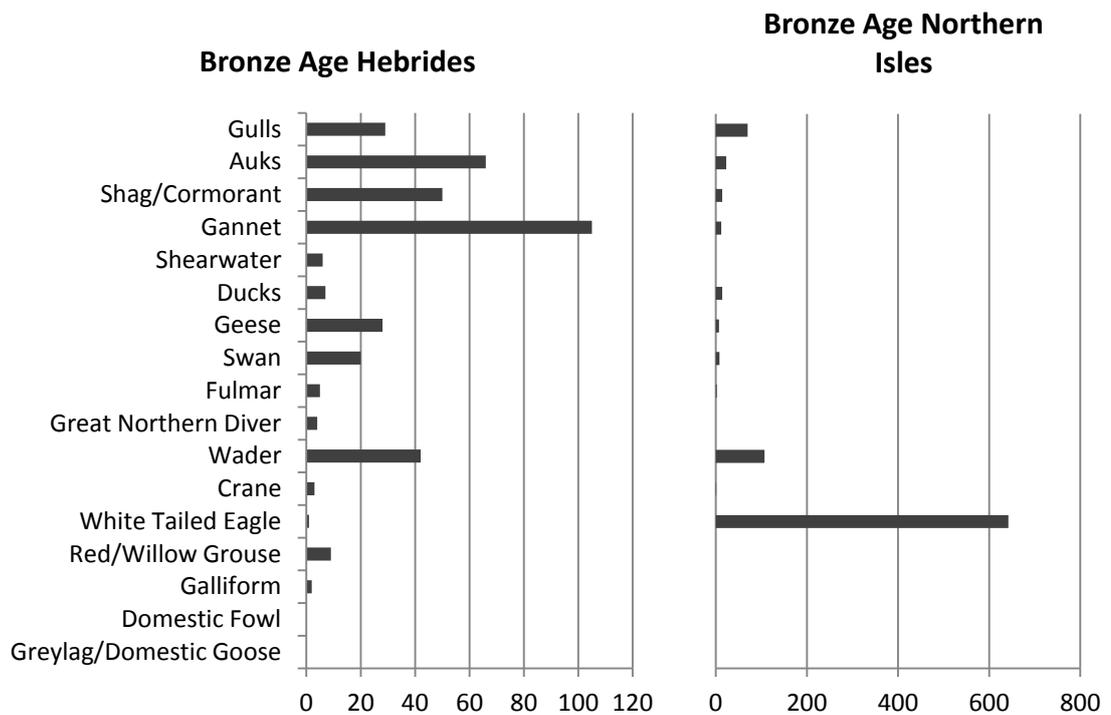
Bronze Age

Overall the Bronze Age assemblage contained a minimum of 55 species, showing that a wide avian resource base was being used. As mentioned under the taxonomic groupings, the Bronze Age material is complex and difficult to interpret, particularly for the Northern Isles, where some of the material (e.g. from Tofts Ness Phase 4) may have been accumulated by animal predators. In terms of NISP the Northern Isles material is dominated by the white-tailed sea eagle, however all except a single bone from Tofts Ness come from the Bronze Age re-use of Isbister: Tomb of the Eagles (Tables 5.22 and 5.24, and Table A5.6). The Isbister eagles, although vital in understanding ritual avian-human relationships and targeted fowling, provided limited insight into the wider avian resource use in this period.

In the Northern Isles the most comprehensive, sizable and accurate assemblage for assessing Bronze Age subsistence and general fowling comes from Early Bronze Age Tofts Ness (Phase 3). Here we see a continued use of the key food species exploited in the Neolithic including the large gulls (great black-backed, herring/lesser black-backed), gannet, great auk and cormorant/shags. This is alongside a smaller use of waterfowl and landbirds. Crane was present at Tofts Ness, providing more evidence for the wider distribution of this bird in the past, even to the most northerly areas of Britain. Again several bird of prey species are present including peregrine falcon, owl *cf.* short-eared and *cf.* buzzard (all Tofts Ness Phase 3), a goshawk came from Tofts Ness Phase 4, whilst a red kite and golden eagle were present at the Point of Buckquoy. Unusual species include terns, moorhen and rails, indicating use of freshwater and shorescape. If in addition the transitional Late Neolithic/Early Bronze Age and Late Bronze Age/Early Iron Age material from Jarlshof is considered (Table A5.7), key seabirds such as

gannet, guillemot, gulls, shag and cormorant again occur most commonly, albeit in small overall numbers.

Figure 5.22: Grouped main species for Bronze Age (NISP) by location (nb varied scales)



The dataset from the Hebrides presents a different picture. The Hebridean avian material comes from a wider range of sites that produced more representative food assemblages which do not appear to have been biased by intrusive material, as was the case at some of the Northern Isles sites. As such the Hebridean data may help shed light on Bronze Age subsistence fowling in the Northern Isles. With the Hebrides, gannet was the dominant component of the assemblage, although the majority (103) derive from a single site; Cladh Hallan, and is only represented elsewhere by individual bones at Rosinish and Udal. Auks remain important within Hebridean bird exploitation, as do the shag, cormorant, and gulls. Great auk and puffin both occur at five of the 11 sites making them the most commonly exploited in terms of spatially repeated selection.

Figure 5.23: Species Abundances for Bronze Age Hebrides (by NISP).

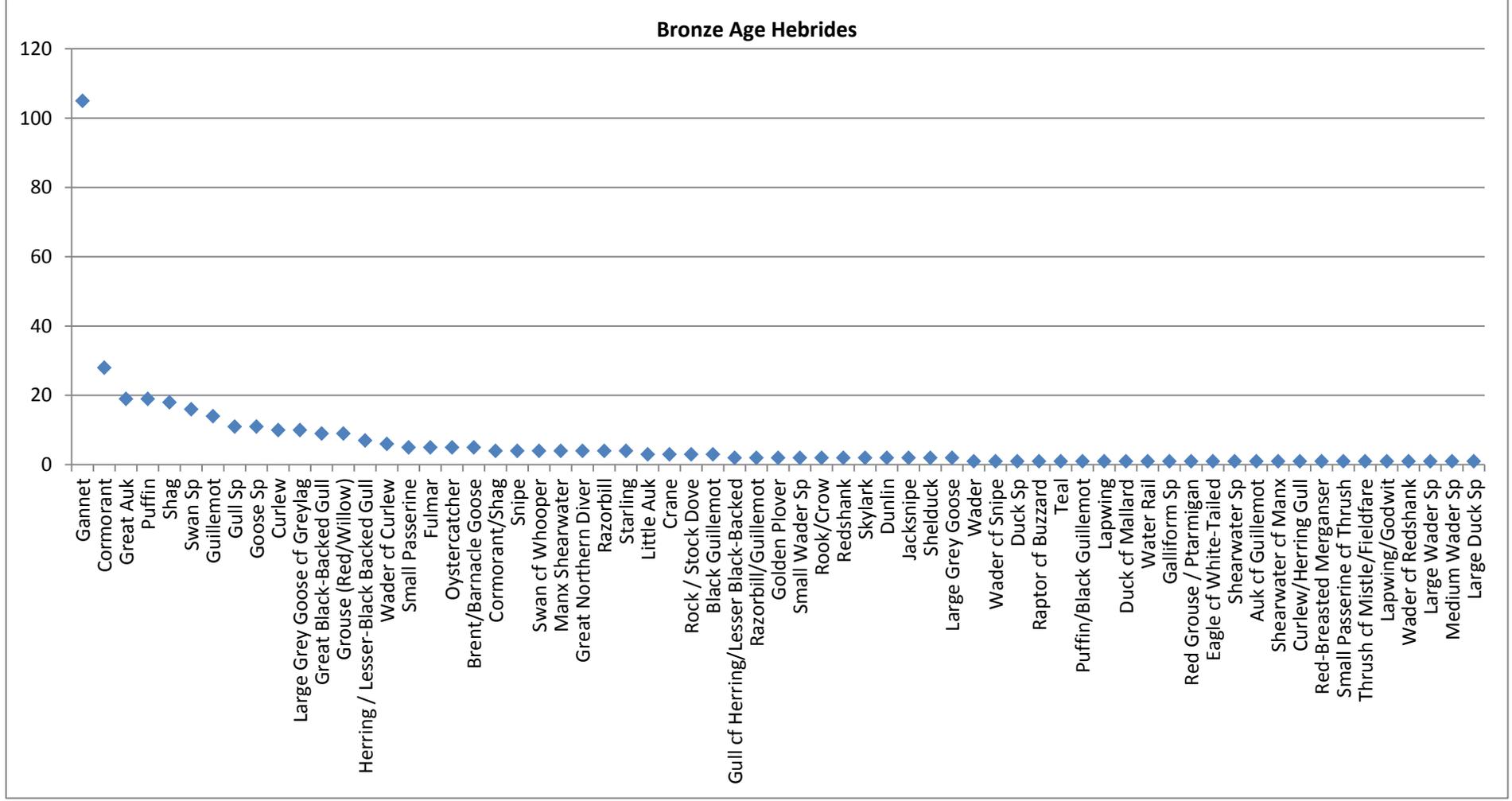
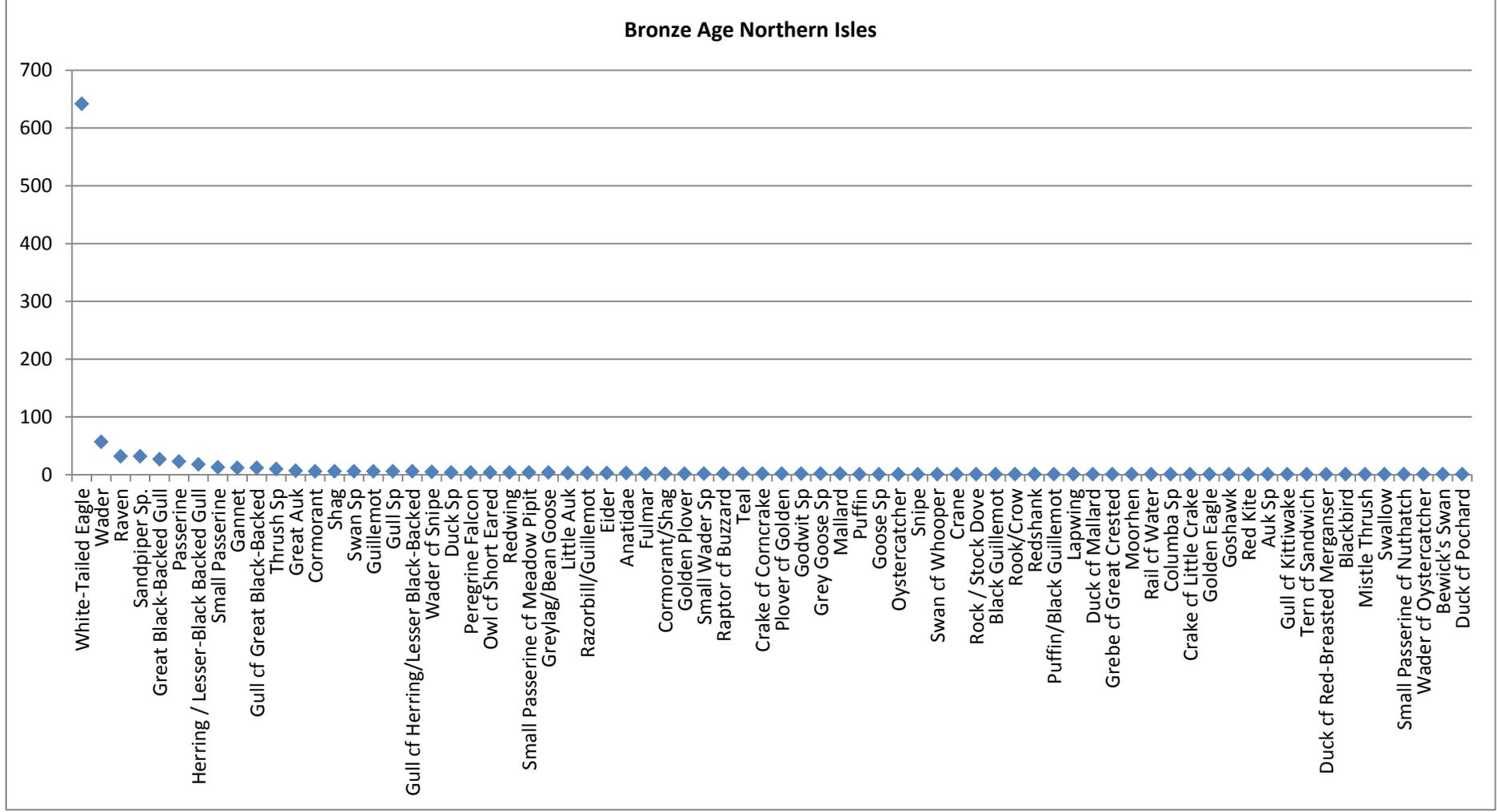


Figure 5.24: Species Abundances for Bronze Age Northern Isles (by NISP)



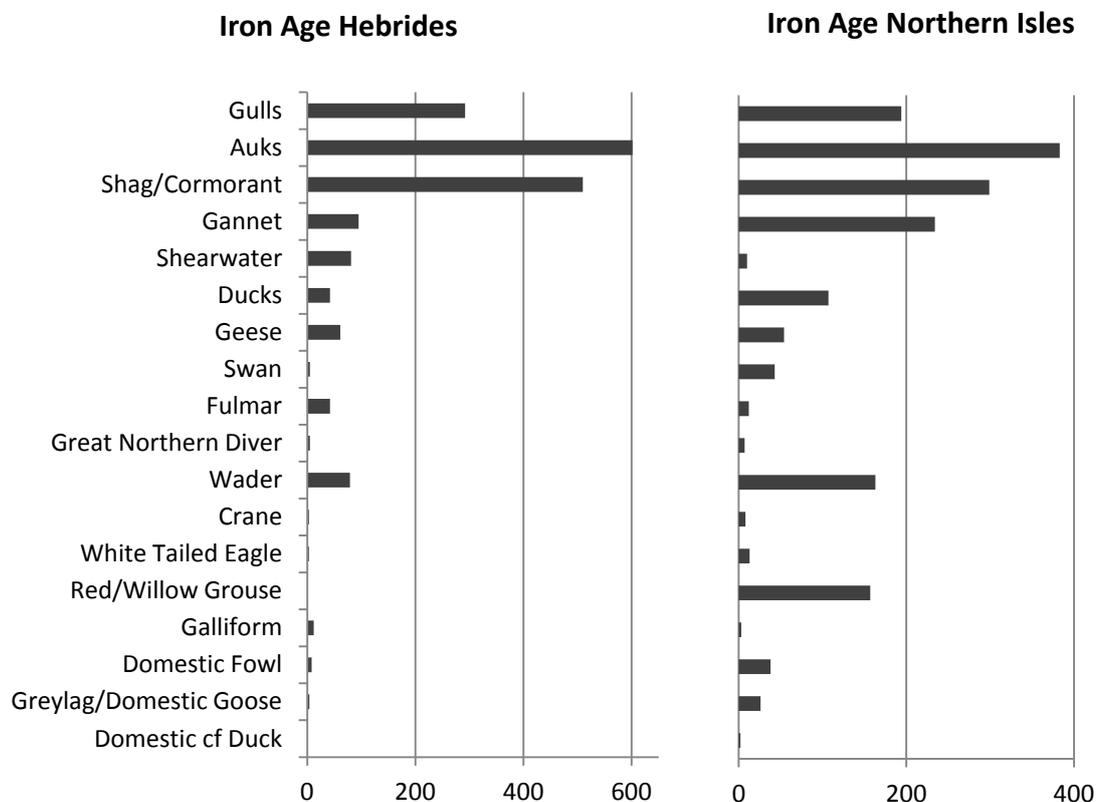
A wide range of waders also make a moderate contribution, some of which (as seen in Chapter 4.8) were butchered. This could indicate that some of the apparently non-anthropogenically assimilated (though not necessarily non-archaeological) waders in the Northern Isles assemblages such as those at Tofts Ness 4 or the Point of Buckquoy (Cuttings 5 and 6) could have been caught and eaten by human predators, but become indistinguishable from the animal-assimilated material. A range of ducks, geese, swans and landbirds such as red grouse were also captured; demonstrating that a variety of habitats were being used. Interestingly crane is present at two of the Hebridean sites; the aforementioned Cladh Hallan and at Ardnave on Islay in the Inner Hebrides. Ardnave also produced a worked bone which was *cf.* crane. These large and elegant birds would still have been relatively rare occurrences, and as such may have been processed specially, or held in high esteem (Albarella and Thomas 2002, 23-25 and 34-36; Boisseau and Yalden 1998, 482-500; Stroud *et al.* 2001a, 436). The presence of Manx shearwater and shelduck in small numbers in addition to the more common puffin would indicate that some of these were acquired from the burrow environment during nesting when they were easiest to catch (Nelson 1980, 118-127).

Iron Age

The Iron Age avian data came from a very large number of archaeological sites; 58 in total with 21 from the Northern Isles and 37 from the Hebrides, but around half of the sites had NISPs less than ten. In both of the island groups the shag was clearly a very important part of the fowling practices, with the cormorant also regularly exploited, but in slightly lower overall quantities (Figures 5.25 to 5.27). Shag forms an exceptionally large proportion of the site assemblage at Dunan Ruadh on Pabbay accounting for 74% of the NISP, and forms 73% of the remains on nearby Mingulay. Today the island of Mingulay is a Special Protection Area for this species, demonstrating a continuity of

these birds in this location and illustrating that the inhabitants were making logical use of the prolific birds around them (Stroud *et al.* 2001a, 55). The shag also forms around a sixth of the Bornais Mound 1 and Skail remains, and a fifth of the Scatness assemblage (Appendix Table A5.8). Despite this site specific concentration the shag occurs at 29 of the sites and cormorant at 28, demonstrating that they were repeatedly chosen for capture across the different Scottish Islands. Although both shag and cormorants were important in some of the earlier assemblages the rise in shag as a highly prominent individual species at a range of Iron Age assemblages could imply a greater focus on resident seabirds. The shag is today more numerous than the cormorant and its large colonies are more widely distributed across the Scottish Islands which indicates some breeding season usage and helps to explain its increase over the cormorant if being targeted during the summer nesting months (Stroud *et al.* 2001, 47-55).

Figure 5.25: Grouped main species for Iron Age (NISP) by location (nb varied scales)



Some individual sites do exhibit a high cormorant use such as Scalloway (a broch site in Shetland), and notably the Calf of Eday (the Iron Age settlement and reuse of a Neolithic chambered cairn) where cormorants dominated the entire faunal assemblage (Platt 1937a, 153-154).

The second most common individual bird in the Hebrides is the puffin, which also occurs at over 40% of the Hebridean sites (Figures 5.25 and 5.26 and Table A5.8). It dominates the assemblage from Rough Island 41B on the Shiant Isles, where in the Iron Age phases it accounts for over 90% of the NISP, and it forms nearly two thirds of the remains from Bostadh on Lewis (Best and Mulville 2010). The auk family overall constitutes a large portion of the NISP at around 30% of the Hebridean total Iron Age NISP. This use of auks is also visible in the Northern Isles where they account for nearly a sixth of the total NISP at 15%. In the Northern Isles puffins were prominent at Scalloway where they accounted for a quarter of the site NISP. However, in the Northern Isles fowling is less exclusively focused on auks with a larger body of other birds playing an increased overall role.

Shearwaters, 94% of which are Manx, occur more commonly in the Hebrides than the Northern Isles (Figure 5.25), forming 4% and <1% of the total NISPs respectively. As noted above, puffin was also more prolific in the Hebrides, suggesting that raiding of burrow nests was taking place within the Iron Age fowling practices. Whilst Manx shearwater may not have been specifically targeted, until the bird is out of the burrow the fowler does not know what he/she is catching. However, they are good sources of oil and would make a valuable catch. The Manx shearwater is semi-altricial, meaning that both adult and chick would be available from around the burrow for an extensive period of time (between 50 and 70 days) (Brooke 1990; Serjeantson 1998, 29).

Interestingly, the Northern Isles populations focused on gannets to a much greater degree and quantity than their Hebridean counterparts (Figures 5.25 to 5.27). Gannet is the second most common individual species in the Northern Isles (exceeded only by the probably largely intrusive starling). It is particularly prominent at Skail Deerness of Orkney where it formed 18% of the NISP. Gannet is present at a large proportion of the sites from both the Hebrides and Northern Isles, occurring at near 60% of the former and over 70% of the latter. However, out of the 21 Hebridean sites where it is present only three exceed a NISP of five, whereas in the Northern Isles eight out of the 15 sites which contained gannet have NISPs between 10 and 81. The Hebridean exceptions include the aforementioned Dun Vulcan (see Chapter Four) and the Late Iron Age phases at the Udal on North Uist. This again suggests that in the Western Isles when captured in larger numbers they may have been acquired non-locally to a site by specific fowling trips, whilst suggesting that in Orkney and Shetland more birds may have been available locally to allow more regular, larger capture. In the Northern Isles, and particularly in Shetland there are more modern breeding populations of gannets and other suitable locations which probably would have held more colonies or pairs in the past. For example, gannets have recently expanded their range to include Noup Cliff in Orkney, where over 600 pairs now breed (Stroud *et al* 2001a, 45-46; WWW19). This demonstrates locations in the main Orcadian islands where gannets can and will breed. Whilst there are several offshore islands and stacs housing gannets in the Outer Hebrides (such as Sula Sgier, The Flannan Isles, or the St Kildan sites of Stac Lee, Stac Arman or Boreray) many of the islands in the Hebrides such as the Uists or Barra have no suitable habitat and other sites, although appropriate, are today not occupied. As such unless the gannet bred more widely upon the main Hebridean islands in the past its capture would have necessitated seafaring (Serjeantson 2001, 48; Stroud *et al.* 2001a,

44-46; Webb *et al.* 1990, 115-123). (See section 5.5 for further gannet discussion.) Another species which is notably more captured in the Northern Isles is the red grouse, represented at six of the Northern Isles site, but for which there are no confident Hebridean identifications and only 8 'grouse sp' bones, although three black grouse bones were present (see Figure 5.25 'red/willow grouse', 'Galliform' entries, and Table A5.8). This might suggest a higher use of areas such as heath or moorland for fowling in the Northern Isles (Bramwell 1994, 153; Cramp 1980, 392).

Interestingly the fulmar is relatively well represented, particularly in the Hebrides where it occurs at 27% of the sites. Although this species sometimes enters deposits intrusively via its nesting habits, its presence at such a range of archaeological sites helps to clarify the extent of its past distribution and decline (explored further in section 5.5).

As discussed in section 5.3, domestic birds make their first appearance in the archaeological record during the later phases of the Iron Age and of these domestic fowl are most numerous (Figure 5.25). However, three probable domestic geese were present at Outer Hebridean Dun Vulcan. In the Northern Isles there is one *cf.* domestic goose, 25 'greylag/domestic' geese, and two *cf.* domestic ducks present at Howe and Skail.

Minor Iron Age species include short-eared owl, kestrel, skuas, red-throated and great northern diver. A species of gadfly petrel identified by DNA as Fea's petrel, previously unknown archaeologically in Britain, was identified by Dale Serjeantson at Killian Farm (Islay, Inner Hebrides) and Udal (North Uist Outer Hebrides). A single bone was also present at Brettness²⁴ (Rousay, Orkney, c.AD 650-850). Unrecorded in Britain until recently, today it breeds no closer than Madeira, indicating a wider past range (Brace *et al.* In Prep.; Serjeantson 2005, 235; Serjeantson 2014; Snow 1971).

²⁴ Brettness data not included in this thesis due to ongoing analysis .

Figure 5.26: Species Abundances for Iron Age Hebrides (by NISP). (Only NISPs of 3 and higher are shown)

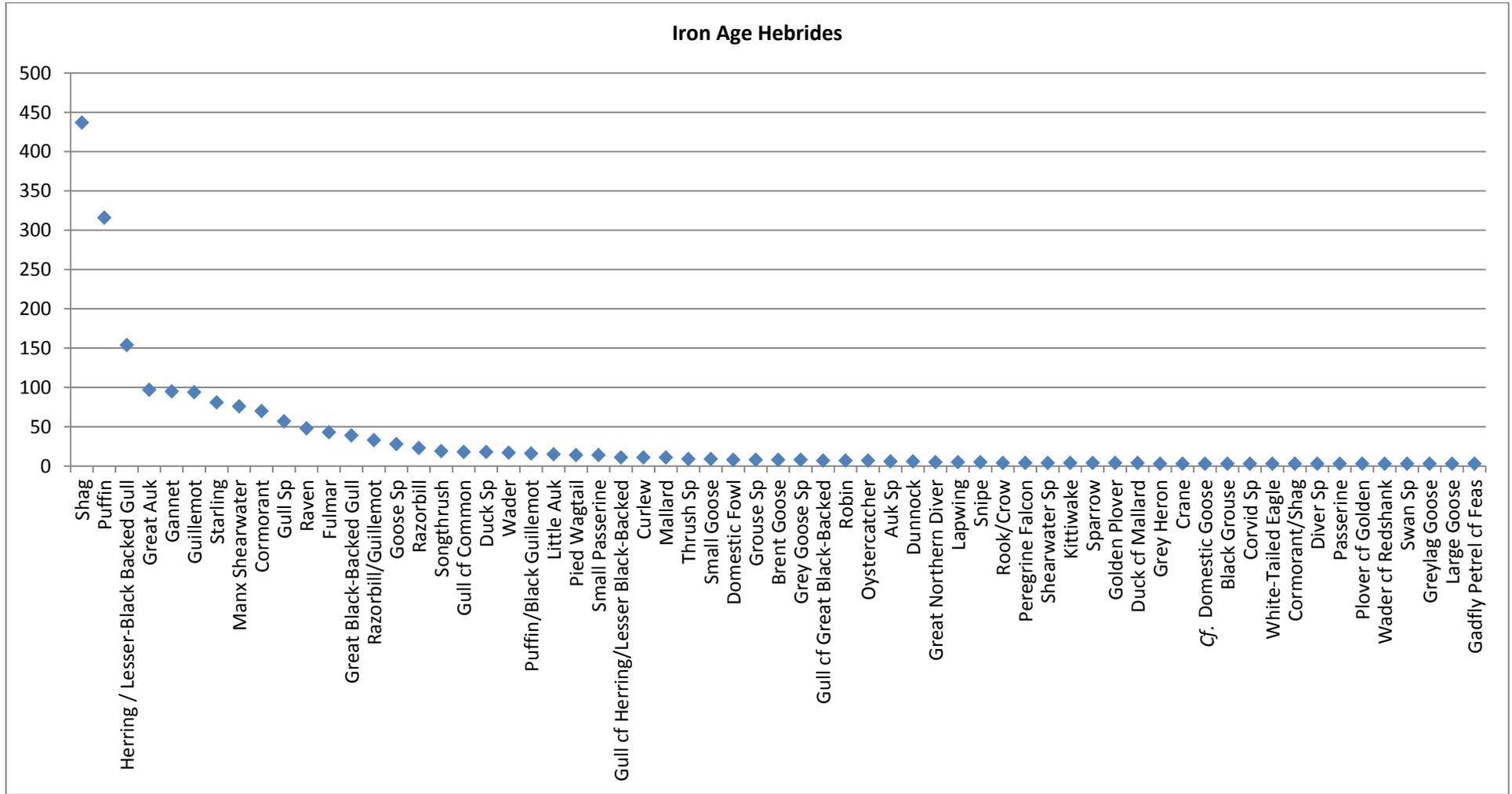
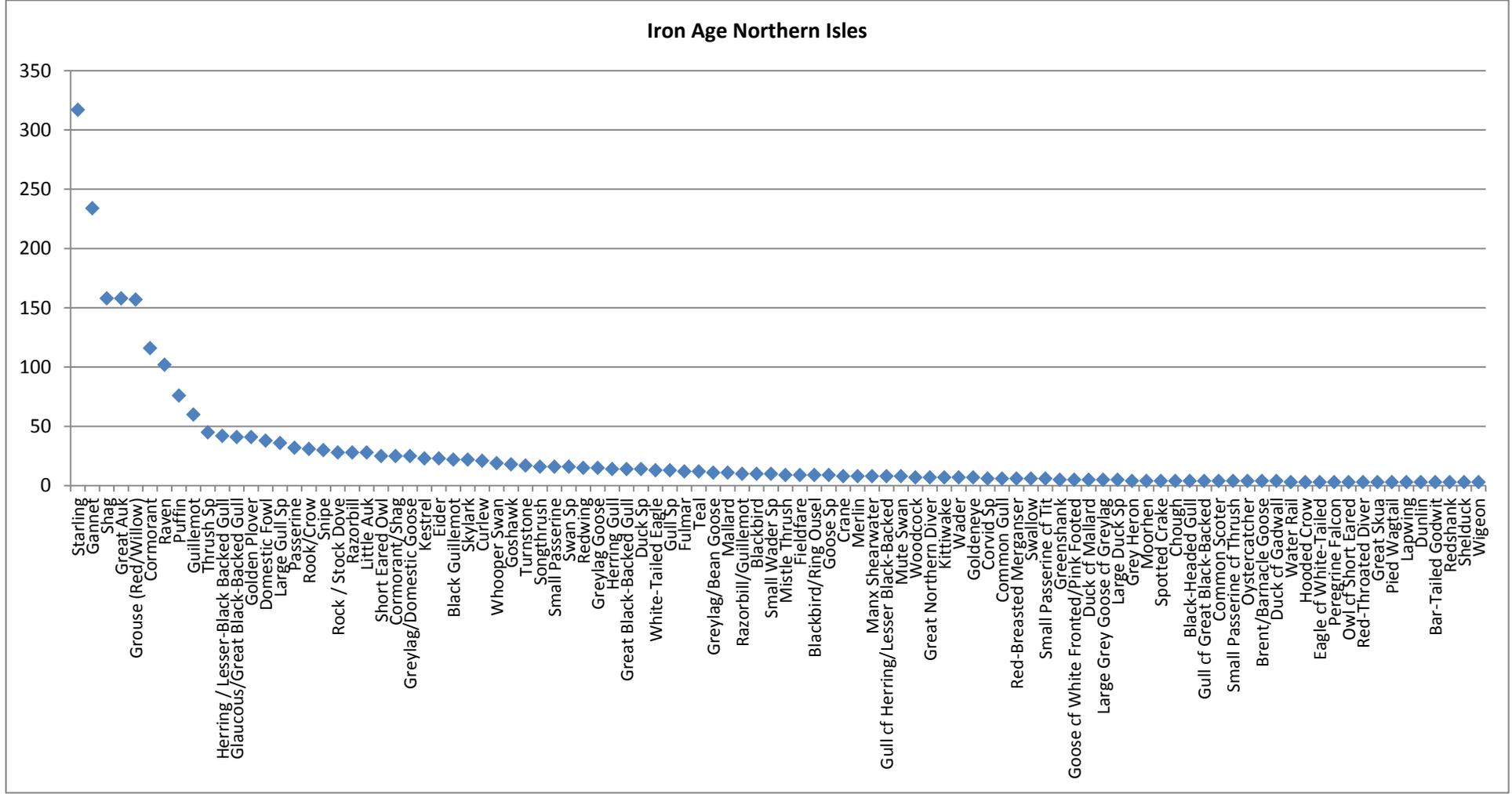


Figure 5.27: Species Abundances for Iron Age Northern Isles (by NISP). (Only NISPs of 3 and higher are shown)



Pre-Norse/Pictish

The Pre-Norse/Pictish assemblages considered are both small in number and in NISP (Table 5.7). Unfortunately although a small avian assemblage was also recovered from Room 5 Clifftop Settlement, Brough of Birsay, the NISP is unknown and thus excluded.

Table 5.7 Species Abundances Pre-Norse/Pictish Hebrides and Northern Isles (NISP)

SITE NAME	Bornais M2	Buckquoy	Old Scatness	Saevar Howe	
ISLAND GROUP	Outer Hebrides	Orkney	Shetland	Orkney	
PERIOD	PN/Pict	PN/Pict	PN/Pict	LIA/PN/Pict	Total
Gannet		27	2	2	31
Shag			15	1	16
Puffin	1	5	4		10
Great Northern Diver		9			9
Fulmar		6	2		8
Guillemot	1	7			8
Curlew		8			8
Herring / Lesser-Black Backed Gull			5		5
Manx Shearwater	1	3			4
Great Black-Backed Gull			4		4
Cormorant		1	1	1	3
Large Gull Sp			3		3
Moorhen			2		2
Domestic Fowl		1		1	2
Razorbill/Guillemot			1	1	2
Gull <i>cf.</i> Common	2				2
Eider			2		2
Thrush Sp		1	1		2
Passerine			2		2
Turnstone		2			2
Large Grey Goose <i>cf.</i> Greylag	2				2
Galliform <i>cf.</i> Domestic Fowl	1				1
White-Tailed Eagle	1				1
Osprey		1			1
Herring Gull				1	1
Glaucous/Great Black-Backed Gull		1			1
Black-Headed Gull		1			1
Small Gull Sp		1			1
Black Guillemot		1			1
Little Auk		1			1
Great Auk		1			1
Auk <i>cf.</i> Great			1		1
Starling		1			1
Small Passerine <i>cf.</i> Thrush	1				1
Small Passerine <i>cf.</i> Starling			1		1
Snipe			1		1
Small Wader Sp	1				1
Wader <i>cf.</i> Snipe	1				1
Goose <i>cf.</i> Domestic	1				1
Duck/Goose			1		1
Wigeon		1			1
Duck <i>cf.</i> Teal			1		1

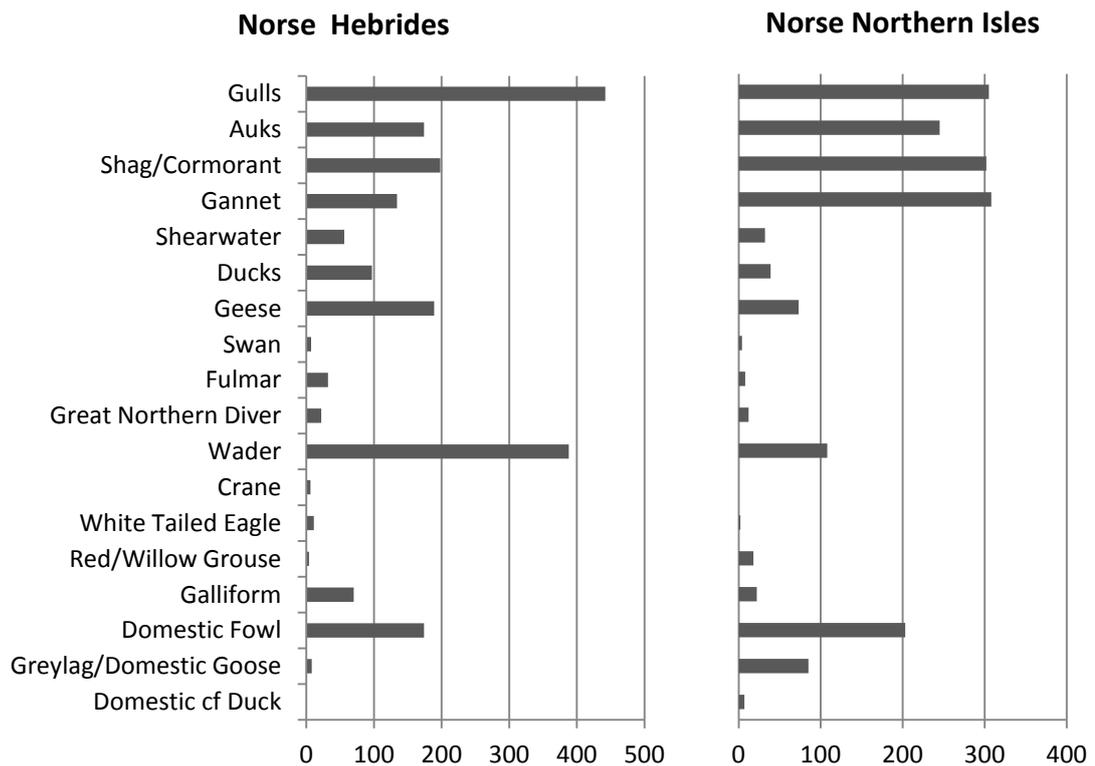
As in the comparable Late Iron Age assemblages, the Pre-Norse/Pictish dataset reveals a small-scale introduction and uptake of domestic birds, including chicken and possibly goose, which occurred alongside the continued exploitation of the wild avian resources afforded by the island locations. In the Northern Isles the gannet and the shag are prolific, both of which would likely have been caught during the breeding season, although the resident shag may be captured at multiple points of the year. Meanwhile in the small Hebridean assemblage gulls and auks are prominent; again these may have been taken from the nest. However even this small Pre-Norse/Pictish assemblage indicates use of birds year-round through the presence of winter visitors such as the great northern diver, turnstone and little auk.

Norse

The Norse period sees one of the most substantial changes to bird use in the Scottish Islands through a substantial increase in domesticates for the first time on both sets of islands (see Figure 5.28). These include geese and ducks in small numbers, with domestic fowl or chickens as the major domesticate. Domestic fowl occur at nearly 90% of the Norse sites and accounts for 8% of the overall Hebridean NISP and 10% of the Northern Isles NISP. They are the second most common individual species overall in both the Hebrides and the Northern Isles. However, although the rise of domesticates was clearly an important part of the avian-human relationships of these island populations, they had a fairly limited impact on the overall fowling profile both in general and at many individual sites. At nearly three quarters of the total sites they form between 0-10% of the assemblage. Of the remaining sites, at six domestic fowl form between 10-15% of the NISP, and at an exceptional four sites they form 22-31% of the NISP. The highest representation of domestic fowl (31% of NISP) is from Late Norse

Earl's Bu, Orkney, whilst at Udal VII-IX (Lewis, Outer Hebrides) and Tuquoy (Orkney) they made up 25% of the site NISP, and at Middle Norse Bornais Mound 3 (with a very small NISP of 9) they formed 22%. The presence of probable domestic geese also increases in the Norse period, with them occurring on South Uist in the Hebrides (see Chapter Four), and at a fifth of the Northern Isles sites, where these geese form a larger part of the assemblage, with one being a certain example from 9th-12th century Buckquoy (Figure 5.28 and Table A5.9). Within the Norse data seven bones of possible domestic ducks were noted at two sites; Tuquoy and Jarlshof (both in the Northern Isles), suggesting that the domestic resource base could have been expanding.

Figure 5.28: Grouped main species, Norse period (NISP) by location (nb varied scales)



Interestingly one bone of pheasant (an introduced species) was recorded at Earl's Bu, and another Galliform *cf.* pheasant was noted in the c.10th to 11th century layers at Jarlshof. However, in both cases no mention is made by the authors of the rarity of the pheasant at this date, or the significance of this find, which could make the

identification slightly questionable. Whilst its occurrence is by no means impossible, the pheasant was an imported exotica prior to its establishment in Britain c.1066 and although it increased significantly during the Medieval period, its introduction to Scotland (like with the chicken) is thought to have occurred later than in England (Dobney *et al.* 2007, 226-229; Poole 2010, 159-160; Yalden and Albarella 2009, 101-107). If correctly identified, and not confused with another Galliform, these two fragments would represent the earliest pheasant bones in the Scottish Islands (Lever 1977, 337-8; Poole 2010, 158).

However, alongside these increased new arrivals many of the key seabird species exploited in the earlier periods remained important components of the Norse avian assemblage, demonstrating that while the increase of domesticates would have provided a valuable managed resource, the majority of the avian resources (in terms of NISP) came from wild species. The gannet continues to occur frequently both in terms of its site distribution and NISP, as do the shag and cormorant. These were important species in the preceding Iron Age assemblages, indicating a degree of fowling continuity probably based on species availability, existing fowling practices and transferable knowledge (e.g. of large breeding colonies). The gannet is the most commonly occurring individual species in the Northern Isles, where it occurs at 85% of the sites and constitutes over 15% of the total period NISP. In the Hebrides it also occurs at over 75% of the sites, but only forms 6% of the NISP by comparison. Again at the majority of the Northern Isles sites they are represented by over 10 fragments, whereas in the Hebrides the majority have under 10 present, indicating that these birds may have been harvested from breeding colonies (where highly numerous) or from occasional birds or isolated breeding pairs/groups (where they are only represented in small numbers).

Figure 5.29: Species Abundances for Norse Hebrides (by NISP). (Only NISPs of 3 and higher are shown)

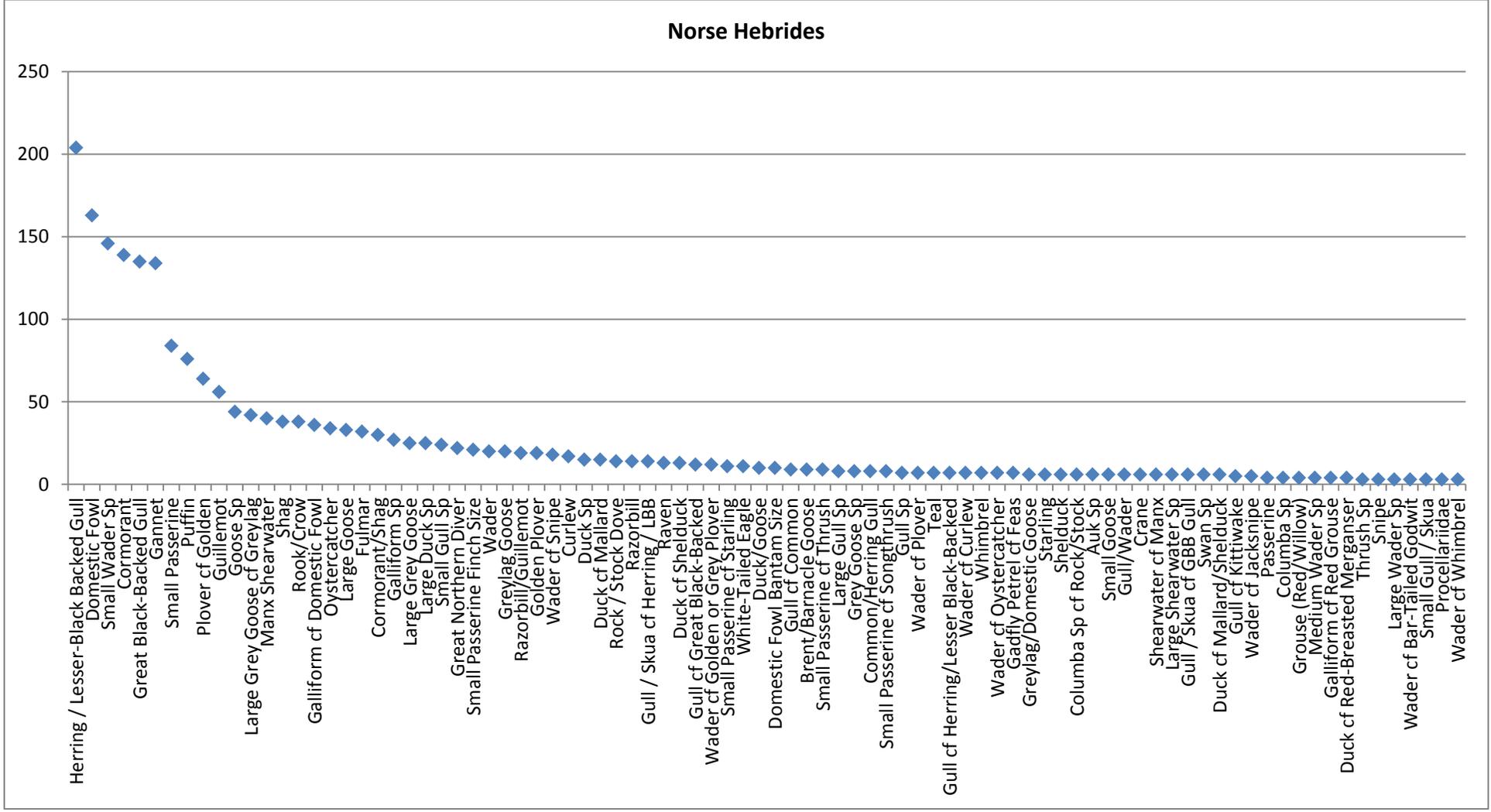
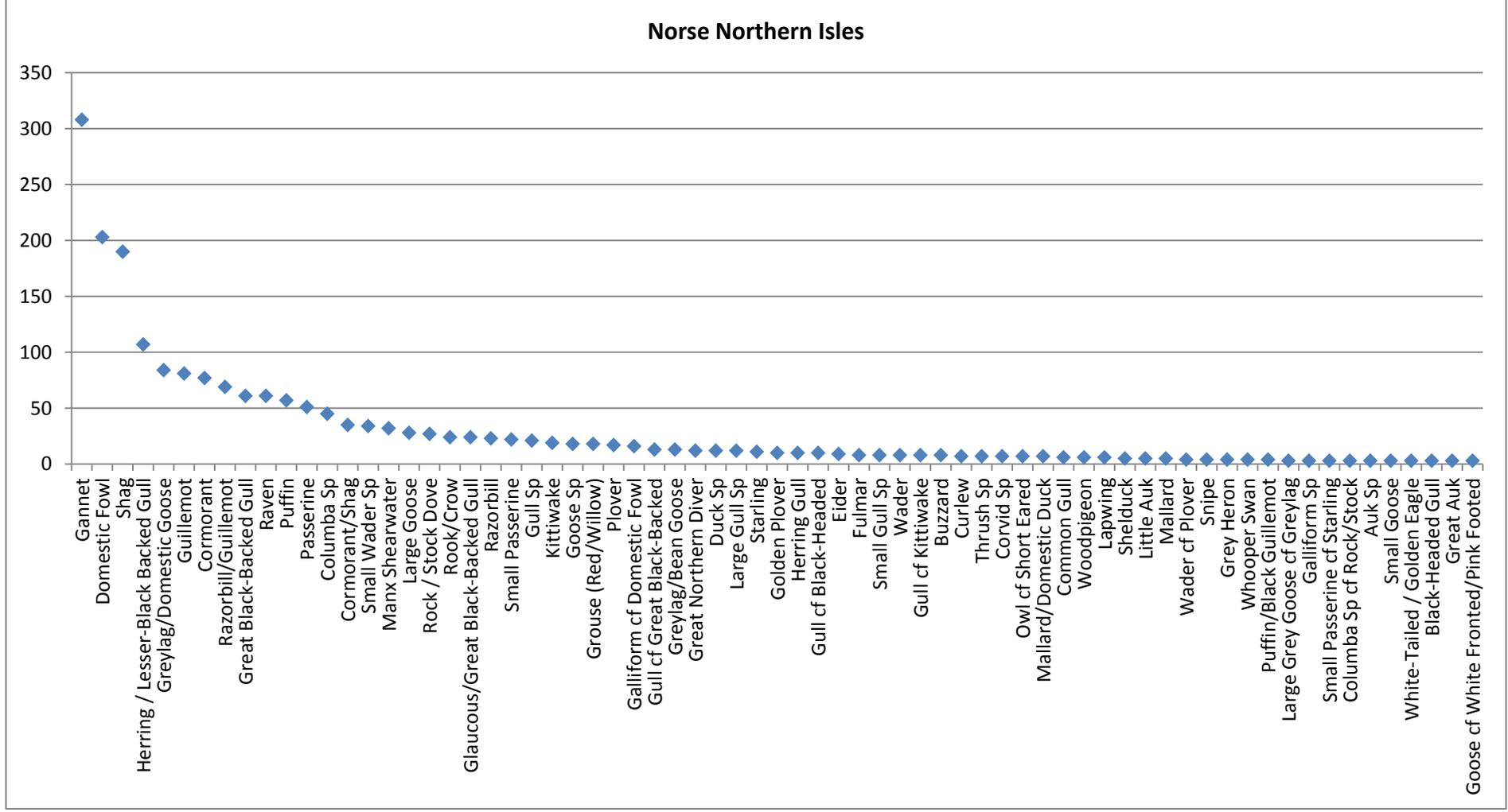


Figure 5.30: Species Abundances for Norse Northern Isles (by NISP). (Only NISPs of 3 and higher are shown).



Both the shag and the cormorant remain an important part of Norse fowling (Figure 5.28). The shag is the third most common individual species in the Northern Isles, but interestingly is much lower represented in the Hebrides (Figures 5.29 and 5.30). In the Hebrides the cormorant occurs much more frequently than the shag having over three times the NISP (Figure 5.29) despite shag being very important in the Iron Age data²⁵. Whilst as discussed the past populations may not have differentiated between these species, the contrast is interesting. The Hebridean assemblages in the Norse period see a diversification with a higher use of waders and waterbirds compared to the very seabird focused Iron Age. Cormorants come inland, particularly during the winter, whilst shags remain coastal (although both return to land each night to roost). This could suggest that the higher Hebridean use of cormorants in the Norse period may be linked to the increased use of inland freshwater areas associated with waterfowl capture.

Gulls form a large proportion of the bird remains from the Norse Hebrides, particularly the herring/lesser black-backed and the great black-backed, the former of which was the most frequently occurring Hebridean classification. As seen in Chapter Four they were particularly dominant at Bornais, however they also form 5% of the Udal assemblages, and a quarter of the small assemblage from Bostadh. In both the Norse Hebrides and the Northern Isles these large gulls form a higher proportion of the overall assemblage than in the earlier periods, even though gulls were dominant at Iron Age Bornais. For example these large gulls form 16% of the Hebridean Norse NISP compared with 10% in the Iron Age, while in the Northern Isles they form 11% of the Norse NISP as opposed to 6%. Whilst this is difficult to interpret it could theoretically result in part from gull scavenging behaviour of food waste, particularly when the importance of

²⁵ See Chapter Eight: Discussion for further discussion of the shag/cormorant representation during the Iron Age and its complexities.

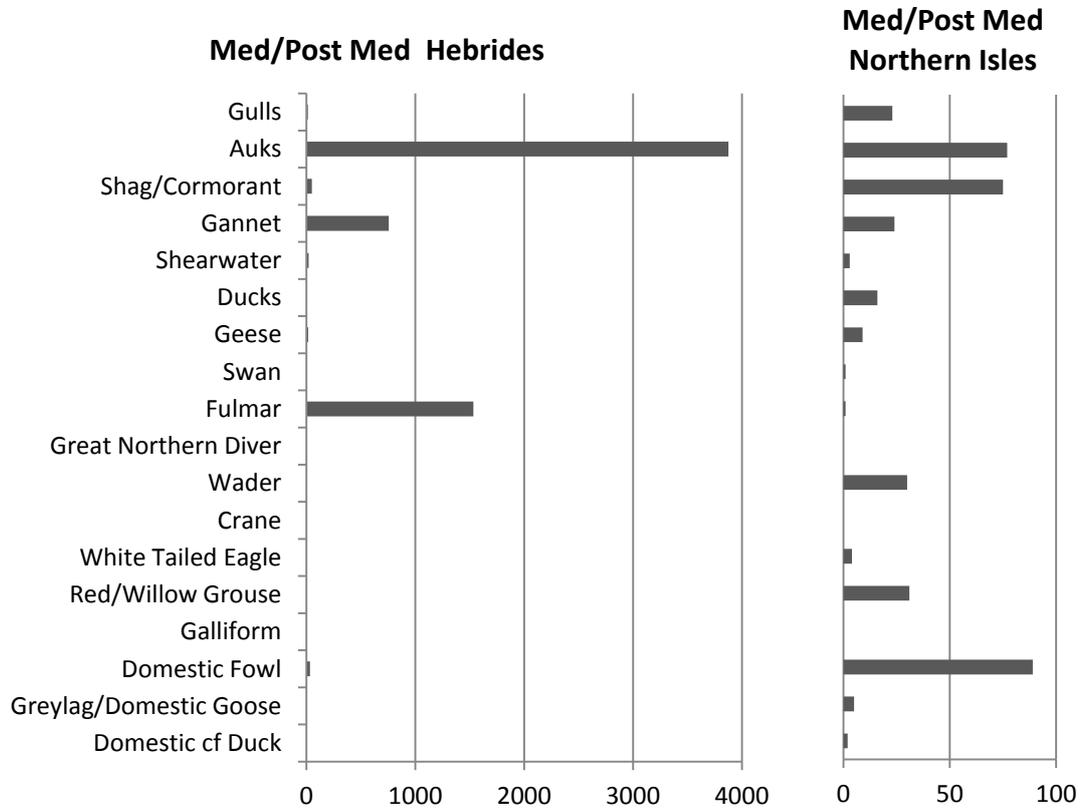
Norse fishing is considered and its resultant processing. Such activities would have attracted scavengers which could then be killed and eaten. A wide range of minor species are represented in both island groups including eider, white-tailed eagle, black geese, little auk, divers, swan, and corvids such as the raven

Medieval / Post-Medieval

The small number of Medieval and Post-Medieval assemblages allow an insight into more recent fowling practices continuing after the main archaeological periods covered herein. Furthermore, in the case of the Outer Hebrides specifically, they provide the unusual opportunity for direct comparison between the historical sources and the archaeological data at the aforementioned site of St Kilda.

In the Northern Isles although there is a continued use of auks, shag, cormorant and gulls, the domestic fowl occurs most commonly, with other domestic species, ducks and geese, represented only by single bones. The small number of medieval sites considered here suggest that the wild resources formed a lesser part of avian subsistence strategies in this period. However, there are still a wide range of species represented in the Northern Isles assemblages, approximately 49 as a minimum (from a total NISP of 494). This would suggest occasional use of a wide range of species on a minor opportunistic basis to supplement the domestic birds and mammals, but in conjunction with a small scale, more focused fowling period targeting breeding seabirds such as the gannet. The red grouse forms over 6% of the NISP, and was particularly targeted at Howe, where it also was a key Iron Age species. This site shows an increase in domestic fowl and they account for over a quarter of the NISP, whereas in the Iron Age at this site they formed less than one percent of the site NISP.

Figure 5.31: Grouped main species for Medieval/Post-Medieval period (NISP) by location (nb varied scales)



The Hebridean sites present a rather different picture and include data from the Shiantis and St Kilda, both of which are renowned for their birdlife. The St Kilda material dominates the Hebridean assemblage, and as was seen earlier, it is nearly entirely comprised of seabirds. Of these the puffin is the most common individual species followed by the fulmar, guillemot, gannet and razorbill. Today St Kilda houses the largest breeding populations of gannets, fulmar and puffins, showing the population made good use of these available resources and indicating that these populations were also consistently large in the past (Fisher 1941; Stroud *et al.* 2001a, 44-46, 32-34, 397-400). The largest avian assemblage from St Kilda comes from Blackhouse 8. This produced an avian NISP of 5,353 which was almost entirely composed of five key food

species: fulmar, puffin, gannet, guillemot and razorbill. Puffin formed nearly half this NISP, fulmar 20% and gannet 11%. The next biggest assemblage came from a rubbish pit associated with Blackhouse G, within which fulmar is again dominant accounting for over 82% of this assemblage, followed by puffin at 11%. The written evidence indicates that fulmar was a preferred species for eating, oil and feathers from at least the 17th century and it became the main focus of fowling from the 18th century, particularly after its oil and feathers came into demand from the mainland (Table 5.8) (Harman 1997, 218-220; MacAulay 1764, 154; Maclean 1992, 67 and 92; Sands 1877, 47-59). The smaller but easy-to-gather puffin was also consistently exploited in large numbers.

Within the large St Kildan Blackhouse 8 assemblage a sizable 22% of the overall fulmar remains came from immature birds, with these juveniles making up a third of the fulmar remains in some phases. Writers describing life on St Kilda state that the young fulmars were better eating than their parents and were pleasantly palatable even to the unaccustomed diner. A school teacher sent to the island writes in 1889 that:

“The fulmar when young and fresh is best roasted. Indeed, when properly done this way and when one has the nerve to start, it tastes fairly well.

Something like young pork, but as tender as chicken” (Ross, 1889).

The young fulmars also remain in the nest for 7 weeks, and prime harvest time was just before they learned to fly (and were at their fattest) (Mackenzie, 1911, 397-402; Maclean 1992, 93-95). The importance of young fulmar in this location is clear both archaeologically and historically, particularly when it is considered that the preservation conditions mean poorer survival of immature bones. As discussed the fulmar had a historically constricted breeding range prior to its expansion in the 19th century, but the archaeological evidence suggests that the fulmar bred more widely in the past. The

value of this bird to human predators and the myriad of uses to which it could be put would have made it a prime target for exploitation. Combined with its inability to relay (should its egg be lost), over exploitation of this resource would have been one factor in its decline and constriction of breeding sites. Ironically, their most concentrated breeding colony (St Kilda) was the location where (at least in modern times) they were most heavily persecuted. However, the size of this colony and the St Kildans' self-imposed restrictions on not taking the eggs provided a degree of sustainability and population buffering (Maclean 1992, 93).

St Kilda also provides evidence for changes in species use over time both archaeologically and in the written literature. Interestingly within the pre-blackhouse phases of the Black House 8 assemblage (which incorporated Late Medieval data) gannet was more dominant than fulmar, reflecting the documented early preference for gannet before the fulmar in the written material (Maclean 1992, 67) (Appendix Table A5.10 and Table 5.8). The puffin has been an important source of meat and feathers for many of the North Atlantic island communities in Scotland, Iceland and the Faroe Isles. By the late 19th century on St Kilda the demand for feathers was such that sources such as Connell (1887,123) record that the puffins were then being killed primarily for this resource, with carcasses often being discarded and used to fertilise the soil. Whilst a proportion of the killed puffins in this specific context were still eaten (with perhaps the very small, not-worth-processing birds being used for fertiliser) it demonstrates that particular situations can create very different and unexpected patterns of bird use, particularly in Post-medieval and Modern examples (Harman 1996, 99). The St Kildan bone material indicates both the frequent exploitation of these important birds and continued consumption of at least some of the birds through their presence in house and

rubbish pit assemblages (see Appendix Table A5.10).

Therefore combining the archaeological and the historical data together can both help validate the interpretation of the avian bones, and also clarify or provide additional information on how these resources were used. For example, at Blackhouse 6 on St Kilda the small bone assemblage was dominated by birds, of which gannet was the most common bird in this context, followed by fulmar. At least five left and five right gannet wings are represented. Harman uses the elemental representation and butchery to interpret some of the gannet wing concentrations as brushes which were used around the house; a use which is supported by the historical sources with several mentions of these wing-brushes being employed around the hearth, for example in cleaning griddles (Harman 1996, 36).

Table 5.8: Number of birds captured on St Kilda recorded in historical documents (Based on example from Harman 1997, 220).

Species	Date	Birds taken	Source
Gannet	1696 - annual take	22,600 consumed	Martin Martin 1698/1753
Gannet	Late 17 th C	5,000-7,000	Martin Martin 1698/1753
Gannet	1823 - 1 expedition	1,600	MacDonald 1823, 27
Gannet	1827 - 1 expedition	800	Kennedy 1932, 286
Gannet	1830-1843 - annual	<4,000	MacKenzie, 1911, 48-9
Gannet	1877 – one man 1	600	MacDiarmid 1878, 252
Fulmar	1830-1843 - annual	12,000 young	MacKenzie, 1911, 42
Fulmar	1830s - annual	18,000-20,000	MacLean 1838, 9
Fulmar	1885	6,000-9,000 preserved	MacNeill 1885, 7
Fulmar	1897	8,960 annual take	MacPherson 1897
Fulmar	1902 (+- some years)	7,500-9,000 young	Wigglesworth 1903, 55
Oil Fulmar	1875	4,530 pints exported	Sands 1878, 46
Puffin	1800–1850 - annual	20,000 – 25,000	Maclean 1992, 99
Puffin	Post 1850 ?	10,000	Maclean 1992, 99
Puffin	1876	89,600	Sands 1878, 89
Eggs: Puffin	Early 18 th century	32,400 from one 'rock'	MacLeod 1756-75; Harman 1997
Eggs	1690s	16,000 given as a gift	Martin Martin 1698/1753

5.5 Individual Species – A Closer Look

Great Auk

The recent extinction of the great auk is one of the most remembered and discussed avian losses, partially because of the significant role that overexploitation played in its extinction (Serjeantson 2001, 43). Unfortunately for the great auk it was large, apparently very good eating and flightless. It was also very ungainly on land, meaning that it could not easily run to elude capture, even if other birds were being killed around it. There are even accounts of the ill-favoured bird literally being herded into boats for the slaughter (Grieve, 1885, 5). The great auk only visited land to breed for around six weeks each year between May and June, they paired for life and laid a singular non-replaceable egg each year (Love 2007, 25; Martin 1753, 34-36; Mudie 1835, 273-274; Parkin 1894, 8). These eggs were large, and occasionally left unattended when the female went to sea to feed, rather than the male provisioning her (Mudie 1835, 275). Sources such as Martin indicate that like the razorbill / guillemot, great auk chicks were soon taken to sea (Love 2007, 25; Martin 1753, 27).

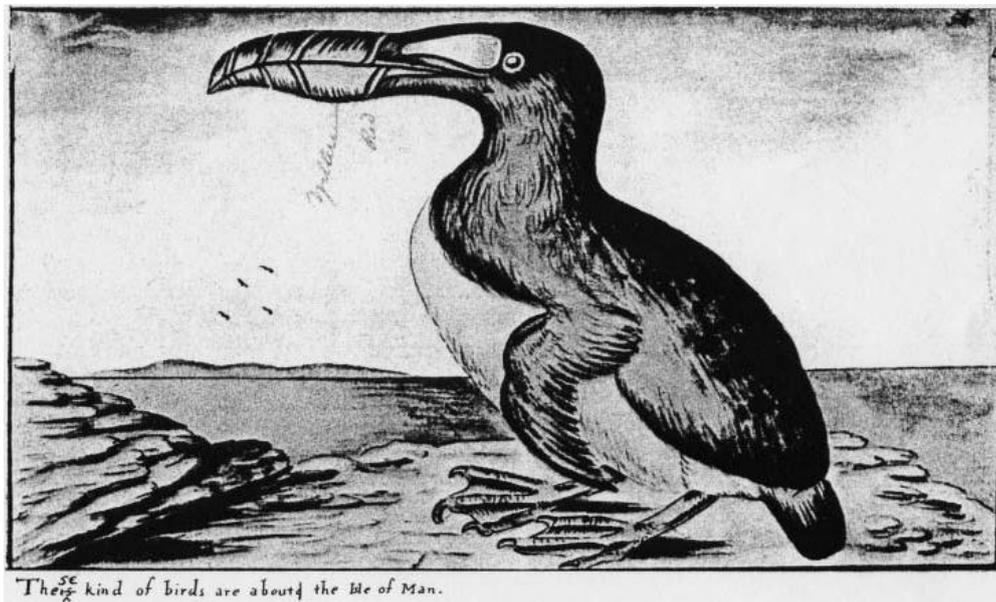
It was in many senses a colony breeder, however, it was not exclusively so and had been known to breed in small groups or pairs even when larger colonies were still in existence (although this could in part be due to declined numbers in specific areas) (Smith 1879, 100). However, large colonies were exceedingly limited in number and very location dependent (due to the bird's lack of flight and poor mobility on land); interestingly the North American/Canadian colonies (such as on Funk Island, but also Grand Banks off of Newfoundland and around Labrador) were extremely large in comparison to those found in Britain which have never been documented as reaching

the size of those found in the Americas (Grieve 1885, 8; Lucas 1890, 494; Parkin 1894, 7; Serjeantson 2001, 44). The colonies could also be taxonomically mixed; breeding alongside other auks in particular (Gaskell 2000, 142; Grieve 1885, 19; Harvie-Brown and Buckland 1888). Since some historical sources do not distinguish adequately between the various auks, the size of colony (particularly within Britain) should be questioned; great auks are unlikely to have been as numerous in Britain as other very social breeders such as gannet and puffin, although calculations of their past frequency is exceedingly problematic (Hardy 1888, 382; Grieve 1885, 129-131; Smith 1879, 95). The historical documentary and illustrative evidence for great auk demonstrates that they did breed around the coast of Britain, but the locations revealed by this strand of data are limited. Only two locations in Britain have been historically described as housing great auk colonies (on St Kilda and Orkney) (Grieve 1885, 4; Mudie 1835, 273-274; Parkin 1894, 8-10). The other British locations in which they occur and are historically documented indicate individual pairs or small clusters, not colonies ripe for targeted exploitation. Some of the references are also notably tenuous and require cautious interpretation. Furthermore (and most importantly from an archaeological perspective) the historical material only depicts the breeding habits and distribution of a seriously reduced population, sometimes in their last phases of existence.

Outside of Scotland the British locations outlined in the historical sources include the Isle of Man and Lundy. Their historical presence on the Isle of Man is indicated by a 1652 drawing by Daniel King which states: “Theis [These] kind of birds are aboute the Isle of Man” (see Figure 5.32) (Baldwin 2010, 156; Baldwin 2011; Cullen and Jennings 1986, 184). Also on the Isle of Man, fishermen report seeing the bird at Port St Mary in the late 18th to early 19th century (Gawne 1944, 9-11). In 1865 The Reverend Heaven

wrote a letter which suggested that great auks had recently laid on the island of Lundy in 1838/39. Heaven's men had taken a very sizable egg which was identical to that of a guillemot but twice the size from a location visited for several years by the 'King and Queen Murre' (Baldwin 2009, 79- 84; Carter 1940, 569-571; Heaven 1866, 100-102).

Figure 5.32: Daniel King's 1652 illustration of a great auk. From Baldwin 2010, 163, which was attained: *Courtesy of Manx National Heritage; © The British Library Board*



In Scotland records also indicate that a pair of great auks appeared near Papa Westray in 1816, perhaps signifying that they were breeding on the more suitable Holm of Papa Westray islet (Yalden and Albarella, 167). Once again some of the best literary evidence for great auk breeding locations and habits is focused on St Kilda. Martin Martin writing in 1698 documented that the species bred upon the islands and that according to the islanders it had a short on-land breeding season of about six weeks and soon returned to the sea with their young (Martin 1753, 27; Mudie 1835, 273-274). Pennant in 1768 (517) wrote that the great auk was known to breed albeit infrequently in the Faroes, Iceland, Greenland, Newfoundland, Norway and in a “certain number of years” on St Kilda (Pennant 1768, 517; Smith 1879, 101).

The archaeological evidence from North Atlantic island sites suggests that the great auk bred more widely in the past than the few documented accounts, and as such the osseous material dramatically bolsters the written and drawn sources. All of the archaeological great auk specimens point to breeding birds (pairs), since as mentioned the flightless great auk only came ashore to breed, (being highly pelagic at other points of the year) and was exceedingly vulnerable to capture on land. Summer would have been the most probable time for human capture; their prowess at sea makes capture outside of the nesting season less likely (though by no means impossible).

Great Auk was identified at 51 sites/period subdivisions in the Scottish Islands, extending from the Mesolithic to the Norse and possibly beyond. Within the data there are clear temporal trends indicating a large decline in great auk numbers and distribution by the Late Iron Age (Tables 5.9 and 5.10). In terms of distribution by frequency of occurrence, the great auk was present at all the Mesolithic sites and 44% of the Neolithic sites. However, by the Norse period only 8% of sites contain great auk bone (Table 5.9). The great auk frequency also declines by NISP as a proportion of the avian assemblage over time, ranging from 6% of the period NISP in the Mesolithic and Iron Age to a low 0.07% of the Norse NISP.

Table 5.9: Great auk frequency in the archaeological record by period. Number of sites represented at, sites as a % of total sites, and great auk as % of each period's NISP

	No site present at	% of total sites	% of Period NISP
Mesolithic	6	100	6
Neolithic	7	44	5
Bronze Age	6	35	2
Iron Age	23	40	6
Pre-Norse/Pictish	2	50	1
Norse	3	8	<1 (0.07)

Table 5.10: Great auk NISP as % of the site NISP (where present), in period order

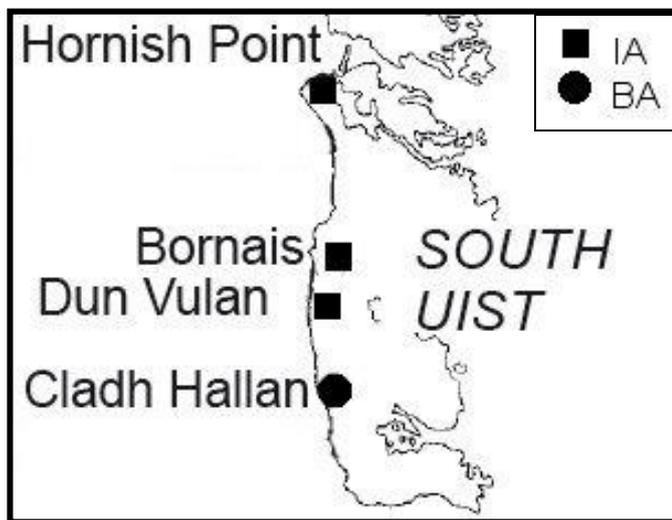
SITE NAME	ISLAND	ISLAND GROUP	PERIOD	GREAT AUK	SITE NISP	% SITE NISP
Cnoc Coig	Oronsay	Inner Hebrides	Mes	58	400	15
Caisteal nan Gillean	Oronsay	Inner Hebrides	Mes	18	22	82
An Corran	Skye	Inner Hebrides	Mes	17	124	14
Sand	Inner Sound	Inner Hebrides	Mes	11	1288	1
Cnoc Sligeach	Oronsay	Inner Hebrides	Mes	1	13	8
West Voe (Preliminary)	Mainland	Shetland	Mes	1	9	11
Knap of Howar	Papa Westray	Orkney	Neo	35	254	14
Tofts Ness 1 & 2	Sanday	Orkney	Neo	23	211	11
Links of Noltland	Westray	Orkney	Neo	6	331	2
Skara Brae	Mainland	Orkney	Neo	5	139	4
Knowe of Ramsay	Rousay	Orkney	Neo	1	17	6
Holm of Papa Westray	Holm of Papa	Orkney	Neo	1	2	50
Pierowall Quarry	Westray	Orkney	LNeo	1	83	1
Jarlshof Tr 1	Mainland	Shetland	LNeo/ EBA	1	16	6
Udal	North Uist	Outer Hebrides	Beak	1	2	50
Northton	Harris	Outer Hebrides	Beak	1	15	7
Tofts Ness 3	Sanday	Orkney	EBA	7	118	6
Udal	North Uist	Outer Hebrides	EBA	2	16	13
Cladh Hallan	South Uist	Outer Hebrides	LBA	14	307	5
Udal	North Uist	Outer Hebrides	LBA	1	4	25
Howe	Mainland	Orkney	EIA	20	87	23
Udal	North Uist	Outer Hebrides	EIA	5	40	13
Howe	Mainland	Orkney	MIA	25	507	5
Cnip	Lewis	Outer Hebrides	MIA	11	36	31
Udal	North Uist	Outer Hebrides	MIA	8	141	6
Sloc Sabhaid Baile Sear	Baile Sear	Outer Hebrides	MIA	4	30	13
Scalloway	Mainland	Shetland	MIA	2	3	67
Dun Vulcan	South Uist	Outer Hebrides	MIA / LIA	43	384	11
Howe	Mainland	Orkney	MIA / LIA	2	84	2
Jarlshof	Mainland	Shetland	MIA / LIA	2	4	50
Ceardach Ruadh Baile Sear	Baile Sear	Outer Hebrides	MIA / LIA	5	50	10
Dunan Ruadh (PY10)	Pabbay	Outer Hebrides	MIA / LIA	1	360	<1
Broch of Ayre	Mainland	Orkney	M?IA	1	14	7
Skaill Deerness	Mainland	Orkney	IA	61	442	14
Milla Skerra Sandwich	Unst	Shetland	IA	28	113	25
Sollas wheel house B	North Uist	Outer Hebrides	IA	5	31	16
Hornish Point	South Uist	Outer Hebrides	IA	2	12	17
Sollas wheelhouse A	North Uist	Outer Hebrides	IA	2	5	40
Pool	Sanday	Orkney	IA	1	8	13
Howe	Mainland	Orkney	LIA	15	490	3
Bornais M1	South Uist	Outer Hebrides	LIA	9	315	3
Udal XI XIII	North Uist	Outer Hebrides	LIA	2	109	2
Pool	Sanday	Orkney	LIA	1	109	1
Brough Road (areas 1, 2 & 3)	Mainland	Orkney	LIA / N	1	135	1
Pool	Sanday	Orkney	LIA / Vik	1	368	<1
Old Scatness	Mainland	Shetland	LIA?/PN/Pict	1	49	2
Buckquoy	Mainland	Orkney	PN/Pict	1	79	1
Skaill Deerness	Mainland	Orkney	Vik	1	240	<1
Newark Bay	Mainland	Orkney	Norse	1	35	3
Pool	Sanday	Orkney	Norse	1	153	1
Howe	Mainland	Orkney	Recent	9	218	4

Within this a greater degree of temporal resolution can be seen (Table 5.10). The Iron Age appears to contain extensive exploitation in the Early and Middle phases, but by the Later Iron Age the decline is in full swing. For example at Howe on Orkney the great auk is an important Iron Age bird. However, it falls from 23% of the Early Iron Age assemblage, to 5% in the Middle Iron Age and then to 3% in the Late Iron Age. This is despite the Middle and Late Iron Age assemblages being very similar in size (interestingly the frequency of red grouse doubles in the middle and later period despite the assemblages otherwise being taxonomically similar, perhaps indicating a higher use of landbirds on the decline of a key marine species) (Bramwell 1994, 153). At Pool great auk falls from 13% of the NISP in the Iron Age to less than one percent in the Late Iron Age/Viking Interface. In the Late Iron Age and Norse periods great auks do not form above three percent of the NISP at any site. This is compared to an average of 22% of the NISP for the Early and Middle Iron Age data.

On South Uist the great auk is quite frequent at Late Bronze Age – Early Iron Age Cladh Hallan. It is present in the Iron Age at Hornish point and Bornais Mound One, but it is absent from Late Norse Bornais Mound 3 – see Figure 5.33 (Cartledge 2005, 41, 145 and 177; Cartledge and Serjeantson 2012; Serjeantson 2003, 151). None were present at Norse Bornais Mounds 2/2A on South Uist although there was one robust unidentifiable auk fragment from Middle Norse Mound 2, but unfortunately the condition prevented confident identification. At Iron Age Dun Vulcan the great auk has the highest NISP, and even when the partial skeleton is excluded it still dominates the assemblage by MNI. However, it is decreasing by the latest Iron Age layers and absent from the later deposits (Cartledge and Grimby 1999, 282-288). It is entirely absent from Norse Cille Pheadair (Best and Cartledge In Press). On neighbouring North Uist at

the Udal it occurs relatively frequently in the Beaker and Bronze Age levels, is quite numerous in the Early and Middle Iron Age, but has declined by the Late Iron Age (in both count and percentage of assemblage) and is absent at the Udal from the Norse period onwards (Finlay 1984, 177; Serjeantson 1988, 218-224; Serjeantson 2001, 48). Similarly, the great auk forms 14% of the Iron Age NISP at Skail, with 61 bones present, but in the Viking levels there is only a single bone, representing a meagre 0.4% of the NISP, and none are present in the Medieval material from this site.

Figure 5.33: Great Auk on South Uist (Base map by Ian Dennis)



The Udal remains show great auk decreasing rapidly in the Middle to Late Iron Age. By the Late Iron Age they were making up a very small part of the avian assemblage, and gannet numbers had increased to account for nearly a third of the assemblage (Table 5.11 and Figures 5.34 to 5.35). The Late Iron Age Udal avian assemblage contains the first domestic birds on North Uist; the same period in which the first domesticates were identified on South Uist. The domestic fowl are present initially in small numbers, indicating that they had a limited role in the avian economy at this point. However, domestic birds increase significantly in the Viking, Norse and later phases at the Udal. This indicates that with the decline in great auk availability, gannet and domestic fowl became more prominent in the assemblage, accounting for increasingly higher

proportions of the overall NISP (see Table 5.11 and Figures 5.34 to 5.35). The gannet in particular appears to have been a substitute or replacement species when the more easily captured great auk was not accessible, in addition to being a valuable resource in its own right. Although caution is necessary in using a singular site as a key example, the longevity of the Udal combined with its sieving/sampling strategy and known avian analysis renders it a valuable expression of the pattern seen across the Scottish Islands.

Table 5.11: Great auk, gannet and domestic fowl as a % of the Udal NISP by period

Udal - By Period	Great Auk as % NISP	Gannet as % NISP	Domestic Fowl as % NISP
Neolithic	0	0	0
Beaker	50	0	0
Early Bronze Age	13	6	0
Late Bronze Age	25	0	0
Early Iron Age	13	5	0
Middle Iron Age	6	5	0
Late Iron Age	2	30	2
Viking Norse	0	16	13
Norse	0	23	27
Late / Post-Medieval	0	38	21

Figure 5.34: Temporal variation of great auk, gannet and domestic fowl as % of The Udal avian NISP

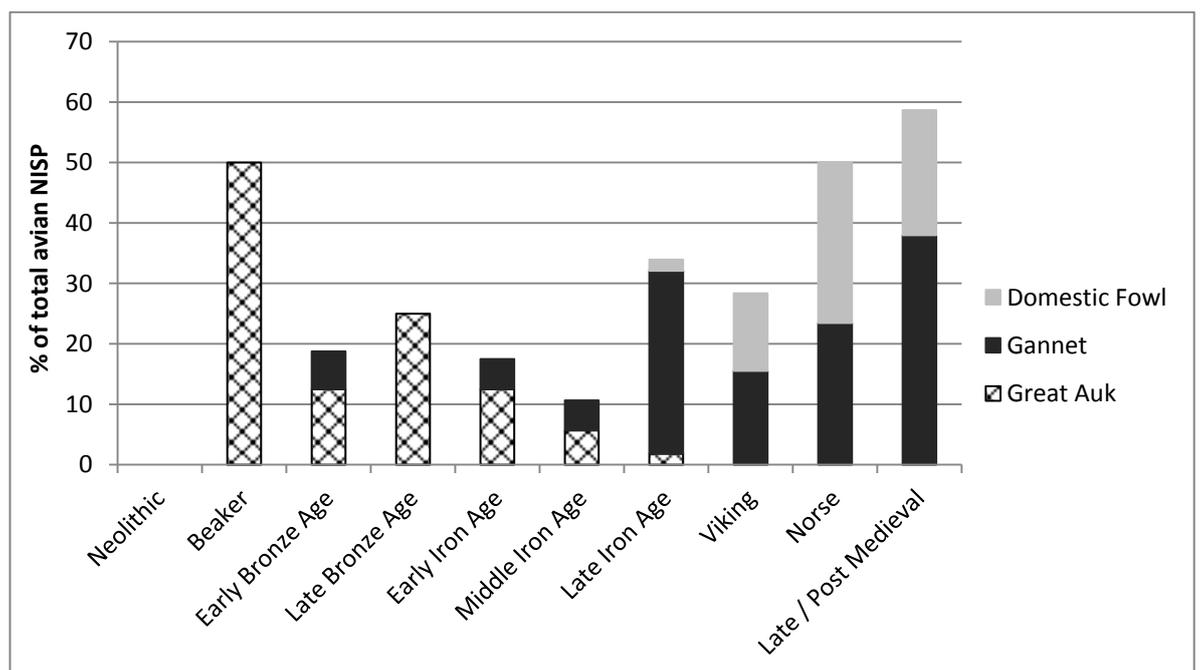
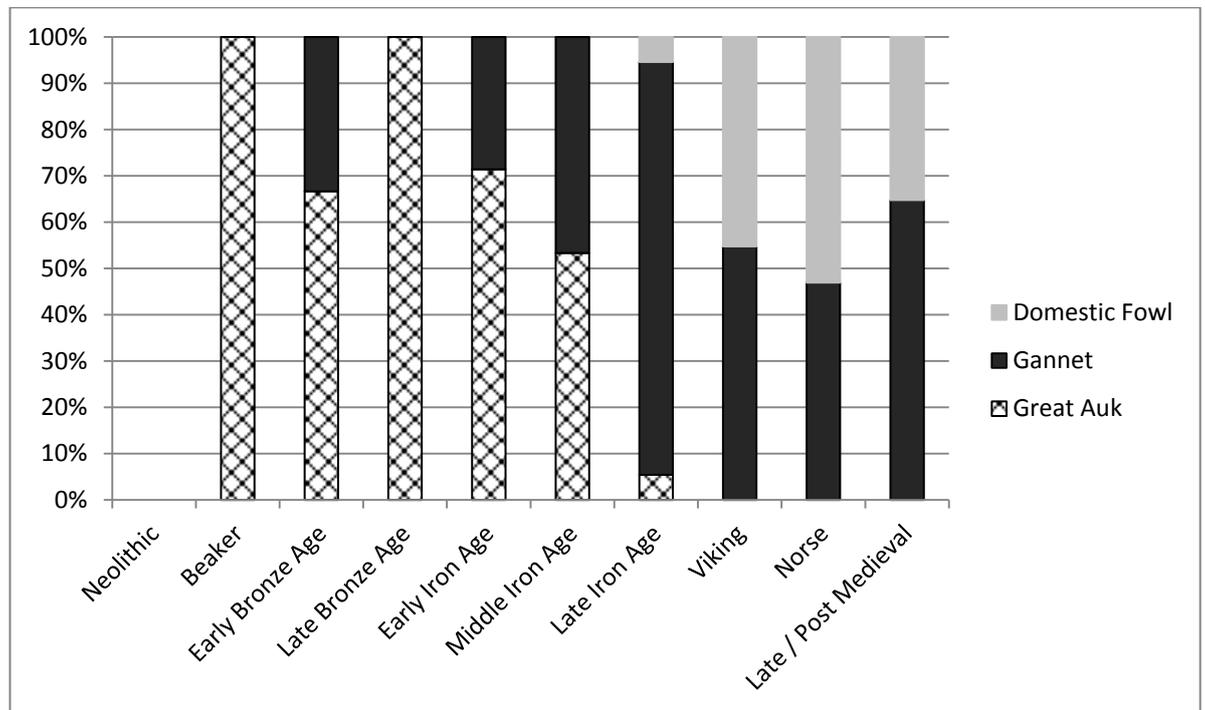


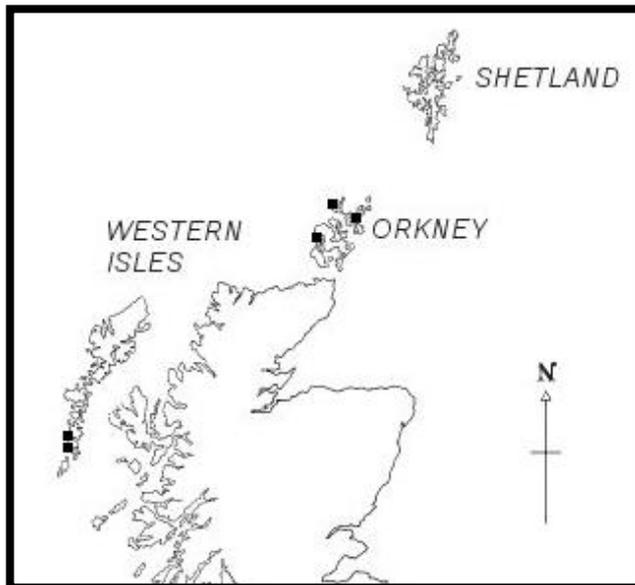
Figure 5.35. : Temporal variation of great auk, gannet and domestic fowl as a % of their combined NISP, The Udal



The majority of archaeological great auk material comes from adult birds, with juveniles being rare. In the pre-existing collated data juvenile remains were only identified at three sites, all of which were on Orkney, namely Late Iron Age/Viking Interface Pool, Middle Iron Age Howe and Neolithic Knap of Howar. Some juvenile bones were also recovered from Phases 6/9 of Howe which represent mixed Iron Age/Recent material; it is likely the young auk bones are from the Iron Age assemblage, but unfortunately this dataset is limited. Recent work (by the author and by Dale Serjeantson) has also identified juveniles on South Uist suggesting that the great auk once bred here and on many of the islands in the Outer Hebrides. The landscape along the western seaboard of several Hebridean islands such as Barra, the Uists and Benbecula would have provided suitable breeding locations for the species. The Hebridean juvenile great auk bones were found at Late Bronze age Cladh Hallan and in

the Late Iron Age levels at Bornais Mound 1. The Orcadian specimen from Pool is the latest example temporally, suggesting that by the commencement of the Norse period the breeding populations had already severely declined.

Figure 5.36: Juvenile Great Auk Bone (Base map by Ian Dennis)



Very intriguingly the ‘recent’ phases from Howe also contain 9 great auk bones, which appeared to be from one individual. However, the presence of singular birds in Medieval and later contexts should not to be excluded or discounted since the great auks are historically documented in the vicinity in the relatively recent past; for example a pair of great auks was reportedly seen off of Papa Westray, the female of which was killed shortly before 1812, and the male just after (Smith 1879, 91). They were referred to here as the King and Queen of the Auks (Smith 1879, 91). A repeated naming convention for these unusual (and at that point, rare) birds can be seen. The material therefore shows that even in Post-Medieval and Recent sites these birds (although now becoming very rare) remained sought after targets for capture, although in the modern context their capture was often partly fuelled by curiosity and antiquarian specimen collection rather than primarily as food resources.

Gannet

The gannet is a commonly exploited bird through time and across locations in the Scottish Islands, occurring within a large number of the assemblages (Table 5.12). The scale of its presence within these assemblages is however very varied (Table 5.12).

Table 5.12: Gannet NISP as % of the site NISP (where present), in period order.

SITE NAME	ISLAND GROUP	PERIOD	Gannet NISP	Site NISP	Gannet as % of NISP
An Corran	Inner Hebrides	Mes	1	124	1
Cnoc Sligeach	Inner Hebrides	Mes	1	13	8
West Voe	Shetland	Mes	1	9	11
Cnoc Coig	Inner Hebrides	Mes	16	400	4
Midhowe Cairn	Orkney	Neo	1	8	13
Blackhammer	Orkney	Neo	2	4	50
Quanterness cairn	Orkney	Neo	7	128	6
Knowe of Ramsay	Orkney	Neo	7	17	41
Tofts Ness 1 & 2	Orkney	Neo	11	211	5
Skara Brae	Orkney	Neo	20	139	14
Knap of Howar	Orkney	Neo	24	254	9
Links of Noltland	Orkney	Neo	27	331	8
Pierowall Quarry	Orkney	LNeo	1	14	7
Northton	Outer Hebrides	LNeo	2	23	9
Pierowall Quarry	Orkney	LNeo	10	83	12
Point of Cott	Orkney	LNeo	2	242	1
Rosinish	Outer Hebrides	Beaker	1	9	11
Udal	Outer Hebrides	EBA	1	16	6
Point of Buckquoy (Area 6)	Orkney	EBA	1	23	4
Tofts Ness 3	Orkney	EBA	9	118	8
Cladh Hallan	Outer Hebrides	MBA	1	6	17
Tofts Ness 4	Orkney	LBA	2	186	1
Cladh Hallan	Outer Hebrides	LBA	102	307	33
Jarlshof	Shetland	LBA/ EIA	4	19	21
Cladh Hallan	Outer Hebrides	EIA	1	41	2
Udal	Outer Hebrides	EIA	2	40	5
Pierowall Quarry	Orkney	EIA	2	7	29
Howe	Orkney	EIA	16	87	18
Bu	Orkney	EIA	27	270	10
Dun Mor Vaul	Inner Hebrides	MIA	1	29	3
Kilellan Farm	Inner Hebrides	MIA	1	6	17
Bruach a Tuath	Outer Hebrides	MIA	1	3	33
Midhowe Broch	Orkney	(M)IA	1	7	14
Sloc Sabhaid Baile Sear	Outer Hebrides	MIA	4	30	13
Broch of Ayre	Orkney	(M) IA	4	14	29
Udal	Outer Hebrides	MIA	7	141	5
Howe	Orkney	MIA	26	507	5
Cnip	Outer Hebrides	M (/L?) IA	2	36	6
Beirgh	Outer Hebrides	M/LIA	1	3	33
Howe	Orkney	M/LIA	1	84	1
Ceardach Ruadh Baile Sear	Outer Hebrides	M/LIA	2	50	4
Dunan Ruadh (PY10)	Outer Hebrides	M/LIA	3	360	1
Dun Vulcan	Outer Hebrides	M/LIA	24	384	6
Udal XI XIII	Outer Hebrides	M/LIA	33	109	30
A'Cheardach Mhor IV	Outer Hebrides	LIA	1	1	100
Bostadh	Outer Hebrides	LIA	1	61	2

Bornais M1	Outer Hebrides	LIA	5	315	2
Scalloway	Shetland	LIA	5	32	16
Pool	Orkney	LIA	13	109	12
Howe	Orkney	LIA	16	490	3
Sheader (SY14)	Outer Hebrides	IA	1	4	25
Sollas wheelhouse A	Outer Hebrides	IA	1	5	20
Sollas wheel house B Midden	Outer Hebrides	IA	1	5	20
Northton	Outer Hebrides	IA	1	1	100
Sollas wheel house B	Outer Hebrides	IA	2	31	7
Gurness	Orkney	IA	2	9	22
Tofts Ness Phases 5 & 6	Orkney	IA	5	87	6
Scalloway	Shetland	IA	14	177	8
Milla Skerra Sandwich	Shetland	IA	21	113	19
Skaill Deerness	Orkney	IA	81	442	18
Saevar Howe	Orkney	LIA/PN/Pict	2	7	29
Old Scatness	Shetland	PN/Pict (/LIA?)	2	49	4
Buckquoy	Orkney	PN/Pict	27	79	34
Pool	Orkney	LIA/Vik	40	368	11
Brough Road (areas 1, 2 and 3)	Orkney	LIA/N	18	135	13
Skaill Deerness	Orkney	Vik	20	240	8
Udal Ixc X	Outer Hebrides	Vik	23	148	16
Old Scatness	Shetland	Vik / EN	4	63	6
Buckquoy	Orkney	EN	1	9	11
Quoygrew Farm Midden ii	Orkney	EN	1	48	2
Bornais M2	Outer Hebrides	EN	1	65	2
Bornais M2A	Outer Hebrides	EN	6	154	4
Saevar Howe	Orkney	EN	9	27	33
Sandwick North	Shetland	EN	34	109	31
Buckquoy	Orkney	E/MN	47	142	33
Bornais M2A	Outer Hebrides	MN	2	51	4
Bornais M2	Outer Hebrides	MN	3	514	1
Sandwick North	Shetland	M/LN	1	40	3
Quoygrew Fish Midden 2	Orkney	M/LN	14	68	21
Quoygrew Farm Midden iii	Orkney	M/LN	15	325	5
Cille Pheadair	Outer Hebrides	E/LN	32	645	5
Beachview Burnside	Orkney	(L)E /LN	33	132	25
Beachview Studio Site	Orkney	E/LN	42	146	29
Old Scatness	Shetland	LN	2	36	6
Bornais M2	Outer Hebrides	LN	9	171	5
Bornais M2A	Outer Hebrides	LN	21	195	11
St Magnus' Kirk Birsay	Orkney	N	3	52	6
Jarlshof	Shetland	N	1	30	3
Bornais M3	Outer Hebrides	N	3	55	6
Bornais M2 (Unphased Norse)	Outer Hebrides	N	4	77	5
Bornais M1	Outer Hebrides	N	7	68	10
Udal VII IX	Outer Hebrides	N	23	98	24
Tuquoy	Orkney	N	24	360	7
Pool	Orkney	N	57	153	37
Brough of Deerness	Orkney	LN/EMed/Recent	2	59	3
Tuquoy	Orkney	LN/Med -PMed	8	136	6
St Kilda Black House 8	Outer Hebrides	Med/PMed	64	207	31
Quoygrew	Orkney	LMed/PMed	12	149	8
Udal II VI	Outer Hebrides	LMed/PMed	57	150	38
House Island 15B	Outer Hebrides	PMed	2	106	2
St Kilda Black House G	Outer Hebrides	Modern	18	434	4
St Kilda Black House 6	Outer Hebrides	Modern	24	52	46
St Kilda Black House 8	Outer Hebrides	Modern	591	5353	11
Howe	Orkney	Recent	10	218	5

This variability in its distribution implies that whilst it was regularly exploited in small numbers, larger use of this species was only practised at certain sites indicating that in these instances the birds were harvested from breeding colonies either in the vicinity of a site, or on specific fowling trips to more distant populations. As mentioned in earlier chapters, gannets are cliff nesters, they breed in colonies which are usually large and communal, and they are altricial (meaning that the chick requires longer care at the nest) (Baldwin 2005, 16-17; Serjeantson 1998, 29; Stroud *et al.* 2001a, 44-46). The gannet's choice of nesting environment (either on cliff shelves, the cliff tops, or stac-like islands) means that it would not have bred in all of the locations at which its bones are recovered archaeologically such as on South Uist, North Uist or Tiree (despite large numbers of these birds moving and feeding in the sea around these areas). Concentrated exploitation can therefore indicate human movement around the fowling landscape to access breeding sites. Gannets appear to be valued for their size and fat/oil, but they are a species which would have in many instances required more intensive input to acquire. This is true both in terms of actually accessing a nest physically and getting to the colony, than with other species such as geese and gulls who breed more widely and feed at other points of the year. As such birds moving through the area on migration or fishing (nesting gannets can move long distances to feed) would have been valuable targets for capture and some of assemblages with small gannet contributions may reflect such opportunistic capture (Serjeantson 2001, 44).

Interestingly the number of sites producing gannet bones is highest in the Norse period (Table 5.13). The small number of Pre-Norse/Pictish sites has resulted in an overly high representation for this earlier period, although it appears gannets played an important role at some sites, including the aforementioned Buckquoy and Saevar Howe. Gannets

also form a higher proportion of the period NISP in the Norse period than in the Iron Age or earlier. This could suggest that gannets were being more regularly utilised in this period, partially as a result of the decline in great auk availability, and also potentially through changes in seafaring and fishing providing increased opportunities for capture both at sea and for accessing colonies on offshore stacs and islands.

Table 5.13: Number of sites represented at, sites as a % of total sites, and gannet as % of each period's NISP

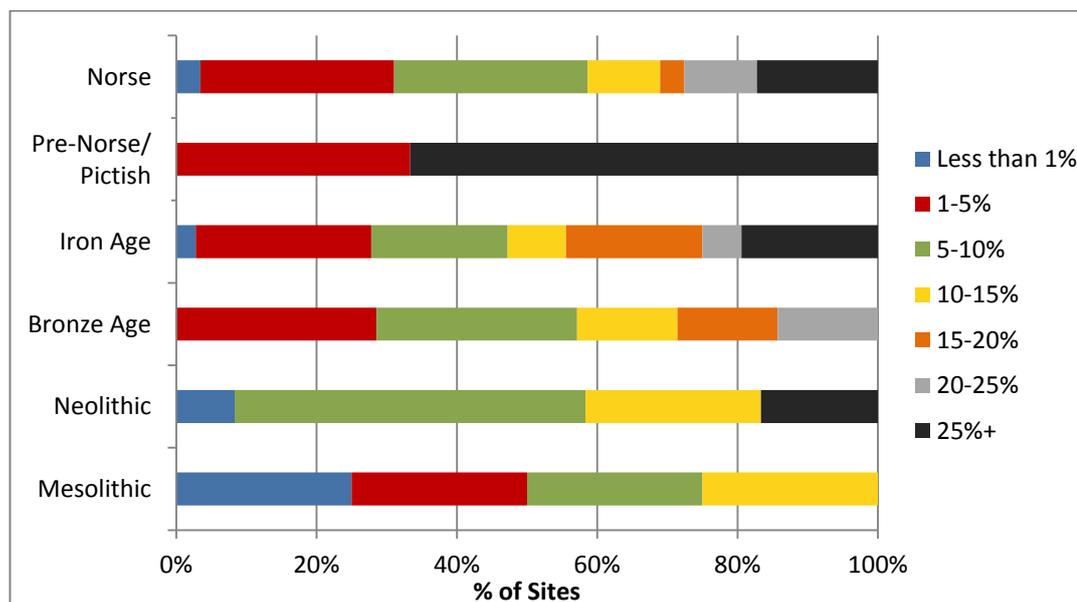
Period	No site present at	% of total sites	% of Period NISP
Mesolithic	4	67	1
Neolithic	12	67	7
Bronze Age	7	41	8
Iron Age	36	62	7
Pre-Norse/Pictish	3	75	21
Norse	29	81	10

Where gannet is present it also forms a higher proportion of individual site assemblages more frequently in the Iron Age and Norse periods than in the Mesolithic to Bronze Age assemblages (Figure 5.37); gannets form over 20% of the avian NISP at around a quarter of the sites in the Iron Age (25%) and Norse Period (28%), compared to 0-17% in the earlier periods. This might possibly reflect changes in resource availability in the Iron Age based on the continuing decline of the great auk and the introduction of domestic fowl. It may also imply (since gannets form under 5 and 1% of the NISP frequently in the Mesolithic and Neolithic sites) that at a higher proportion of these earlier sites gannets were being taken as an occasional resource. This may be at sea, or on migration (although in these situations the birds are more difficult to catch), however it may also suggest that gannets were breeding more widely around the Scottish Islands before the Iron Age. In such a situation small colonies local to a site could have been targeted (Serjeantson 2001, 44 and 48). Hunting would have encouraged the birds to remove themselves from easily accessed locations in favour of colonies on offshore

stacs and remote islands. In the Bronze Age gannet use was lower in terms of frequency with them occurring at just over 40% of the sites (5.13). However, when they do occur they fairly often form a large proportion of a specific assemblage (such as Cladh Hallan) indicating occasional intensive fowling trips.

Although overall in the Norse period there appears to be an increase in the frequency and proportion of gannet use, there also continues to be assemblages in which gannets form only a small part of the site NISP. Gannets make up less than 5% of the avian NISP at around a third of the Norse sites and just over a quarter of the Iron Age sites. The seafaring and fishing developments mentioned above may have provided increased opportunity for capture at sea, both intentionally and through accidental catches whilst fishing. The trade of bird resources must also be proposed and considered, particularly in the Norse Period; a practice which for fish is evidenced archaeologically and historically, and is also documented in written sources for birds from the Late Medieval period onwards (Barrett 1997, 616 and 632-634; Serjeantson 2001, 44 and 48-53). Trade of birds and the archaeological evidence is discussed further in Chapter Eight.

Figure 5.37: Number of assemblages per frequency category for gannet as a % NISP



Puffin

Whilst clear trends through time can be seen influencing the capture of species such as the great auk, gannet and domestic fowl, this is less the case for the puffin (Appendix Table A5.13). In this instance exploitation scale is a reflection of location more than time, and is dependent on the access to puffin colonies. Puffin forms a higher average proportion of NISP in the Hebrides than in the other Northern Isles. In terms of the separate island bodies Orkney consistently displays the lowest puffin use, with them forming a lower proportion of the NISP on average (see Appendix Table A5.14). Within the assemblages which do contain puffin, but where they formed under one percent of the NISP all but one was from Orkney. Furthermore, although puffins occur at just over half of the sites/period subdivisions and in all periods they frequently form less than 3% of the NISP (in a fifth of the assemblages). However, when they do exceed this they can form a very large proportion of the NISP (Appendix Table A5.15).

Interestingly all of the assemblages in which puffin constitutes over 25% of the NISP came from the Outer Hebrides except for a single example from Shetland (Iron Age Scalloway) (A5.13 and A5.15). This implies that puffin fowling was practised more in the Hebrides than the Northern Isles, and within the latter puffins formed a larger part of the economy in Shetland than Orkney. Today areas of the Hebrides such as the Shiant Isles and St Kilda contain some of the largest breeding populations of puffins, suggesting that this was also true in the past, and that the populations in these locations made good use of the abundant resources (Stroud *et al.* 2001a, 397-400). Meanwhile the overall distribution suggests that although puffins probably bred more widely in the past than they do today they were only exploited in large numbers where colonies were easily accessible. This is unexpected since, being easy to catch and with little of the risk

associated with cliff nesters, the burrow-dwelling puffin would have been worth conducting special fowling trips to large colonies to harvest in great numbers. It is for example absent from some assemblages which display a very heavy auk focus, such as Mesolithic Sand where none were certainly present despite razorbill and guillemot being the key species exploited in intense numbers. This indicates (in this specific case and further afield) a clear division between the use of cliff nesting auks and burrow-nesting ones; and very different patterns of landscape use. There is little reason to suppose that past populations would have associated the guillemot and the razorbill with the puffin.

Guillemot and Razorbill

As has been identified in the species profiles auks remained an important bird family for exploitation through time and space. The guillemot overall occurs more frequently by frequency (NISP) and distribution, being present within nearly half of the assemblages compared to nearly a third. Today the guillemot is the more numerous species within Britain, thus the archaeological dataset indicates that this was also the case in the past (Stroud *et al.* 2001, 389-396). Like the puffin, the razorbill and guillemot do not exhibit changes in usage over time as dramatic as those of the great auk. However, the results (see Appendix Tables A5.16 and A5.18) do suggest some temporal and location variations in their capture. The Mesolithic exhibits a high use of these auks, maximising resource use through a specific fowling focus. The inconsistent representation of razorbills and guillemots within various assemblages suggests that these resources were (like the gannet) being targeted at their cliff breeding sites in specific but not universally conducted fowling trips. Resultantly at many sites they form a minor component of the NISP, indicating capture away from the nesting grounds.

Interestingly guillemot and razorbill combined occur at 95% of the Norse sites, which is similar to the strong focus identified for the Mesolithic (where they occurred at 83% of the sites), but much higher than the Neolithic to Iron Age where they are only represented at around half the sites (Table A5.17). This may indicate targeted capture by hunter-gatherers in the Mesolithic, and greater accesses in the Norse period facilitated by a different and increased movement around the seascape during this period.

Crane

The once more widely distributed crane occurs at 13 of the Scottish Island sites, ranging from the Mesolithic to the Norse period. Although the dataset is small they do not occur in Orkney after the Late Iron Age/Norse assemblage from the Brough Road, signifying that their range could have been starting to contract about this time. There are no examples of the crane in Shetland, indicating that its range did not extend that far north.

In addition to the juvenile remains outlined in Chapter Four, another two examples were present within the wider Scottish Island environment. One came from Mesolithic Cnoc Coig, Inner Hebrides and another eight bones of an individual chick from Iron Age Howe on Orkney. This demonstrates that the crane was breeding occasionally on the Scottish Islands, even as far north as Orkney. This suggests that whilst the majority of cranes may have been targeted on their summer and winter passage through Britain from other breeding grounds, a number were available for capture in the summer. It is likely that these large birds were specifically targeted for a range of reasons including their size, rarity and symbolic associations, however their bone form would be very good for making tools and objects such as tubes, points and awls. Young cranes may also have been taken as pets and can even act as guard-birds, calling if intruders approach (Bartosiewicz 2005, 263).

Table 5.14: Crane NISP by site, period and location

SITE NAME	ISLAND GROUP	PERIOD	CRANE	CF. CRANE
Cnoc Coig	Inner Hebrides	Mesolithic	1	
Tofts Ness 3	Orkney	Early Bronze Age	1	
Ardnave	Inner Hebrides	Bronze age	1	1
Cladh Hallan	Outer Hebrides	Late Bronze Age	2	
Ceardach Ruadh Baile Sear	Outer Hebrides	Middle-Late Iron Age	1	
Howe	Orkney	Late Iron Age	8	
Bornais M1	Outer Hebrides	Late Iron Age	1	
Bac Mhic Connain	Outer Hebrides	Iron Age	1	
Brough Road (areas 1, 2 and 3)	Orkney	LIA/Norse 7th to 13th C	5	1
Cille Pheadair	Outer Hebrides	Norse L10th/E11th - M-L 13th	4	
Bornais M2	Outer Hebrides	Middle Norse	1	
Bornais M2 (Unphased Norse)	Outer Hebrides	Norse	1	
Frobost	Outer Hebrides	Medieval 13th - 14th Century		1

The White-Tailed Sea Eagle

This bird (also known interchangeably as just the white-tailed eagle) is the largest bird of prey in Britain. It became extinct in Scotland and the rest of Britain in the late 19th and early 20th century (Bramwell 1983b, 164; Serjeantson 2010, 152). The population present within Britain today has grown from intentionally reintroduced birds. The white-tailed eagle occurs most frequently in the Neolithic and Bronze Age of Orkney, particularly within cairns/tombs.

It was thought that people made no distinction between the white-tailed eagle and the similar golden eagle until the 17th Century (Serjeantson 2009, 152). However the archaeological evidence suggests otherwise. At Isbister and at Point of Cott Westray multiple individual birds are present within the tomb environment. All of these are white-tailed not golden eagle. At Isbister at least 10 and even potentially up to 20 individual birds have been identified, with a further eight individuals present at Point of Cott. To capture this many individuals of the same species indicates that a differential understanding of the two eagles may have been in place as early as the Neolithic and Bronze Age. Whilst today the golden eagle is rare in Orkney and Shetland (which

would explain its absence in the above assemblages), the only archaeological example of golden eagle in the collated Scottish Island data is from Orkney, suggesting that the two species did overlap in the past (Stroud *et al.* 2001a, 197-198). Alternatively, the white-tailed eagle, a scavenger, may have been easier to catch (Yalden 2007, 471-473).

Although eagle remains may have been traded, none in this context were worked into objects, suggesting that these were locally captured fleshed-birds. This is also indicated by the examples exhibiting knife cuts from Bornais Mound 2 and Mound 2A discussed in Chapter Four. One worked bone tube from Midhowe broch came from large bird bone described as being the size of a 'large goose' or 'eagle'. Their continued exploitation into the Norse period and even beyond indicates a constant presence of these birds across the Scottish Islands, although the population might have been small.

In England a decline is visible in and from the Middle Ages (Serjeantson 2010, 153). Within the Scottish Island sites a potential decline is visible at a much earlier point in time. As mentioned the Neolithic and Bronze age exhibits the highest use of these raptors, particularly within tombs/cairns. The large NISP of 91 from the Neolithic settlement Links of Noltland is interesting in that it is not a mortuary context. However, in this instance (unlike the discussed tombs), the bones may come from a small number or even a single individual²⁶. After the Bronze Age the NISP never exceeds seven fragments in any assemblage, suggesting that these birds were familiar but relatively rare; that their populations had been larger in early prehistory; and/or that the tomb cultures of Orkney went to substantial effort to acquire these birds. One might postulate that several birds could have been captured over a period of months or years and curated for inclusion in tomb deposits.

²⁶ Unfortunately side and zone information was not present in the analysis, although in many other ways it is exceptionally detailed (Armour-Chelu 1985)

Table 5.15: Eagle NISP shown by site, location, site type

SITE NAME	ISLAND GROUP	PERIOD	SITE TYPE	WHITE TAILED EAGLE	GOLDEN EAGLE	EAGLE CF. WHITE TAILED
An Corran	Inner Hebrides	Mesolithic	Rock Shelter and Midden	2		
Carding Mill Bay I	Mainland	Early Neolithic	Midden	1		
Links of Noltland	Orkney	Neolithic	Settlement	98		
Holm of Papa Westray	Orkney	Neolithic	Chambered Cairn	1		
Knowe of Ramsay	Orkney	Neolithic	Stalled Chambered Cairn	1		
Point of Cott	Orkney	Neolithic	Stalled Cairn	139		
Isbister	Orkney	Bronze Age Reuse 2450-2050 cal BC	Chambered Cairn	641		
Point of Buckquoy (Cuttings 5 and 6)	Orkney	Middle Bronze Age c 1770-1370 cal BC	Midden		1	
Cladh Hallan	Outer Hebrides	Late Bronze Age	Settlement			1
Tofts Ness 4	Orkney	Later Bronze Age	Roundhouse Settlement	1		
Howe	Orkney	Middle Iron Age	Broch 2	1		
Dun Vulcan	Outer Hebrides	Middle - Late Iron Age	Broch Site	1		
Howe	Orkney	Late Iron Age	Farmstead	7		
Udal XI XIII	Outer Hebrides	Late Iron Age AD 300 - 800	Settlement	1		
St Boniface's Church	Orkney	Iron Age	Settlement			3
Skail Deerness	Orkney	Iron Age	Settlement	2		
Milla Skerra Sandwick	Shetland	Iron Age	Settlement	1		
Calf of Eday	Orkney	Iron Age	Stalled Cairn	1		
Tofts Ness Phases 5 & 6	Orkney	Iron Age	Roundhouse Settlement	1		
Northton	Outer Hebrides	Iron Age (I)	Midden	1		
Bornais M2	Outer Hebrides	Pre-Norse/Pictish	Settlement	1		
Pool	Orkney	Late Iron Age / Viking Interface Phase 7	Settlement transition	1		
Udal Ixc X	Outer Hebrides	Viking	Settlement	2		
Skail Deerness	Orkney	Viking	Settlement	1		
Bornais M2A	Outer Hebrides	Early Norse	Settlement	1		
Bornais M2	Outer Hebrides	Middle Norse	Settlement	7		
Cille Pheadair	Outer Hebrides	Norse L10th/E11th - M-L 13th	Long Houses	1		
Tuquoy	Orkney	Norse	Longhouse	1		
Iona Abby / Monastery	Inner Hebrides	Medieval (Early?)	Monastery Midden		1	
Howe	Orkney	Med/ Post-Med / Recent		4		

Fulmar – An Intrusive Species?

The presence of fulmar bones at archaeological sites has been the subject of discussion and uncertainty for some time now (Fisher 1941). Until the late 19th century its historically documented breeding was restricted to St Kilda. However in 1878 a colony was established on Foula in Shetland, and since this point has rapidly expanded (Fisher 1941, 204-272; Fisher and Lockley 2013). The fulmar, as mentioned, often nests in ruined structures such as houses or cleitains, which can lead to intrusive bones entering the archaeological record. Unlike small passerines, whose presence can be questioned based purely on the taxonomy, it has been demonstrated that the fulmar can be a valuable food bird for humans, as at St Kilda, making their presence in the archaeological record complex. However, fulmar remains have now been recovered from a wide range and number of archaeological sites from the Mesolithic to the Post-Medieval period (43) (see Appendix Table A5.12). In many of these cases the fulmar bones appear to be archaeologically secure. These include Old Scatness in Shetland, Mesolithic Cnoc Coig on Oronsay based on Nolan's spatial analysis (1986, 278 and 280), and at Bornais on South Uist with seven bones in a compacted floor surface within Middle Norse House 2 (Nicholson 2010, 169; Sharples pers. comm.).

Other rare examples have evidence for direct human interaction such as one fulmar bone from Norse Cille Pheadair with knife cuts upon the shaft and a second with possible cut marks. A worked fulmar Ulna is also present in the Late Bronze Age Cladh Hallan assemblage, which is the only recorded example from these Scottish Island sites (see Figure 5.38). These fragments indicate and support the suggestions that many archaeologically occurring fulmar remains are anthropogenic in origin. Butchery marks were present in the recent deposits at St Kilda, but only on two fragments. In this

instance there is documentary and pictorial evidence of fulmar fowling, providing some comparative material against which to compare the earlier remains, and this example emphasises how low the incidence of butchery can be on avian bone. Of course, some fulmar remains are likely to be intrusive but these can often be identified (and handled accordingly) by examining the avian data holistically. For example, at Ceardach Ruadh Baile Sear 24 bones from a singular bird (indicated in Table A5.12 by an asterisk) were found in a backfill deposit between walls of a passage; as such there is a possibility that this bird may be intrusive, having settled on the structure and fallen down the crevice at death.

Figure 5.38: Late Bronze Age from Cladh Hallan fulmar ulna worked into a point:
(Photo by the author)



The presence of three sub-adult fulmar bones with the Norse material from Cille Pheadair on South Uist is of particular interest, showing that young fulmars were present in the vicinity of the site. Today, fulmars only come to shore to their breeding sites, but they may be present at these sites for much of the year, and only absent for around three months in the autumn/winter (Maclean 1992, 92-4). The presence of young fulmars, the species' relatively significant frequency in this particular assemblage (15 fragments totalling 2% of the NISP), and their occurrence across seven phases of the site could suggest a more extensive breeding distribution, prior to the 19th century expansion of its historically constricted breeding range.

Skuas

Skuas are large aggressive seabirds, closely related to gulls. They occur rarely in the Scottish Island assemblages only being represented by 15 certain identifications through time (Table 5.16). The skuas that occur in Britain are either summer visitors breeding in specific areas, or are on passage through the country. The Pomarine skua passes through on migration, whilst the great skua is a British breeder whose numbers have expanded in the 20th century (Furness 1987, 67-61; Stroud *et al.* 2001a, 342). Today the majority of British great skuas nest in Orkney and Shetland, with much smaller numbers occurring in the Hebrides and mainland (Stroud *et al.* 2001a, 342-343). In the archaeological record there appears to have been a similar situation in the past. The great skua and skua sp. are only present in Orkney and Shetland, whilst the only Hebridean examples are two skua bones which are *cf.* pomarine. The Orcadian population may have killed these birds in order to protect livestock such as small lambs and (from the Iron Age onward) domestic fowl.

Table 5.16: Skua NISP by site, period and location

SITE NAME	ISLAND GROUP	PERIOD	GREAT SKUA	SKUA SP	SKUA <i>CF.</i> POMARINE
An Corran	Inner Hebrides	Mesolithic			2
Knap of Howar	Orkney	Neolithic	5	1	
Midhowe Cairn	Orkney	Neolithic		1	
Jarlishof	Shetland	LBA / EIA		1	
Bu	Orkney	Early Iron Age	3		
Old Scatness	Shetland	Viking / Early Norse	1		
Buckquoy	Orkney	Norse (9th to 12th c AD)		1	

Unusual Ducks

Today the common scoter is rare breeder²⁷ in Britain but can be found in the Northern Isles, Inner Hebrides and areas including Caithness. Much larger numbers winter on the eastern coast, but overall it is relatively scarce in the Western Isles, particularly in the

²⁷ It was not a recorded British breeder until 1885, maybe indicating changed population (Berry 2011, 139)

south (Berry 2011, 139-140; Hopkins 1979, 438; Stroud *et al.* 2001a, 160-161; Yalden and Albarella 2009, 207). The velvet scoter winters along the eastern seaboard (Stroud *et al.* 2001a, 158-159). The archaeological data (Table 5.17) suggest that these birds may have had broader ranges in the past, with the common scoter occurring in the Outer Hebrides. These may also have been unusual accidental occurrences of birds blown off course or taken at sea. The material also suggests that the wintering velvet scoter's range extended further north and west than it does today, encompassing Shetland and the Western Isles where today it is rare (Berry 2011, 141-143).

Table 5.17: Scoter NISP by site, period and location

SITE NAME	ISLAND GROUP	PERIOD	COMMON SCOTER	VELVET SCOTER
Cnoc Coig	Inner Hebrides	Mesolithic	3	1
Links of Noltland	Orkney	Neolithic		4
Knap of Howar	Orkney	Neolithic		1
Bu	Orkney	Early Iron Age	2	
Howe	Orkney	Middle Iron Age	1	1
Ceardach Ruadh Baile Sear	Outer Hebrides	Middle-Late Iron Age	1	
Howe	Orkney	Late Iron Age	1	
Jarlshof	Shetland	Norse		1

Quail

As mentioned, quail is a migrant game bird that occasionally, and often unintentionally, breeds in Scotland (Sharrock 1987, 144; Šťastný 1995: 159; Sterry *et al.* 2001, 78). Although there has been a recent decline in the 19th and early 20th century, it only occurs at three sites in the Scottish Island archaeological material, indicating that it was also a rare visitor in the past, that was captured when available (Table 5.18).

Table 5.18: Quail NISP by site, period and location

SITE NAME	ISLAND GROUP	PERIOD	SITE TYPE	QUAIL
Cnoc Coig	Inner Hebrides	Mesolithic	Shell Middens	11
Quanterness cairn	Orkney	Neolithic	Chambered Cairn	1
Bu	Orkney	Early Iron Age	Broch-like Roundhouse	2

Small Passerines

Starlings were found in large numbers at Iron Age Howe and Bu on Orkney (which are about 1km apart). Today the starlings are very numerous on Orkney, but their numbers have only increased in the last 150 years. The archaeological evidence suggests that in the past Orkney held a larger number of starlings, as it does today, and that their decrease was a temporary variation, perhaps influenced by changes agricultural practices which altered the fields in which it fed.

Gulls

As seen in the species data large gulls such as herring, lesser black-backed and great black-backed play an important role in several of the archaeological assemblages and periods. It is notoriously difficult to confidently distinguish between the herring gull and the lesser black-backed gull. The gull problem, and the difficulties in distinguishing between waterfowl such as geese, was one reason for deciding to conduct eggshell analysis (which will be explored in Chapter Seven). In some instances it can differentiate between similar species which cannot often be separated with certainty when using bone data (Sidell 1993). Again it should be emphasised that it cannot be assumed that past peoples would have made a distinction between (e.g.) the lesser black-backed gull and the herring gull, particularly as they often nest communally together and with other gulls. Herring and lesser black-backed gulls can interbreed and the resultant hybrid offspring complicate our modern categorisations further, but in other contexts and periods examples such as this may have served to further lessen distinctions made between certain similar species. Even larger gulls such as the great black-backed gull may not have been attributed a separate identity since they share several characteristics with the herring and/or the lesser black-backed gull – for example

it has a black back like the latter and pinkish legs like the former. To heighten this idea further even some of the most identifiable characteristics are not certain since subadult lesser black-backed gulls have pinkish legs rather than clearly yellow. It could therefore be argued that the identification of these large gulls to exact species is not necessary. However, gulls are very responsive and flexible in their behaviour, but each species has some individual preferences and traits. Distinguishing between similar species is therefore important since it can identify changes in species distribution which in turn informs upon human landscape use/modification, habitat and changes in bird populations.

For example at Late Iron Age and Norse Bornais on South Uist the great black-backed gull forms a higher proportion of the gull remains in the Norse period and herring/lesser black-backed gull decreases in its dominance (although still being prominent) (see Table 5.19). While the nesting preferences of these three gull species overlap to a degree there are important differences. The lesser black-backed gull primarily nests on sand dunes and grassland, and also around inland water (Cramp *et al.* 1974, 121; Webb *et al.* 1990, 179). The herring gull also commonly nests on sand dunes as well as cliffs, shingly skerries and inland water. For both the herring and lesser black-backed gull the machair would have been an ideal breeding environment and also one that they could have been found feeding upon several points of the year (Cartledge and Serjeantson 2012, 232-233; Heinzel *et al.* 1992: 150). The great black-backed gull tends to nest in small colonies and is less likely to nest on sand dunes and grassy slopes than the herring and lesser black-back, preferring stacs and rocky shore areas (Stroud *et al.* 2001a, 362). As such the herring and lesser black-backed gull would have been more susceptible to disturbance through increased animal grazing on the machair, associated human activity

and any resultant destabilisation of the machair environment. The increase of the great black-backed gull in the archaeological record at Bornais may therefore represent the lesser impact that such activities and changes had on their breeding profile and suggest that the balance of the gull population in the vicinity of the site had shifted to contain a higher proportion of great black-backed gulls, which then came in for increased capture (whether intentionally or merely as a result of their increased abundance).

Table 5.19: Shows Bornais Mound 2 and Mound 2A herring/lesser black-backed gulls and great back-backed gulls as a proportion of their total NISP.

SITE NAME	PERIOD	Total H/LBB and GBB	H/LBB % Gulls	GBB % Gulls
Bornais	Late Iron Age	171	81	19
Bornais	Pre-Norse/Pictish	0	0	0
Bornais	Early Norse	45	62	38
Bornais	Middle Norse	143	59	41
Bornais	Late Norse	30	63	37

Another interesting pattern also emerges from the gull analysis when these birds are considered by individual site as well as overall period. For example, although in the Norse period of the Hebrides (and Northern Isles) gulls form a larger proportion of the overall assemblage than in the Iron Age, site-specific decreases of gulls can be seen in the Norse data. When the large gull species are examined together as a percentage of the Period NISP it appears a period of extensive gull exploitation is followed by a decrease/lull in their prominence in the proceeding period/phase's assemblage within a specific location. For example the Iron Age Mound 1 assemblage at Bornais was heavily dominated by gulls which accounted for nearly two thirds of the Iron Age avian NISP at this site. Gulls were still the most commonly exploited birds in the subsequent Norse Phases of Mound 1, but declined to slightly under 40% of the bird assemblage (Cartledge and Serjeantson 2012). In the Middle and Late Norse assemblage from

Bornais Mound 3, gulls were still the most commonly occurring birds but now only accounted for 24% of the assemblage (Sharples and Cartledge 2005, 163-4). In the combined Early to Late Norse assemblages of Bornais Mound 2 and Mound 2A gulls only form just over 20% of the NISP. It has been suggested that this decrease in gulls at Bornais may have resulted from increased grazing upon the machair, or the pressure of continued culling (Cartledge and Serjeantson 2012). At the nearby Norse site of Cille Pheadair gulls are again the dominant species forming over 18% of the NISP, but within this assemblage the number and proportion of gulls have decreased by the latest phases. It is clear that various species of gull were prevalent enough in the locality of these sites to remain one of the most frequently captured birds in all phases at Cille Pheadair and be the long-term, dominant species at Bornais. However, continued exploitation of a population, if not conducted in a sustainable manner, could have affected the breeding population, as would any encroachments of grazing animals on to their breeding sites which could have contributed to this location specific decline (Hallanaro 2005).

5.6 Seasonal Use through Time and Space

The section explores seasonality by time and location, using species as a proxy for season. The NISP presented here includes all species for which seasonal information could be assigned. Not all groupings e.g. 'small wader' could be given a seasonal attribute, and as such are excluded from this overview. As mentioned in Chapter Four inferring seasonality can be challenging; this intensifies when comparing island groups since there are some variations in seasonality and bird populations between them. For example, the snipe population in Britain today is mostly sedentary; however there is some southerly movement of young born in the Northern areas of Britain with the onset

of winter, making them more a summer visitor in some locations (Parkin and Knox 2010, 161-162; Stroud *et al.* 2001a, 292). However the subspecies *Gallinago gallinago faeroeensis*, a different population, breeds in the Northern Isles, with migratory birds from Iceland and the Faroes then also moving into Britain to winter (Fuller *et al.* 1979, 425; Gray 1871, 312; Stroud *et al.* 2001a, 292-294). Meanwhile the curlew is likely to have been a winter visitor in the Hebrides, but a breeding species whose numbers were radically swollen during winter in the Northern Isles (Burton and Fuller 1999, 18; Heinzl *et al.* 1992, 138; Hull 2001, 175-6; Stroud *et al.* 2001a, 312-314).

In this section the seasonal distributions are presented first by overall period with all sites combined. This will enable identification of key trends and provides a larger assemblage with which to consider each phase's character. The dataset is then presented through time for the Northern Isles and Hebrides separately (Appendix Tables A5.20-A5.25 for raw data and *cf.* data). The key below will be used throughout this section:

<input type="checkbox"/> Resident	<input checked="" type="checkbox"/> Resident/Winter	<input type="checkbox"/> Summer/Resident	<input type="checkbox"/> Summer
<input checked="" type="checkbox"/> Summer/Winter	<input checked="" type="checkbox"/> Winter	<input type="checkbox"/> Passage	<input checked="" type="checkbox"/> Domestic
<input type="checkbox"/> Resident/Domestic	<input type="checkbox"/> Summer/Passage	<input type="checkbox"/> Winter/Passage	<input type="checkbox"/> Vagrant

Mesolithic

This earliest period has a very high use of summer visitors, particularly visitors to land (Figure 5.39). As seen in the species data, Mesolithic populations were making repeated use of pelagic seabirds including cliff nesting species such as the razorbill and guillemot, and the land-based great auk and puffins. Along with the gannet which was also exploited in smaller numbers, these represent birds which only come to land in the

summer to breed. These sites had a strong summer focus, with perhaps limited use at other points of the year. Sand in particular displays a very strong focus on the auk family, indicating concentrated fowling of these birds when around the breeding sites.

Interestingly, it has been suggested that much of the activity at Cnog Coig occurred in the autumn based on seal and fish remains (Mellars 1978: 380-384; Mellars and Wilkinson 1980, 34, 36-39; Wilkinson 1981: 113-115, 126). However the avian dataset shows repeated use of the aforementioned auks and gannet, indicating that at least some of the activity at Cnoc Coig occurred during the summer months. Although some birds may remain at the breeding grounds into early autumn, most will have left presenting a lessened opportunity for fowling. For example, by August and September puffins have largely moved out to sea and are concentrated in the waters off of Scotland's east coast and continue to move south during the winter (Stroud *et al.* 2001a, 398). The razorbill and guillemot also fledge and leave in August (Harman 1997, 210). These quasi-precocial birds can become less accessible before this point, since the young launch themselves (ineptly) from the nest into the sea where they continue to be raised at sea until independent (Serjeantson 2009, 11-12). These rafts of auks at sea could potentially be exploited but substantially more effort is needed (Baldwin 1974, 67-68). An even earlier leaving date has been proposed for the breeding great auk, between late June and mid July, based on its recorded presence at St Kilda (Love 2007, 25; Mudie 1835, 273-274; Smith 1879, 86) As such, many of the Cnoc Coig birds would have been taken during the summer months. However, gannets leave their breeding colonies slightly later, with chicks fledging around September. After this point their numbers at the colonies rapidly fall, although some birds remain until November; after leaving the breeding site they become highly pelagic. This suggests that although gannets would

have been available in summer (and gugas from mid July) they could also have been accessed in early autumn. (Harman 1997; Maclean 1992, 92; Webb *et al.* 1990, 115-23)

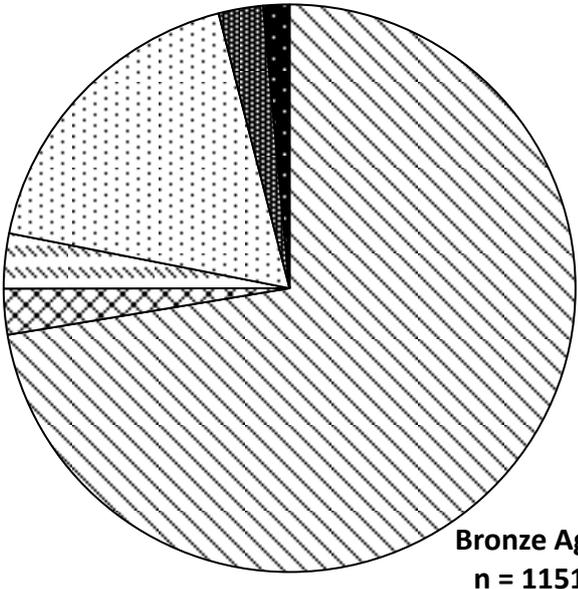
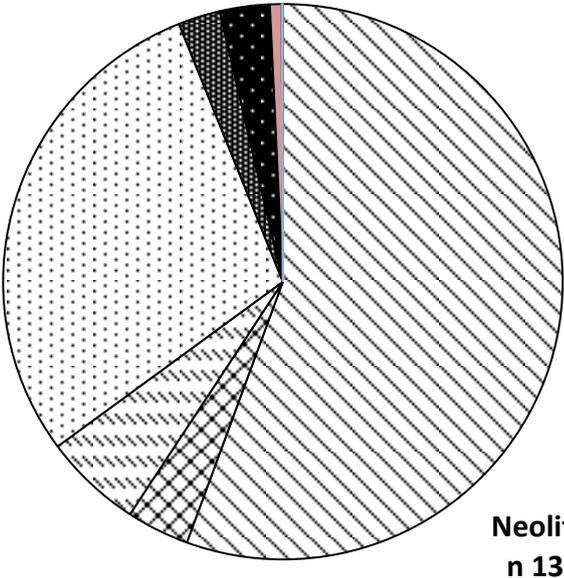
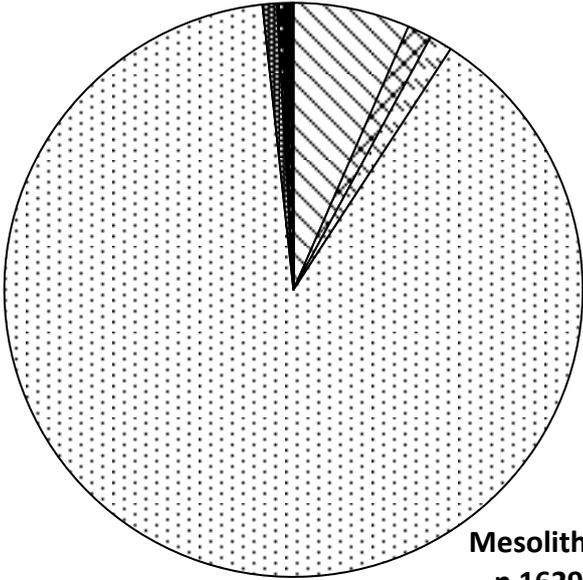
In addition to the focused exploitation of summer visitors, the Mesolithic assemblages also provide evidence for the capture of winter arrivals such as the great northern diver, little auk, whooper swan, and ducks such as the velvet scoter and long-tailed duck. The crane may also have been taken on migratory passage or in some instances as a summer breeder. Other opportunistic capture of passage birds is indicated by the skua *cf.* pomarine. The capture of resident (and resident/summer or resident/winter) seabirds, ducks, geese, gulls and raptors forms a relatively small overall contribution.

The Mesolithic seasonality graph has not been redrawn to separately show the Northern Isles and Hebrides since all the sites bar West Voe²⁸ come from the Inner Hebrides.

West Voe does show some differences to the Hebrides and is dominated by shags and other seabirds. The status of shag as a resident in Britain would mean that in the Northern Isles the Mesolithic profile is more focused on residents than summer breeders, although this is not to say that these residents were not taken in the summer. Indeed, the presence of juveniles and adults at West Voe suggests that the young birds were being harvested at the nest site, probably just prior to fledging. The great auk also indicates summer activity at West Voe, since it only came to land to breed and was then easy to catch.

²⁸ Preliminary data, full data not available at present. As such, whilst valuable since it is the only Northern Isles Mesolithic avian assemblage, it would be inaccurate to treat it as a full picture to interpret this period

Figure 5.39: Seasonality based on species shown by NISP for each period.



Neolithic

Fowling in the Neolithic (Figure 5.39) made a higher use of resident birds such as the shag, cormorant and great black-backed gull than in the Mesolithic, although these birds could have been caught repeatedly through the year, making them key species for exploitation. This also included an increased use of resident/winter geese such as the greylag and pink-footed or white-fronted goose, and of summer/resident species such as herring/lesser black-backed gull. Passage/winter and passage/summer birds are also represented. Passage/summer birds include the great skua, for which the Scottish Islands hold an important 60% of the world's breeding population particularly in the Northern Isles but with lesser numbers in the Hebrides (Stroud *et al.* 2001a, 341-342)²⁹. Another is the greenshank. Although summer capture is not as dominant as seen in the Mesolithic it remained an important part of the fowling calendar, accounting for 29% of the NISP assignable to species.

However, if the Northern Isles and the Hebrides are considered separately, interesting seasonal differences are visible (Figure 5.42). In the large Northern Isles Neolithic assemblage resident species dominate the overall seasonal profile, which reflects (in part) the large presence of raptors such as the white-tailed eagle, but also the repeated use of great black-backed gull, shag, cormorant and also the red grouse. Waders that have both summer breeding and wintering populations in Britain such as the golden plover and the dunlin are also present, as is the curlew.

Meanwhile in the small Hebridean assemblage (largely from Northton on Harris) summer and summer/resident birds form a much higher proportion of the remains (around two thirds). For example, Northton produced puffin, guillemot, razorbill and

²⁹ This refers to 60% of the subspecies *Catharacta skua skua* which is the only Great shearwater found in the Northern Hemisphere (Stroud *et al.* 2001a, 341-342).

gannet of which razorbill was most common, and also the herring/lesser black-backed gull. The only probable winter visitors in the Hebridean material are two waders: the turnstone and curlew. Resident species included waders such as the oystercatcher and the familiar shag and cormorant, indicating a fowling profile which was focused on seabirds in summer but with occasional use of wider resources

Bronze Age

The Bronze Age as a whole was dominated by resident species which accounted for nearly three quarters of the assemblage. However, by separating the data into island groups two different fowling profiles emerge (Figures 5.39/5.42). The Hebrides again display a much higher use of summer visitors than the Northern Isles where resident species occupy a staggering 91% of the total (Figure 5.42). Inevitably the large number of white-tailed eagles from Isbister's reuse period have heavily contributed to this seasonal profile. However, even when the Isbister eagles are excluded residents still account for 56% of the Northern Isles NISP with summer visitors forming 20% of the seasonable remains. However, in these Isbister-free percentages summer/residents form another 13% of the NISP suggesting that fowling in summer of seabirds such as gannet and herring/lesser black-backed gull was still taking place and valued. The presence of little auk, crane and 'resident/winter' geese again demonstrate the flexibility and the year round capture patterns present in the Northern Isles' avian-human relationships.

Within the Hebrides the key species of gannet, the auks and also the Manx shearwater indicate a fowling profile that was summer focused (half the remains), but that also made use of a range of other avian resources during the winter and throughout the year (Figure 5.42). Several winter visitors were exploited; little auk and great northern diver

were present at Northton on Harris, and the probable winter resource of curlew was present at Northton, Cladh Hallan, Ardnave and Rosinish. This wider Bronze Age dataset from the rest of the Outer Hebrides exhibits a similar species make up to that identified in the South Uist case study. As in the Northern Isles winter/resident geese were utilised at Cladh Hallan and the Udal. These resources could have been used at all points of the year, but the arrival of additional birds in winter could have provided a valuable resource at a hard time of the year

Iron Age

The Iron Age assemblage is fairly similar between the Northern Isles and the Hebrides. In both, resident species such as the shag and the cormorant form an important part of the avian resources and could be exploited at several points of the fowling calendar (Figures 5.40 and 5.42). The Hebrides again display a higher use of summer species at 42 compared to 26% of the remains, and also make greater use of summer/resident birds such as the herring/lesser black-backed gull. The aforementioned gadfly petrel indicates that vagrant or rare species with no or little historical record of presence visited both the Northern Isles and the Hebrides in the past and were captured, perhaps at sea (Serjeantson 2014; Serjeantson 2005, 235).

In the Northern Isles passage/summer birds are again represented by skuas and greenshank. Winter and summer/winter resources are present in both island groups, but form a larger proportion in the Northern Isles by accounting for 9% of the NISP, compared to 3%. Here they include divers, waders such as golden plover, ducks such as the common scoter and wigeon, and also the crane. The crane was represented by multiple bones (5 and 8) at Howe and Brough Road (areas 1, 2 and 3) on Orkney, but

single fragments also occurred at Bornais and Ceardach Ruadh Baile Sear in the Hebrides. The sooty shearwater is a passage bird and occurs at Dun Vulcan on South Uist and at Howe on Orkney, showing both groups making use of these occasional resources when possible.

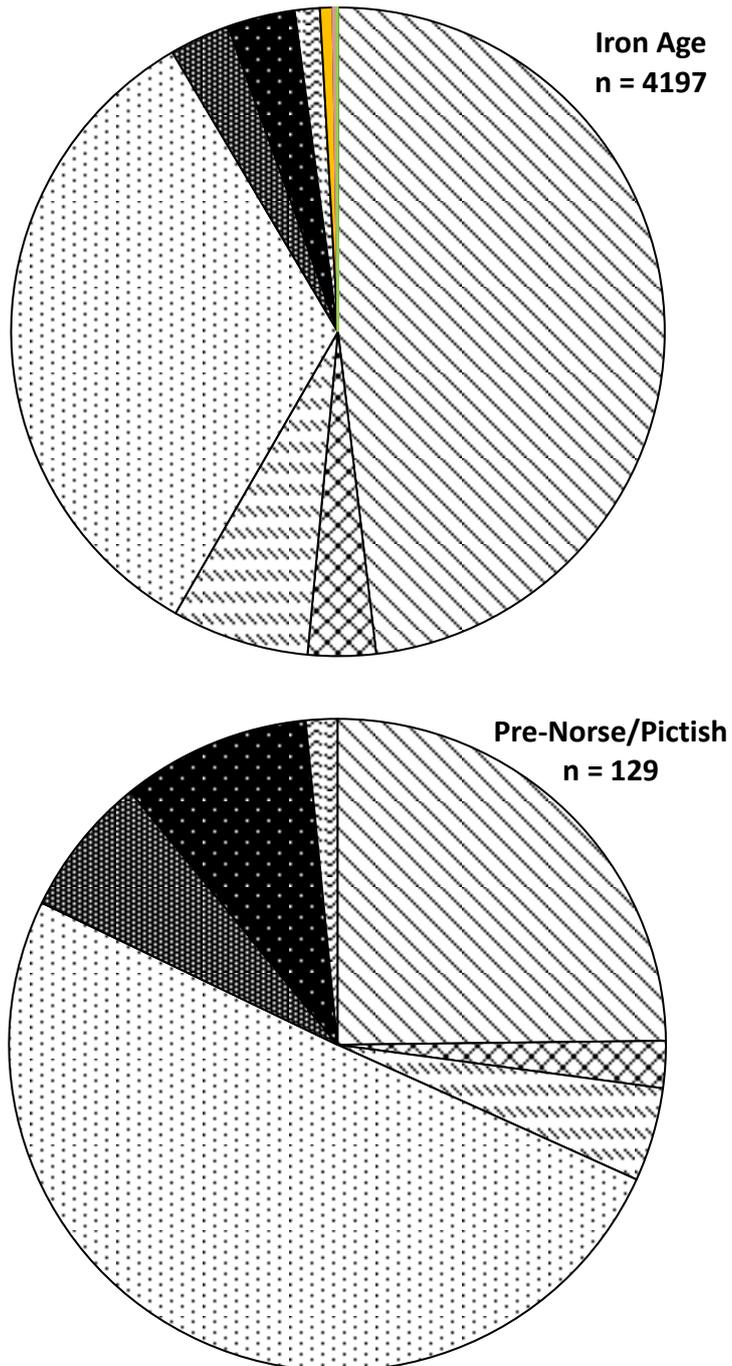
A similar wide range of winter species are exploited in the Hebrides and the Northern Isles, despite them forming more of the assemblage in the latter. These include most commonly the little auk, whooper swan, turnstone, great northern diver and again the curlew. Also present are small passerines such as the fieldfare, black geese, waders such as the grey plover, and ducks including the goldeneye and long-tailed duck. In addition to these green sandpiper and knot were identified in the Hebrides and Slavonian grebe, velvet scorer, pochard and smew in the Northern Isles. This diverse range of winter visitors, many of which are only exploited in small numbers displays the Iron Age populations making use of a wide range of resources when available to supplement key avian resources and the wider faunal economy. It also indicates that a range of habitats from freshwater to muddy shore were being repeatedly used at several points of the year.

Pre-Norse/Pictish

The singular small Pre-Norse/Pictish assemblage from the Hebrides has already been discussed in Chapter Four. However, the larger Northern Isles dataset presents a more diverse picture that has a large use of summer species, and where winter visitors form an unusually high 10% of the material (Figures 5.40 and 5.43). Of these the great northern diver occurs most commonly, but turnstone and little auk are again represented, even within this small assemblage. The ‘summer/winter’ curlew was also

well represented, again potentially indicating winter capture. This suggests that a suite of winter visitors were understood by the island populations and exploited when available.

Figure 5.40.: Seasonality based on species shown by NISP for each period



Norse

The Norse seasonal information illustrates a diverse fowling economy which has a greater focus of resources available at multiple points of the year, while still maintaining an important presence of exploited summer visitors (Figures 5.41 and 5.43). Interestingly, whilst in the earlier periods the Hebrides demonstrated the highest use of specifically summer visitors, when the Norse period material is considered by island group it can be seen that in this instance summer species form a larger proportion of the remains in the Northern Isles; 24% and 35% respectively. As identified earlier in this chapter, whilst the Hebrides see a diversification of the fowling economy in this period which incorporates a greater proportion of waterfowl and waders, the Northern Isles by comparison have a higher proportion and stronger focus on seabirds (see earlier Figures 5.13 and 5.15). The seasonal profiles suggest that this seabird focus in the Norse Northern Isles was concentrated on summer breeders, which would imply that other resident seabirds such as the shag and cormorant were also taken at this time. Resident birds with additional winter populations such as greylag geese were more common in the Hebrides where they total 11% of the data (compared to 5% in the Northern Isles), reflecting the fowling diversification. Both island groups make use of a range of winter and summer/winter birds in small quantities including black geese, whooper swan, curlew and little auk. In both Orkney and Shetland summer/passage birds are again represented by great and other skuas. The role of domesticates in providing a year-round accessible resource can also be seen.

The unusual gadfly petrel previously encountered in the Iron Age material is also present in the Norse levels of the Udal showing a degree of temporal continuity of this rare bird species, at this site.

Figure 5.41: Seasonality based on species shown by NISP for each period

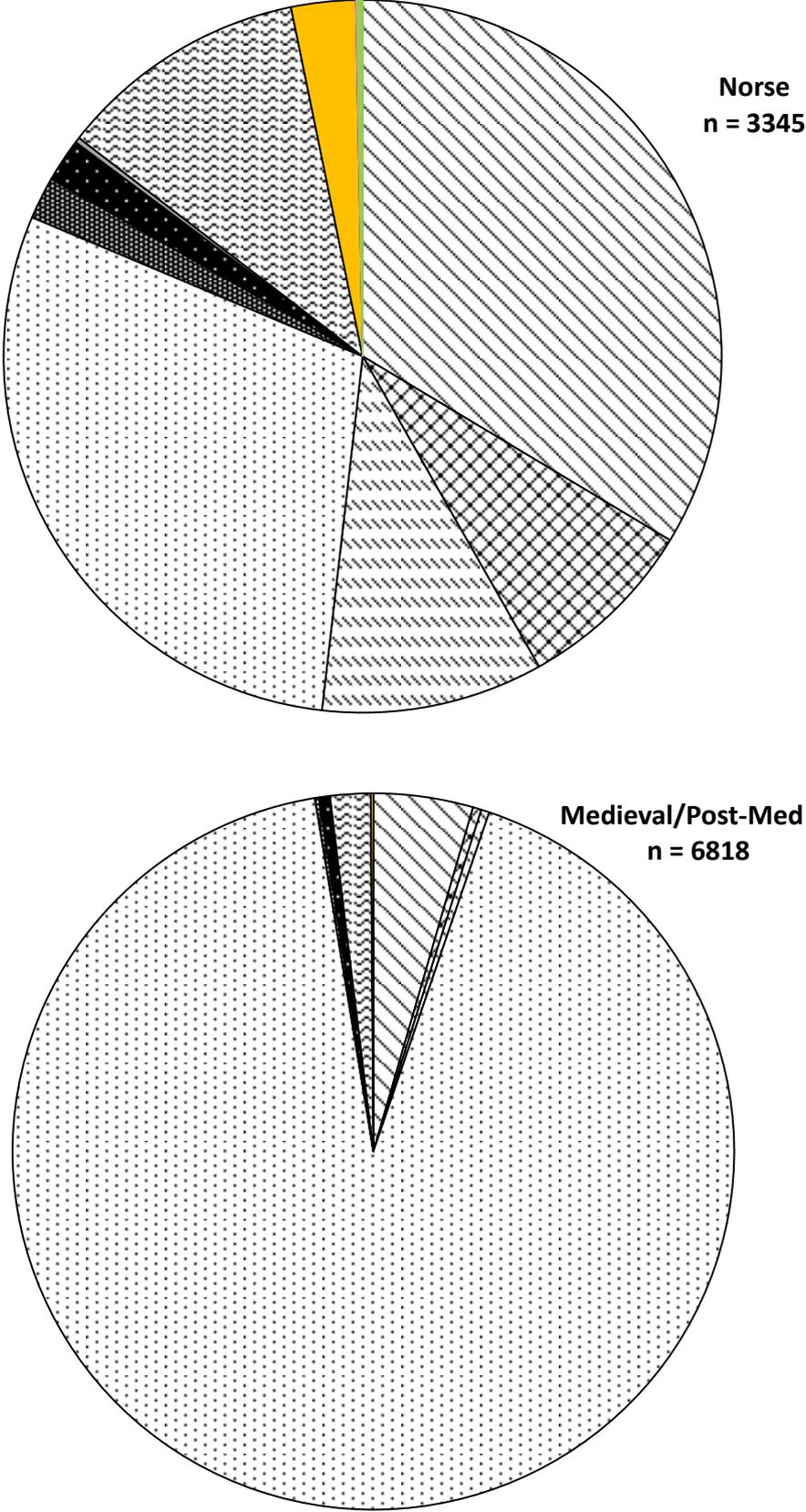


Figure 5.42: Seasonality based on species shown by NISP for each period and area

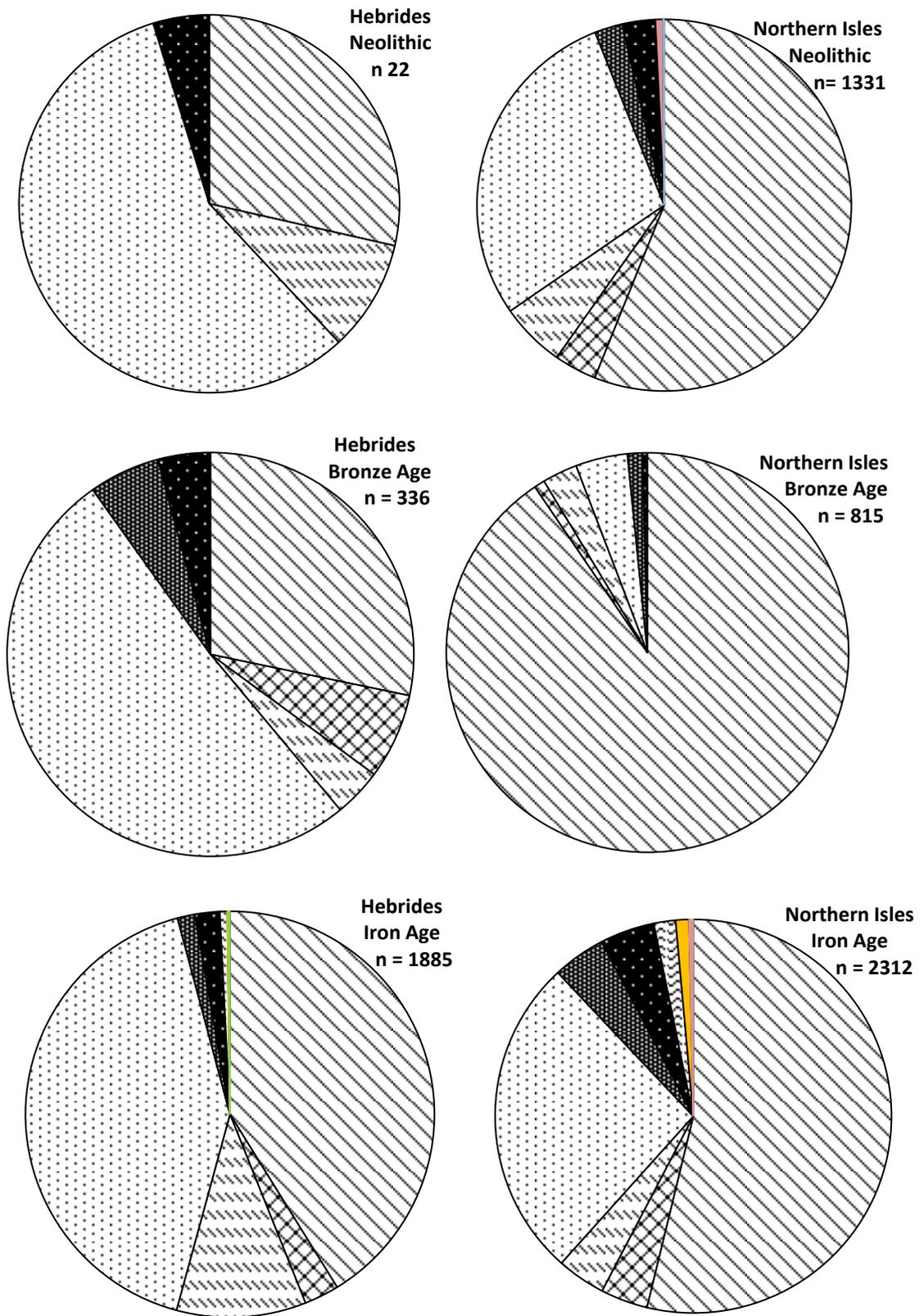
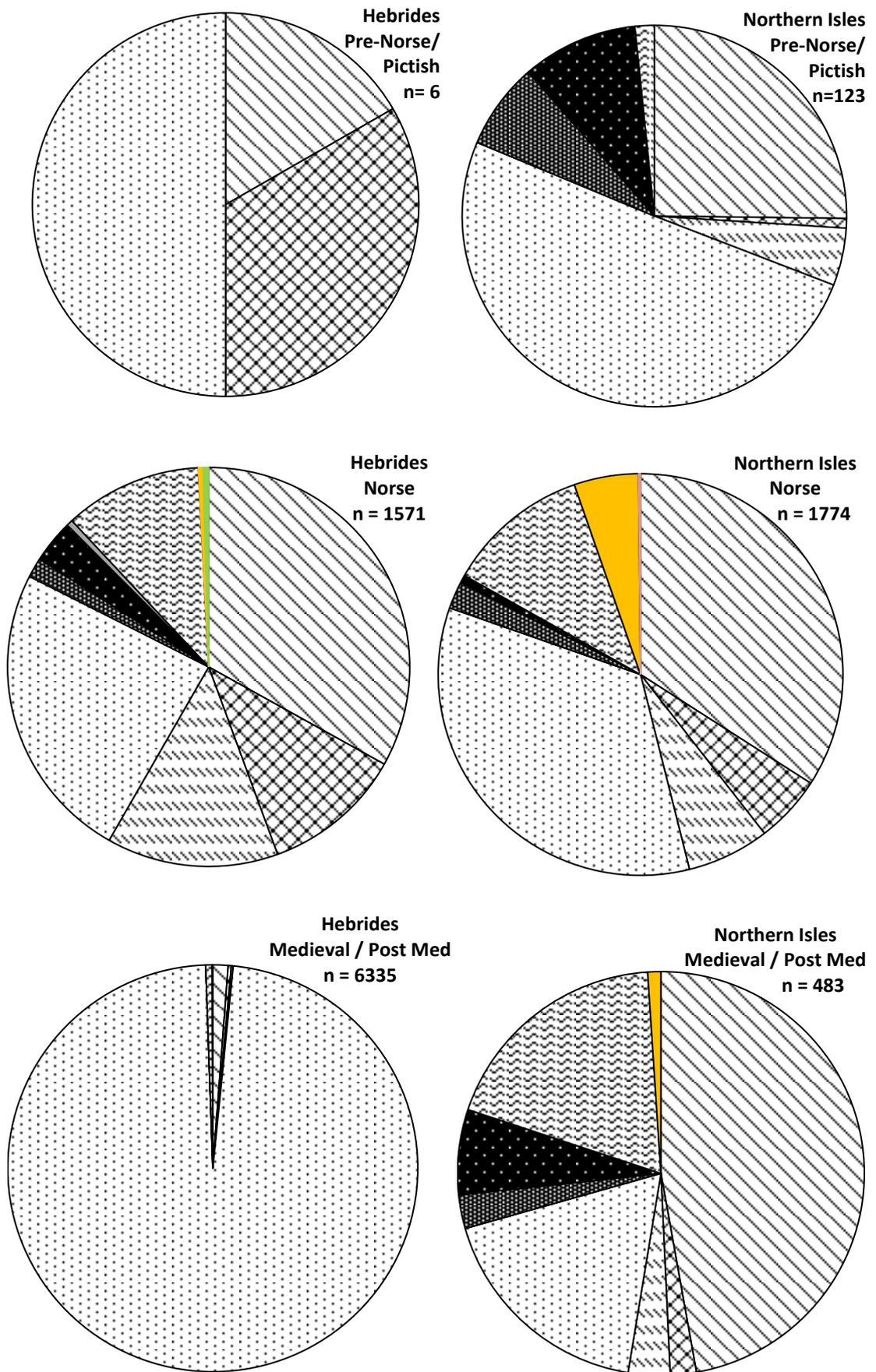


Figure 5.43: Seasonality based on species shown by NISP for each period and area



Medieval / Post-Medieval

The auk-dominated Hebridean assemblage shows an almost exclusive fowling focus on seabirds coming to land to breed in the summer, with minor contributions from resident birds and domesticates (Figures 5.41 and 5.43). In contrast the fowling calendar in the Northern Isles is much more diverse with summer species only forming 18% of the remains, although of course the resident/summer, resident/winter and summer/winter birds may also have been captured during the summer as well as other points of the year. Winter captures in the Northern Isles include little auk, waders such as knot, ruff, grey plover and turnstone, and waterfowl such as the whooper swan and smew. Golden plover and curlew may have been taken both in summer and winter.

This striking difference in the seasonality profiles can be seen to illustrate the different role of birds at this time in these locations. For example the concentrated, focused summer exploitation exhibited on St Kilda (and the Shiant) reflects a society that needed to secure these seabird resources upon which they were reliant in order to provide food for much of the year. The Northern Isles in contrast may reflect populations who were using a variety of avian resources to supplement a domestic focused diet, but without the need to extensively harvest at particular points of the year.

5.7 Juvenile Remains

As was demonstrated in Chapter Four, juvenile bones can be used to understand seasonal use of the avian resources and as a result the areas of the landscape that were being targeted for avian exploitation. Unfortunately evidence for young birds was not recorded at the majority of sites in the Scottish Islands, with the older excavations in particular not employing this valuable tool fully. As mentioned in Chapter Two aging information was not present at nearly two thirds of the sites/period subdivisions considered here. Out of those with age data 44% had only limited information presented (i.e. briefly mentioning juveniles of unusual birds), whilst 15% had no juveniles present (these latter examples come from small assemblages with all bar one having NISPs under 30). Therefore those sites with full aging data are small in number, and two thirds of them come from the new analyses. Although many reports fail to mention any juvenile material (which unfortunately means we cannot know if this is a true absence indicating use outside of the breeding season, or just a failure to record), those that present some aging information (even when the dataset is far from complete) provide valuable material which can be used to consider the wider assemblage more fully and still provide important insights into seasonality. In this section all juvenile evidence from sites (outside of South Uist material already discussed), will be considered, no matter the form in which it is presented, in order to ascertain as great an understanding of avian resource use by season and location as is possible on an island wide scale.

Mesolithic

The Mesolithic assemblage produced a small quantity of juvenile bone from three sites, allowing a partial insight into this early period (Table 5.20).

Table 5.20: Mesolithic Juvenile data by species and frequency

SITE NAME	ISLAND	ISLAND GROUP	FULL INFO?	SPECIES	FREQUENCY
Cnoc Coig	Oronsay	Inner Hebrides	Yes	Crane	1
Cnoc Coig	Oronsay	Inner Hebrides	Yes	Manx Shearwater	1
Cnoc Coig	Oronsay	Inner Hebrides	Yes	Bird Sp.	4
Cnoc Coig	Oronsay	Inner Hebrides	Yes	Passerine	1
Sand	Skye	Inner Hebrides	Yes	Razorbill / Guillemot	5
Sand	Skye	Inner Hebrides	Yes	Auk Sp	10
West Voe	Mainland	Shetland	No	Shag	Unknown

Interestingly no juvenile gannets were recovered from Cnoc Coig (where arguments based on the non-avian data have suggested a high degree of autumnal activity). This lack of immature gannets could either indicate that the birds were caught very late in the breeding season at the start of autumn when the young were indeterminate skeletally, or that the adults were taken early in the season before hatching young. The presence of smaller juveniles at the site such as Manx shearwater indicates that poorer preservation would not have destroyed the gannet's larger bones; it also demonstrates some use of birds in the nesting burrow environment. The juvenile crane from Cnoc Coig also shows that these birds were breeding around the Inner Hebrides during the Mesolithic, and signifies that hunter-gatherer populations used a wide range of bird resources. The young passerine could be an intrusive specimen, or may demonstrate that these smaller resources were also taken when available.

As mentioned the presence of immature shag at West Voe on Shetland indicates that these resident birds were being targeted during the summer breeding season when both adult and young are available, as well as at other points of the year.

The very auk-dominated Sand produced a small number of juvenile bones, most of which belonged to the dominant razorbill/guillemot grouping. Parks and Barrett (2009)

suggest two possible episodes/timings of capture for this very focused fowling economy; during the breeding season in late spring/early summer, or just after during the moulting season this from July to September when the birds are flightless (Serjeantson 2001, 44). Parks and Barrett (2009) lean towards the moulting theory. However, there is no reason why birds may not have been taken in both the breeding and the moulting period, particularly since as mentioned above the quasi-precocial razorbill and guillemot continue to raise their young at sea until independent (Serjeantson 2009, 11-12). Targeting birds in this extension of the nesting environment when caring for crèches of young, combined with the moult could be productive. However since the auk family are not particularly able flyers this loss of flight would not have been an especially great advantage to the prospective human fowler. Indeed, the auks are most proficient at sea, so targeting them in their preferred environment would put the fowler at a disadvantage. This is particularly emphasised when one considers that all auks are ungainly and vulnerable on land due to their legs being set far back within their body/pelvic girdle, creating an upright, waddling posture, a trait which has long been recognised (Kitchen 1890, 85-87). Greater information on the stage of juvenility would be useful for this intriguing Mesolithic site, since this would allow more detailed understanding of whether very young birds were being targeted or if the few juveniles were closer to adulthood; this would in turn inform on capture location. Unfortunately the only available information regarding these young birds was that they were identified “based on the surface texture consistent with immature bones” (Parks and Barrett 2009).

Neolithic

The small Neolithic assemblage reveals summer capture of visitors and resident species (Table 5.21). The great auk (followed closely by the guillemot) was the most frequently exploited species at the Knap of Howar. Even this small amount of juvenile data would support the suggestion that these great auks were taken during the breeding season when vulnerable on land. The unidentifiable waders and shag also indicate that some of these resident birds were taken during the breeding season despite also being available for exploitation during the winter and at other points of the year.

Table 5.21: Neolithic Juvenile data by species and frequency.

SITE NAME	ISLAND	ISLAND GROUP	ALL INFO?	SPECIES	FREQUENCY	AGE STAGE / COMMENTS
Knap of Howar	Papa Westray	Orkney	Yes	Large Wader	2	
Knap of Howar	Papa Westray	Orkney	Yes	Great Auk	1	
Knap of Howar	Papa Westray	Orkney	Yes	Shag	1	
Links of Noltland	Westray	Orkney	No	Puffin	4	Immature not newly hatched
Links of Noltland	Westray	Orkney	No	Cormorants	3+	"young"
Northton	Harris	Outer Hebrides	Yes	Gannet	2	Immature / Subadult
Pierowall Quarry	Westray	Orkney	No	Gannet	1	<i>cf.</i> juvenile

At the Links of Noltland puffin and cormorant juveniles are present. The four immature (but not newly-hatched) puffin bones account for 25% of the puffin NISP at this site, indicating that taking puffins from the burrow during the breeding season was their main time of capture. There are at least three individual juvenile cormorants present, all of which occurred within the same stratigraphic unit indicating a concentrated catch of juveniles (Armour-Chelu 1985, 23). Armour-Chelu suggests that this may represent a deliberate focus on the young birds in order to preserve the breeding pairs, which would be a more sustainable management of the avian resources for continued exploitation (1985, 23). The single possibly juvenile gannet from Pierowall quarry again suggests

that these birds were being targeted whilst nesting rather than at sea at other points of the year.

The only Hebridean material comes from the reanalysis of the Northton assemblage. Both of the gannet bones from this phase are juveniles, and one, the humerus, displays deep cuts on the distal end, clearly illustrating human processing of these large juvenile birds. These birds were approaching the sub-adult stage of ossification, suggesting that they were taken close to fledging towards the end of summer. This would ensure that the juveniles were harvested at their largest and fattiest stage. Neither the juvenility nor the butchery was identified in Finlay's initial analysis (1984, 48) illustrating how such data may potentially have been overlooked at a large number of sites.

Bronze Age

The only juvenile data for Bronze Age sites, outside of those previously discussed for South Uist, occurred at Early Bronze Age Tofts Ness on Sanday Orkney. Here two gull bones exhibited immature porosity indicating that gulls were targeted in the nesting environment, usually found in areas not disturbed by grazing or human activity.

Iron Age

A diverse range of juvenile birds were represented in the Iron Age material (Table 5.22). At Iron Age Skail, Orkney, at least one black guillemot bone provides evidence for the capture of these small auks from their nests on rocky ledges, often on cliffs. The juveniles from Milla Skerra Sandwick, Shetland, include 11 bones from a single shag/cormorant (most *cf.* cormorant) which exhibits knife cuts on the femur indicating butchery and preservation or consumption of these resident birds during the summer.

This site also produced six bones from an immature/subadult eider duck indicating that the species was targeted late in the breeding season, perhaps after the nest had already been exploited for eggs and feathers (see Chapter Eight).

At Howe (where the majority of bird bone came from Iron Age contexts), juveniles made up around 14% of the avian NISP. Whilst at the time Bramwell (1994, 154) described this as a low frequency of juveniles, with the benefit of collative comparison it can be seen that it is quite high (particularly as the porous juvenile bone does not survive so well as adult material). Unfortunately species information is not given for the vast majority of the Howe juveniles, however Bramwell's discussion of capturing young birds focuses on seabirds, suggesting that these are the species most commonly represented in the juvenile material (1994, 154). The relatively high number of juveniles at this site indicates that the Iron Age populations were still making strong use of the seabird resources, particularly targeting the summer breeding colonies of nesting birds, despite also having an increased use of landbirds (explored earlier in this chapter see Figure 5.15). As mentioned a juvenile crane was present at Howe in the Late Iron Age phases, with eight bones identified which probably all came from a single individual (Bramwell 1994, 154). This bird was very young, and would have been removed from the nest whilst still in down during the summer months. These younger cranes were probably better eating than the tough adults if consumption was the focus of this particular fowling event (Albarella and Thomas 2002, 23).

A juvenile and immature bones from a wader identified as turnstone were also present at Howe. It is recorded here as 'wader *cf.* turnstone' since the identification of small waders is challenging without the added difficulties of juvenility and the previously

discussed overconfident identification of some waders. However if correct this would signify that these birds once bred in Britain, whereas today they are only a winter visitor (Bramwell 1994, 156). Several ravens at the fledging stage were also identified, suggesting that corvids were taken young, probably for food (as these young birds were better eating), but also potentially for symbolic reasons (See Chapter Eight) (Cartledge and Grimbley 1999, 285; Serjeantson 2009, 331-332; Serjeantson and Morris 2011, 98-100) They may even have been kept as pets (Bramwell 1994, 155; Luff 1984, 41). Immature short-eared owl was also present at Howe in the rubble of the broch indicating that either young raptors were taken, or that these birds nested or used the broch tower (Bramwell 1994, 155).

Interestingly no juvenile domesticates are present in the Iron Age material despite making their first appearance in this phase, which could tentatively suggest that these birds were not fully established breeding populations in which young birds might be killed for meat, particularly males.

Meanwhile in the Hebrides at Dunan Ruadh on Pabbay, which was almost exclusively dominated by shags, many of the shag “bones come from very young birds”, but unfortunately there is no further quantification or clarification (Cartledge 200, 268). However it appears that these resident species were being heavily targeted with specific fowling activity during the early phase of their breeding season when the young had only just hatched. Unidentifiable juveniles formed 15% of the NISP at Sloc Sabhaid Baile Sear, a juvenile corvid was present at Killelan Farm in the Inner Hebrides and one young shag was present at Dun Mor Vaul on Tiree in the Inner Hebrides. This presence of another juvenile corvid within the Iron Age data could even tentatively suggest that

corvid use in the Scottish Islands might be comparable to the ritual importance these birds held in other areas of Britain (Serjeantson and Morris 2011, 99-104).

Iron Age / Viking Transition

As already mentioned this phase produced the latest juvenile great auk from the Scottish Island material from Pool (see Table 5.22 highlighted in grey). This indicates a continued use of these vulnerable birds during the summer months although their numbers were significantly diminished. Other juveniles from this transitional material indicated continued use of summer visitors (gannet), resident birds (cormorant/shag, raven,) and resident/winter birds (herring/lesser black-backed gull) during the summer breeding season (Table 5.22 highlighted in grey). Interestingly young raptors were caught, namely a kestrel and a white-tailed eagle from Pool, suggesting that these birds were taken for diverse purposes. It is possible that young birds such as the kestrel may have been taken to raise them for hunting and falconry (Prummel 1997, 333). Most falconry birds are taken from the nest or at fledging, since the training of adult birds is much more challenging (Prummel 1997, 333).

Pre-Norse/Pictish

No Pre-Norse/Pictish juveniles were present outside of the Bornais, South Uist examples already discussed in Chapter Four.

Table 5.22: Iron Age juvenile data by species and frequency (excluding South Uist). Iron Age/Norse data highlighted in grey at the bottom.

SITE NAME	ISLAND	ISLAND GROUP	PERIOD	ALL INFO?	SPECIES	FREQUENCY	AGE STAGE / COMMENTS	
Skaill Deerness	Mainland	Orkney	IA	No	Black Guillemot	Unknown	Nearly Fully Sized.	
Milla Skerra Sandwick	Unst	Shetland	IA	Yes	Shag / Cormorant	11	cf. cormorant. One individual. Juvenile. Butchered	
Milla Skerra Sandwick	Unst	Shetland	IA	Yes	Eider	6?	Immature/Subadult	
Dunan Ruadh (PY10)	Pabbay	Outer Hebrides	M/LIA	No	Shag	Unknown	Many from Very Young birds	
Howe	Mainland	Orkney	MIA	No	Great Auk	1+	Juvenile	
Howe	Mainland	Orkney	MIA	No	Tawny Owl	1		
Howe	Mainland	Orkney	M/LIA	No	Wader cf. Turnstone	Unknown	Immature	
Howe	Mainland	Orkney	M/LIA	No	Raven	Unknown	'several at the fledging stage'	
Howe	Mainland	Orkney	M/LIA	No	Short eared owl	Unknown	Immature	
Howe	Mainland	Orkney	LIA	No	Crane	8	Very young chick in down, cf. 1 individual	
Sloc Sabhaid Baile Sear	Baile Sear	Outer Hebrides	MIA	Yes	Small Bird	1		
Sloc Sabhaid Baile Sear	Baile Sear	Outer Hebrides	MIA	Yes	Small Passerine	1		
Sloc Sabhaid Baile Sear	Baile Sear	Outer Hebrides	MIA	Yes	Medium Bird	4		
Kilellan Farm	Islay	Inner Hebrides	MIA	Yes	Corvid Sp	1		
Dun Mor Vault	Tiree	Inner Hebrides	MIA	No	Shag	1 Individual	Young'	
Brough Road (1,2,3)	Mainland	Orkney	LIA/N	No	Shag / Cormorant	1	May be more than one bone from this individual	
Brough Road (1,2,3)	Mainland	Orkney	LIA/N	No	Unidentified	Present		
Brough Road (1,2,3)	Mainland	Orkney	LIA/N	No	Auk Sp	2+		
Brough Road (1,2,3)	Mainland	Orkney	LIA/N	No	Starling	1		
Pool	Sanday	Orkney	LIA/Vik	Yes	Raven	1		
Pool	Sanday	Orkney	LIA/Vik	Yes	White Tailed Eagle	1		
Pool	Sanday	Orkney	LIA/Vik	Yes	Kestrel	2		
Pool	Sanday	Orkney	LIA/Vik	Yes	Great Auk	1		
Skaill Deerness	Mainland	Orkney	IA/Vik	No	Gannet	Unknown		Nearly Fully Sized
Skaill Deerness	Mainland	Orkney	IA/Vik	No	Cormorant/shag	Unknown		Nearly Fully Sized
Skaill Deerness	Mainland	Orkney	IA/Vik	No	Herring / LBB Gull	Unknown	Nearly Fully Sized	

Norse

The Norse juveniles give us a vital insight into the use of wild avian resources alongside an increased number of domestic birds (Table 5.23). Unfortunately the juvenile assemblage is relatively small and in this instance only comes from Orkney, not Shetland³⁰. The juveniles from Viking Skaill demonstrate that wild and domestic resources were being utilised when immature. The majority of these come from domestic fowl, all of which were quite young; the original analyst estimates under five months old (Allison 1997, 247). The presence of juvenile lapwing demonstrates use of this resident wader during the summer when it bred, and indicates use of areas such as marsh, grassland and pockets of machair (Cartledge and Serjeantson 2012; Stroud *et al.* 2001a 265). Nine juvenile domestic fowl were identified at Norse Tuquoy, three of which were very young. This may indicate the culling and management of domestic stock, and their role in meat provision (as indicated by the butchered specimen), although of course natural deaths may be present within these remains. The killing of some young stock for meat once they reach a usable size prevents having to keep expending food and labour resources on them, whilst usually a largely female flock is kept for egg production.

Two bones from greylag/bean goose at Norse Pool suggest that either these were domestic geese who were being managed or that this represents the capture of young wild birds on leaving the nest. The lack of any certain domestic geese at this site and the small presence of domestic fowl (3% of the site NISP) could suggest the latter, which would imply use of freshwater nesting habitats during the summer months.

³⁰ Excluding the South Uist specimens already outlined in Chapter Four.

Table 5.23: Norse Juvenile data by species and frequency (excluding South Uist).

SITE NAME	ALL INFO?	SPECIES	FREQUENCY	AGE STAGE / COMMENTS
Skaill Deerness	No	Lapwing	Unknown	Nearly Full Sized
Skaill Deerness	No	Raven	Unknown	Nearly Full Sized
Skaill Deerness	No	Greylag / domestic goose	Present	
Skaill Deerness	No	Domestic Fowl	Several	Under 5 months old
Tuquoy	Yes	Domestic Fowl	9	6 Immature 3 Very Young.
Tuquoy	Yes	Columba Sp	2	Very Young
Tuquoy	Yes	Galliform <i>cf.</i> Domestic Fowl	2	Immature and Very Young
Tuquoy	Yes	Bird	4	1 Immature 3 Very Young.
Tuquoy	Yes	Mallard / Domestic Duck	1	
Pool	No	Greylag / Bean Goose	2	
St Magnus' Kirk	No	Unidentified	1	Immature

Medieval / Post-Medieval

The Medieval and Post-Medieval juvenile remains show a continued use of wild and domestic resources (Table 5.24). In the Late Norse/Medieval to Post-Medieval data from Tuquoy two mallard/domestic ducks were slightly immature, implying that these were either young domestic stock killed for meat, or just fledging wild birds. A continued use of gulls and cormorant in the summer breeding season is indicated by the presence of immature and subadult individuals respectively. The young resident cormorant could have been targeted slightly later in the season after other summer visitors had left. Some very young unidentifiable birds show that juveniles were being taken soon after hatching in some instances. The Inner Hebridean and Orcadian dataset shows a continued use of juvenile resident shags. Meanwhile on St Kilda the extremely focused fowling economy is visible in the juvenile remains, particularly for the fulmar. As mentioned juveniles account for 22% of the fulmar remains, showing the importance of this immature oily bird in the diet and economy of Post-Medieval St Kilda. The scarcity of young gannets could reflect these birds being taken near fledging, late in their skeletal development (Serjeantson 1998, 30).

Table 5.24: Medieval and Post-Medieval juvenile data by species and frequency. Transitional Late Norse/Medieval/Post-Medieval in grey at top.

SITE NAME	ISLAND	ISLAND GROUP	PERIOD	ALL INFO?	SPECIES	FREQUENCY	AGE STAGE / COMMENTS
Tuquoy	Westray	Orkney	LN/M-PMed	Yes	Cormorant	1	Slightly Immature
Tuquoy	Westray	Orkney	LN/M	Yes	<i>cf.</i> Goose	1	Very Young
Tuquoy	Westray	Orkney	LN/M	Yes	Bird	3	Very Young
Tuquoy	Westray	Orkney	LN/M	Yes	Mallard / Domestic Duck	2	Slightly Immature
Tuquoy	Westray	Orkney	LN/M	Yes	Large Gull Sp	1	Immature
Iona Abby	Iona	Inner Hebrides	EMed	No	Shag	3 individuals	Immature
Quoygrew	Westray	Orkney	LMed/PMed	No	Shag	1	Juvenile
Quoygrew	Westray	Orkney	LMed/PMed	No	Unknown	Unknown	Young
St Kilda Black House 8	Hirta St Kilda	Outer Hebrides	Modern c. 1830-1930	No	Fulmar	243	Immature
St Kilda Black House 8	Hirta St Kilda	Outer Hebrides	Modern c. 1830-1930	No	Gannet	'A Few'	Immature
St Kilda Black House 8	Hirta St Kilda	Outer Hebrides	Modern c. 1830-1930	No	Auks	'A Few'	Immature

5.8 Medullary Bone, Sex and Season

The identification of medullary bone at sites outside of South Uist is very scarce and is only recorded at the Links of Noltland and Quoygrew. For the vast majority of the collated site data from pre-existing publications, it is unknown whether the lack of evidence for medullary bone was an actual absence or just unidentified. However, medullary bone was *not* present in Rough Island 41B or in the identified sample from House Island 15B (both on the Shiants), nor was it present within the reanalysed Neolithic to Iron Age assemblages from Northton (all examined by the author, but only using fragmented material meaning medullary bone could be present in whole bones). It was additionally absent from Kilellan Farm and some levels of Pool and Quoygrew.

The small medullary bone assemblage is comprised entirely of wild species and unidentified fragments. During the Neolithic on Orkney multiple duck species were being taken from the nest; for the eider, this almost certainly represents two separate individual birds. This shows that areas near inland water were being used in the early summer. At Quoygrew the medullary bone demonstrates that the Norse population were taking resident species such as the shag and great black-backed gull from around their nesting areas, close to the point of lay. This again indicates that these resident species, while likely to be used year-round, were targeted during the mating season.

Table 5.25: Medullary bone data from sites outside of South Uist

SITE NAME	ISLAND	PERIOD	SPECIES	ELEMENT	NISP
Links of Noltland	Orkney	Neo	Eider	Ulna	2
Links of Noltland	Orkney	Neo	Shelduck	Femur	2
Links of Noltland	Orkney	Neo	Unknown	Unknown	1
Quoygrew Farm Midden iii	Orkney	M/LN	Unidentified	Humerus	1
Quoygrew Fish Midden 2	Orkney	M/LN	Shag	Humerus	1
Quoygrew Fish Midden 2	Orkney	M/LN	Great Black-backed Gull	Humerus	1

The actual number of medullary-bearing bones is likely to be significantly higher than recorded since, with the exception of The Links of Nolthead, intrusive sampling was not documented as having been conducted, limiting identification to naturally broken bones. At The Links of Nolthead all complete humeri, femora and ulnae were x-rayed and some cross-sectioning and SEM microscopy was also employed (Armour-Chelu 1985, 19-21). This can make comparison of the data challenging; this area would benefit from further work across a diverse range of sites, which was sadly beyond the scope of this thesis.

Sex from Non-Medullary Characteristics

One goshawk at Late Iron Age Pool was sexed via measurement data and identified as probably female (Prummel 1997, 333-338; Serjeantson 2007, 279-285). If this is a wild bird she might have been taken whilst tending young or defending the nest, but there is also the possibility that this could be a tame hunting bird (MacPherson 1897, 166-171 and 196-197). Intriguingly although no sexual indicators for domestic fowl were present in the form of medullary bone at any of the non-South Uist sites, females and males were identified at Pool, Quoygrew and Tuquoy by the tarsometatarsus spur (Table 5.26). This could perhaps indicate different fowl management practices at these sites.

Table 5.26: Non-Medullary sexual characteristic from sites outside of South Uist

SITE NAME	PERIOD	SPECIES	SEX	ID	NISP
Pool	LIA	Goshawk	Prob Female	Metrics	1
Pool	LIA	Domestic Fowl	Prob Female	No spur	1
Quoygrew Farm Midden iii	M/LN	Domestic Fowl	Prob Female	No spur	3
Tuquoy	Norse	Domestic Fowl	Prob Male	Spur	1
Tuquoy	Norse	Domestic Fowl	Male	Spur	1
Tuquoy	Norse	Domestic Fowl	Prob Female	No spur	3
Tuquoy	LN/M-PMed	Domestic Fowl	Prob Female	No spur	1

Domestic Fowl: Breeding and Kill-Off Pattern

This potential lack of medullary bone in the Orcadian domestic fowl suggests that the

proportion identified at Norse Bornais Mound 2 and 2A and Norse Cille Pheadair (both on South Uist) is relatively high and provided vital information on husbandry practices. At these two sites females with medullary bone constituted 12 and 16% of the domestic fowl NISP, and the true proportion will be significantly higher as this figure refers only to broken specimens (Table 5.27). This would suggest a population kept for eggs (Serjeantson 2009, 36).

Table 5.27: Proportion of domestic fowl with medullary bone, Bornais M2/2A

	Domestic Fowl	Galliform <i>cf.</i> Domestic Fowl
NISP	90	34
% with medullary	16	12
% Inc. Possible Medullary	17	N/A

At Cille Pheadair and Bornais the majority of the female birds were identified by the presence of medullary bone. One female fragment (a tarsometatarsus) had no spur present and a thin trace of medullary bone. Only one additional ‘Possible Female’ was identified by a possible thin trace of medullary bone, and a final female was tentatively identified by the absence of spur alone (and as such is not included in the medullary calculations). The large number of females with medullary bone shows that these birds were killed just before egg laying or very shortly after. (It is possible that some may have died naturally, but given that these are domesticates and that one fragment is butchered natural mortality is unlikely to change the overall dataset radically). The majority of the specimens contained a large amount of medullary bone within the shaft suggesting that these birds were still capable of lay, and not that these females were struggling to retain enough calcium for egg creation, or that they had reached the end of their laying-life and the small amount of residual medullary bone was being reabsorbed (Lentacker and Van Neer 1996, 492). This is not the best management practice in terms of sustained economy since these birds would have been providing eggs for food or

young birds. This could suggest that these birds were killed in winter when other avian resources were less prevalent and the surplus male stock had already been killed.

Two bones, the aforementioned tarsometatarsus and another ulna, only exhibited a thin layer of medullary bone which could indicate that these birds were killed when they could no longer lay. However, this is difficult to assess accurately, as medullary bone is also lost during the moult (Van Neer *et al.* 2002, 129-130; Serjeantson 2009, 50-51; Taylor *et al.*, 1971, 630).

Furthermore, in an experimental study investigating medullary bone in domestic fowl conducted by Van Neer, medullary bone was found to occur most commonly in the femur and tibiotarsus and less frequently in the humerus and tarsometatarsus. Medullary bone forms best in elements which have the greatest blood supply such as the femur, tibiotarsus and ulna (Lentacker and Van Neer 1996, 491; Van Neer *et al.* 2002, 129). As a result medullary can more easily fill a large extent of the bone cavity. Elements such as the humerus which are pneumatised are filled to a lesser extent due to air sacks forming a larger proportion of the cavity (Lentacker and Van Neer 1996, 491; Van Neer *et al.* 2002, 129). This variation in medullary bone between elements can affect the calculation of abundance of females in lay, and can make data comparison problematic. This is particularly relevant since the humerus is often one of the most frequently occurring elements, and for example no domestic fowl humeri were found with medullary at these Norse sites. The degree of fill also varies even within individual bones (Van Neer *et al.* 2002, 129). The affect of pneumatisation on medullary bone is also of importance when comparing its presence in different species. Birds such as the gannet have a high degree of pneumatisation in a range of their elements which could in turn affect the appearance, extent, duration and survival of medullary bone. Auks with

their compact wing-bone shafts may also be disadvantaged in terms of observation. As such these key species which were repeatedly targeted in the Scottish Islands may be underrepresented in terms of medullary data.

Therefore while assessing the extent of medullary bone within the cavity can be informative on the cessation of laying, its application is limited and its appearance so variable as to make anything other than extensive filling uncertain of interpretation.

5.9 Taphonomic Profile

Butchery

Birds, because of their size, do not require extensive preparation prior to consumption, resulting in less chance of butchery marks occurring on the remains. However, butchery was identified in every period and at a range of sites with 209 butchered bones in total from sites outside of the already discussed South Uist examples (See Appendix Table A5.26 for full data). Many birds are a size which enables them to be processed whole (Armour-Chelu 1988, 5). It is also practical to butcher birds without using knives by overextending and snapping joints. Marks indicating this were observed on South Uist at Norse Cille Pheadair and Bornais, particularly on the olecranon process of the ulna and the olecranon fossa of the humerus, indicating removal of the wings. Birds are ideally not skinned prior to cooking or consumption since (particularly in oily, greasy seabirds) it loses the valuable layer of fat beneath the skin (Armour-Chelu 1985, 1-5). In cases where the bird is intentionally skinned in order to use the material, this fat can be salvaged. In Northern Canada where this is still sometimes practised the fat was sucked from the skin in before use. This neatly cleans the skin prior to use in clothing and also prevents waste of this valuable fat; a technique which may have been employed in the past (Oakes and Stone 1990, 1-13; Serjeantson 2009, 204).

As such where butchery is observed in the Scottish Island material it usually represents disarticulation or removal of meat from the bones. The majority of butchery examples were in the form of knife cuts. The cuts mainly occur on larger birds such as the gannet, great auk, geese, gulls, shag and cormorant indicating repeated use of these large birds for food. However, this is by no means exclusively so, with butchery also being present on birds such as puffin, ducks, snipe, and a *Columba* sp. Birds as large as the great auk would need more pre-consumption processing than smaller species.

At Neolithic Links of Nolthland the butchery marks were mainly observed on the wing elements, suggesting that they were being removed. The scarcity of flint occurring in Orkney means that in pre-metal societies skaill knives were employed, for which butchery marks can be harder to recognise as was demonstrated in experimental work conducted by Armour-Chelu on chicken bones (1985 24-25). Processing is not just indicated by traditional cut marks but also fractures indicative of sharp breakage. A great auk coracoid from Neolithic Tofts Ness was burnt and snapped; another potential example of butchery without knives. Bronze Age butchery of shag and cormorant indicate processing of these resident birds, perhaps in order to preserve them for consumption at later points of the year (since as indicated above via the juvenile bone some of these birds were captured in the summer).

In the Iron Age, cuts on Brent goose and whooper swan give evidence for processing of winter visitors. Cuts were also identified on an oystercatcher from the Late Iron Age/Viking interface from Pool which indicates preparation of these waders for food. From the Late Iron Age onwards the first processing of domestic birds is visible, with this continuing strongly through the Norse data (accounting for nearly half of the

butchered specimens). This is high when it is considered that despite their increase domesticates still make a modest overall contribution to the Norse avian resource base, indicating potentially differential processing of wild and domestic resources.

Worked Bone

In addition to knife cuts there were 43 worked bones present formed from large birds' bones including gannet, crane, geese and gulls. When it is considered that Late Bronze Age to Early Iron Age Cladh Hallan on South Uist had 28 examples, the rarity of worked bird bone in general is emphasised as is the unusual nature of Cladh Hallan's worked assemblage. Worked bone occurred in the Mesolithic at Cnoc Coig (8) and Sand (1) in the form of points and awls, indicating that the birds in this hunter-gatherer context were employed for more than just food. These tools could have been used to work and pierce material such as skins.

The Neolithic worked bone comes from Skara Brae (1), Tofts Ness (11) and Links of Noltland (1); again the majority of the worked bones were awls and points, with one unknown example also being present. This shows a continuity of tool form and use of bird bones as a raw material in these earliest prehistoric phases. The Bronze Age worked bone from Ardnave, Tofts Ness and Jarlshof also produced awls and points, but in addition included a tube worked from the shaft of a possible crane.

The Iron Age produced the greatest number of worked bones (correlating with its overall size in terms of NISP and number of sites, see Figure 5.16). The variety of forms has also diversified. Awls and points are still present however; pins, tubes, needle-case tubes, and unknown items are also represented. Articulated guillemot wing groups from

Howe have been interpreted as brushes, as described in the context of St Kilda above. A solitary Norse worked bone is present at Saevar Howe and is described as a needle case formed from the tube shaft of a large bird like gannet. Three additional tube like cylinders made from the longbones of large birds were identified at Room 5 Clifftop Settlement, Brough of Birsay, but no quantifiable or identifiable data was available for this site (Curle 1982, 61).

Burnt Bone

Very little bird bone exhibited burning with the exception of Mesolithic Sand (Table 5.28). Here 207 bones were burnt, however it is important to consider that Sand produced a very large assemblage of 16,341 fragments so burning was present on less than 2% of the bones. This low occurrence of burning is typical for those sites where burning information is available, usually being lower than on the mammalian remains (Cartledge and Serjeantson 2012, 298; Harland 2006 384). This probably reflects that birds can be processed whole more easily with less chance that bones in chopped joints will become burnt, and also that any bird bones discarded into the fire are less likely to survive.

Small numbers of snipe, great auk, herring/lesser black-backed gull and razorbill were burnt at Neolithic Northton, Quanterness, and Tofts Ness, indicating that both large and small birds were being processed near the fire environment. A single great auk humerus from Beaker Age Northton exhibited possible calcinations. A guillemot, cormorant, large goose and a puffin exhibited burning in the Iron Age material, again demonstrating that not just the largest birds were burnt.

The only Norse burning comes from Quoygrew. At Quoygrew the burnt bird bone formed between 3-7% of the various phase assemblages which was comparable to the fish remains from this site but substantially lower than the mammalian assemblage (Harland 2006 384). This low incidence of burning is common to other avian assemblages as is the higher expression on the comparative mammalian assemblage. However it is interesting to note that at Quoygrew burning is more evident as a proportion of the bone in the Fish Mound Phase 2 (7%) and the Farm Mound Phase ii (7%) than in the later Farm Mound Phase iii (4%) (Harland 2006, 385). It is also useful to note that the Fish Midden contains only one domestic fowl bone despite being of a comparable date to the later phase of the Farm Mound, which contained a higher proportion of domestic fowl (4% of the NISP). The variance in taphonomic profiles may therefore be linked to the differential processing of certain birds, in different ways, at specific locations perhaps as part of a different taskscape. Different groups of birds may have been perceived as different resources and processed accordingly. For example seabirds may have been more associated with resources caught at sea whilst domestic fowl may have been more equated to domestic mammals. Variations in the butchery and burning profile may therefore reflect more than just alterations in generic processing.

Cooking and Preserving

Fire in particular may have been used differently for different avian resources as would various methods of preservation which may leave traces upon the bones. Today the modern Guga hunters of Lewis use fire to process the young gannets and prepare them for preserving. Fire is used to singe the feathers from the birds since if left in place they could foul the meat. A similar singeing technique was employed on Mingulay for cormorants (Buxton 1995, 82). Drying meat over or next to a fire is an adequate

preservation technique and may create some moderate local burning activity. Whilst domestic fowl could be killed at any chosen time, eliminating the need to preserve this specific species, their eggs may have been preserved for use during gaps in egg laying. Specific timings regarding how much of the year hens laid for and how long they stopped laying during the moult are complex and uncertain (Stewart *et al.* In Prep.; Stone 2006, 148-161).

Interestingly no burning was present in the Post-Medieval assemblages from St Kilda despite documented evidence of drying and smoking around the fire, which demonstrated that heat processing may leave no marks on the bone. Three fragments from the Medieval to Post-Medieval assemblage on St Kilda produced calcined bone, showing processing of some key species (puffin, gannet and guillemot), and probably the disposal of waste on the domestic hearth. At Pre-Norse/Pictish and Norse Old Scatness several gull bones were found in and around the Viking hearth with several elements from the shoulder girdle and upper wing exhibiting cut marks. This suggested to the excavators (and to this author) that the birds were being processed in this environment, and that cooking or drying of the bird meat was taking place (Nicholson 2010, 169). Birds could also be preserved by hanging in the house, salting, or by stacking in cleitean so that the wind passed through and dried them; such methods were employed on St Kilda (Kearton 1897, 113; Maclean 1992, 99; Martin 1753, 25). Eggs could also be preserved by burying them in peat ash for up to eight months (Martin 1753, 36).

Table 5.28: Burnt bird bones in period order.

SITE NAME	ISLAND GROUP	PERIOD	SPECIES	ELEMENT	TYPE	FREQUENCY
Sand	Inner Hebrides	Mesolithic	Unknown	Unknown	Calcined	6
Sand	Inner Hebrides	Mesolithic	Unknown	Unknown	Charred	261
Quanterness cairn	Orkney	Neolithic	Snipe	Coracoid	Charred	1
Tofts Ness 1 & 2	Orkney	Neolithic	Great Auk	Coracoid	Burnt and snapped	1
Northton	Outer Hebrides	Late Neolithic	Herring/LBB Gull	Tibiotarsus	Possible charring	1
Northton	Outer Hebrides	Late Neolithic	Herring/LBB Gull	femur	Possible Heating	1
Northton	Outer Hebrides	Late Neolithic	Razorbill	Humerus	Charred	1
Northton	Outer Hebrides	Beaker V/VI	Great Auk	Humerus	Possible Calcination	1
Howe	Orkney	Middle Iron Age	Guillemot	Humerus	Calcined	1
Howe	Orkney	Middle Iron Age	Cormorant	Humerus	Scorched	1
Sloc Sabhaid Baile Sear	Outer Hebrides	Middle Iron Age	Large Goose	Carpometacarpus	Burnt	1
Bostadh	Outer Hebrides	Late Iron Age	Puffin	Humerus	Possible Burning	1
Quoygrew Farm Midden ii	Orkney	Early Norse AD 779-981	Unknown	Unknown	Charred	5
Quoygrew Farm Midden ii	Orkney	Early Norse AD 779-981	Unknown	Unknown	Calcined	3
Quoygrew Farm Midden iii	Orkney	Middle-Late Norse AD 1035-1261	Unknown	Unknown	Charred	25
Quoygrew Farm Midden iii	Orkney	Middle-Late Norse AD 1035-1261	Unknown	Unknown	Calcined	5
Quoygrew Fish Midden 2	Orkney	Middle-Late Norse AD 1066-1294	Unknown	Unknown	Charred	13
Quoygrew Fish Midden 2	Orkney	Middle-Late Norse AD 1066-1294	Unknown	Unknown	Calcined	3
St Kilda Black House 8	Outer Hebrides	Medieval 10th-13th century onwards	Puffin	Unknown	Calcined	2
St Kilda Black House 8	Outer Hebrides	Medieval 10th	Guillemot	Unknown	Calcined	1
St Kilda Black House 8	Outer Hebrides	Medieval 10th	Gannet	Unknown	Calcined	1
Quoygrew	Orkney	Late Medieval - Post-Medieval	Unknown	Unknown	Charred	2

Table 5.29: Gnawing information in period order (table over two pages)

SITE NAME	ISLAND GROUP	PERIOD	SPECIES	TYPE	FREQUENCY
Sand	Inner Hebrides	Mes	No species given	Carnivore	2
Sand	Inner Hebrides	Mes	No species given	Rodent	1
Quanterness cairn	Orkney	Neo	Small Species	Possible Owl Pellet	Unknown
Links of Nolthland	Orkney	Neo	Snipe	Carnivore Puncture	1
Links of Nolthland	Orkney	Neo	Unidentified	Carnivore Puncture	1
Tofts Ness 1 & 2	Orkney	Neo	Gulls	Possible human gnawing / crushing	129
Northton	Outer Hebrides	LNeo	Gannet	Rodent Gnawing	1
Northton	Outer Hebrides	Beak	Cormorant	Rodent Gnawing	1
Northton	Outer Hebrides	Beak	Shag	Carnivore Punctures	Unknown
Cnip	Outer Hebrides	MIA	Shag	Carnivore	2
Cnip	Outer Hebrides	MIA	Goose Sp.	Carnivore	2
Northton	Outer Hebrides	IA	White Tailed Sea Eagle	Carnivore Puncture	1
St Boniface's Church	Orkney	IA	Goose Sp	Carnivore <i>cf.</i> cat	1
Pool	Orkney	LIA	Fulmar	Carnivore	1
Pool	Orkney	LIA/Vik	Unknown	Carnivore	Unknown
Quoygrew Farm Midden ii	Orkney	EN	No species given	Carnivore	1
Tuquoy	Orkney	Norse	Domestic Fowl	Carnivore	2
Tuquoy	Orkney	Norse	Domestic Fowl	Carnivore	4
Tuquoy	Orkney	Norse	Domestic Fowl	Rodent	1
Tuquoy	Orkney	Norse	Domestic Fowl	Carnivore	1
Tuquoy	Orkney	Norse	Gannet	Carnivore	1
Tuquoy	Orkney	Norse	Greylag / Domestic Goose	Carnivore	1
Tuquoy	Orkney	Norse	Greylag / Domestic Goose	Carnivore	7
Tuquoy	Orkney	Norse	Razorbill	Carnivore	1
Tuquoy	Orkney	Norse	Shag	Carnivore	2

Tuquoy	Orkney	Norse	Shag	Carnivore	1
Tuquoy	Orkney	Norse	Shag	Carnivore	1
Tuquoy	Orkney	Norse	Shag	Carnivore	1
Pool	Orkney	Norse	Gannet	Carnivore	Unknown
Pool	Orkney	Norse	Goose	Carnivore	Unknown
Pool	Orkney	Norse	Cormorant	Carnivore	Unknown
Quoygrew Farm Midden iii	Orkney	M/LN	No species given	Carnivore	3
Quoygrew Farm Midden iii	Orkney	M/LN	No species given	Rodent	1
Quoygrew Farm Midden iii	Orkney	M/LN	No species given	Rodent and Carnivore	1
Quoygrew Fish Midden 2	Orkney	M/LN	No species given	Carnivore	1
Quoygrew Fish Midden 2	Orkney	M/LN	No species given	Rodent	1
Tuquoy	Orkney	LN/Med-PMed	Cormorant	Carnivore	1
Tuquoy	Orkney	LN/Med	Mallard/Domestic Duck	Carnivore	1
Tuquoy	Orkney	LN/Med	Greylag/Domestic Goose	Carnivore	1
Tuquoy	Orkney	LN/Med	Greylag/Domestic Goose	Carnivore cat otter or dog	2
Tuquoy	Orkney	LN/Med	Shag	Rodent	1
Tuquoy	Orkney	LN/Med	Shag	Carnivore	1
Tuquoy	Orkney	LN/Med	Gull <i>cf.</i> Common	Possible Carnivore	1
Tuquoy	Orkney	LN/Med	Bird	Rodent Moderate	1
Tuquoy	Orkney	LN/Med	Domestic Fowl	Rodent	1
Quoygrew	Orkney	LMed/PMed	No species given	Rodent	3
Quoygrew	Orkney	LMed/PMed	No species given	Carnivore	2

Continued Table 5.29: Gnawing information in period order

Gnawed Bone and Animal Accumulation

Gnawing occurred in small quantities in all periods except for Pre-Norse/Pictish (Table 5.29). The majority is inflicted by carnivores, but there is also one example of possible owl pellet encompassment from Neolithic Quanterness for small intrusive birds such as small passerines. Another 13 bones displayed rodent gnawing. Perhaps most unusual is the Neolithic assemblage from Tofts Ness in which 129 gull bones exhibited repeated damage patterns compatible with human gnawing and crushing (Serjeantson 2007a, 120-121).

Animal gnawing, and particularly carnivore gnawing, mainly occurs upon the wing and lower leg longbones, particularly the humerus and the tibiotarsus, perhaps indicating disposal of part of the bird during processing when it still bore some flesh. Gnawing occurs most commonly on large seabirds and waterfowl such as gannet, shag and goose. However duck and razorbill both survived and displayed carnivore gnawing.

The gnawing information demonstrates that animals had access to the avian remains and may have destroyed or moved some of the material. It also implies that some waste elements may have been discarded with some flesh adhering, making them attractive to the scavenging carnivores. One interesting fragment identified during the Northton reanalysis was a Late Neolithic juvenile gannet humerus that not only displayed cut marks, but had also been rodent gnawed. This helps to demonstrate these remains were open to animal predation after human processing.

An Example of the Problem of Non-Anthropogenic Assemblages

As mentioned during this chapter several of the assemblages contain material identified as possibly or probably intrusive. In particular the cairns and brochs of Orkney potentially have sizable non-anthropogenic components, largely in the form of small passerines. These have been (where possible) distinguished in the recording process. However, this segregation is not always clear cut. For example, at Early Iron Age Bu on Orkney many of the bird bones (264) came from abandonment deposits. However, these deposits contain a large number of domestic mammal remains, and other finds which suggest that much of the material in these deposits (including the birds) is from the occupation material, and as such we risk unduly excluding avian data from analysis (Bramwell 1987, 135; MacKie 2002a). For example at Bu, gannet forms 10% of the NISP and shag, cormorant and razorbill/guillemot are also numerous. These birds are not only unlikely to enter the environment of their own volition (unlike the passerines), but these larger species are much less likely to have been assembled by an avian predator. The only remains from the pure occupation layers were a little auk, a gannet, a merlin, three red grouse, one golden plover and one skylark; it therefore appears that in this instance some of the material may have become mixed.

Using the Body – Elemental Representation

Elemental evidence is the strand of data least well represented in the collated avian material. Where it is presented it is usually in an incomplete form partially because elemental evidence can be very complicated to interpret particularly for avian assemblages which (as seen) are often very diverse in terms of species. Furthermore the information it can convey is frequently limited and time/space restrictions within reports or publications hinder its application. Overall the elemental information suggests that

the majority of the birds recovered from archaeological deposits entered the site in question whole. This includes both human-captured species, and some of those which entered through non-anthropogenic means. Examining elemental distributions, articulated skeletons and element 'bundles' can help to determine whether the remains are the result of human resources or accidentally included specimens. In many instances intrusive specimens can be identified based on their size, species and elemental make up. For example at Links of Noltland a range of small passerines and some small waders were highlighted as intrusive material from raptors (Armour-Chelu 1985; Armour-Chelu 1988, 69-76).

However a presence of small birds need not always dictate a non-human predator. At Cille Pheadair it has already been seen that small waders formed an important part of the assemblage, some of which had knife cuts – a definite indication of human use. Also there are several historical and ethnographic accounts which show the use of small birds (see Discussion). However, these are usually used in conjunction with the available larger birds, so an assemblage such as that at Tofts Ness Phase 4 where larger remains were scarce may signify that a non-human predator was contributing. (It is also worth noting this Later Bronze Age assemblage from Tofts Ness was the only period which did not produce worked/butchered bird bone). This goes to emphasise that all strands of evidence should be integrated and considered in assessing an avian assemblage before attaching dietary or economic significance.

5.10 Meat Weight and Dietary Contribution

Unfortunately the lack of MNE data does limit the extent to which dietary input can be estimated. However, at Mesolithic Sand bone weights were given for identified bones which allows some reconstruction to be attempted. The overall avian bone weight from Sand was 2263.05g. The identifiable birds seen in Table 5.31 by weight, indicate that the majority of this mass is made up by members of the auk family (all species). Shag and cormorant make a minor contribution, but this weight is based on fewer bones since these are larger birds (7 for them compared to 19 for razorbill which produced a similar weight). From this bone weight a very rough and minimal approximation of the dietary input of these Mesolithic birds can be achieved. Using the conversion factor presented in Table 3.1 a meat weight of 33.9458 kg is attained (Colten 1995, 100). Using Smith's (2000) conversion dietary input values outlined in Tables 3.6 to 3.8, a dietary contribution of 108966.018 kcal is achieved (Table 5.30). Taking a modern dietary need of 2000 kcal a day as an approximation, the birds at Sand could have at minimum provided over 54 days of subsistence for an individual. Within the avian food products there would have been nearly five and a half kilograms of protein and almost ten kilograms of fat. When the fatty, greasy, oily seabird form is taken even further into account (remembering that Smith's values are an adjusted proxy), these dietary inputs could be much higher and would have been eaten in conjunction with a range of other food products.

Table 5.30: Dietary input values based on the Sand bird bone.

Meat Weight kg	Protein g	Fat g	Energy kcal
33.946	5431	9844	108966

Table 5.31: Bird bone by weight from Mesolithic Sand (based on Parks and Barrett 2009)

Species	Weight (g)
Shag / Cormorant	13.56
Razorbill	13.95
Guillemot	66.87
Razorbill / guillemot	391.92
Little auk	0.34
<i>cf.</i> Puffin	0.28
Great auk	19.26
Auk family	49.67
Thrush and chat family	0.34

5.11 Closing Summary

This chapter has detailed the archaeological avian resource use and distribution through time and space. Continuous trends in the archaeological material have been considered using both anthropogenic and natural factors to explain their presence and persistence. Patterns of decline, increase and other changes in the observed use and distributions have been explored. The fowling communities of these Scottish Islands are part of a wider landscape of bird use, both in terms of the extension of this research to consider eggshell material, and also their place within the wider island landscape of the North Atlantic. The next chapter will therefore focus on bird use in the Wider Island World of Faroe and Iceland to develop this contextual setting, followed by Chapter Seven which details the existing eggshell analyses of the Scottish Islands and the novel analyses on the Bornais eggshell. This will help to inform upon human exploitation choices, environmental parameters, technological developments, landnám, and changes in avian populations as a result of exploitation and persecution.

CHAPTER SIX

THE WIDER ISLAND WORLD



6.0 Introduction

This chapter explores bird use via archaeological remains from locations within the wider island world surrounding the Scottish Islands; namely Iceland and the Faroe Isles. This will facilitate broader understanding of bird use through time and space, the persistence or unique nature of certain trends and allow wider contextual comparison in Chapter Eight: Discussion. The data presented here (whilst not extensively collated in the manner conducted for the Scottish Islands in this thesis) show continuation of certain trends, and some variations, within the North Atlantic's fowling landscape.

The first part of this chapter will explore the bird bone from Alþingisreit examined by the author as part of this thesis in order to provide analogously analysed and recorded material for comparison with the Scottish Island novel assemblages. Due to a variety of factors (including competition between different factions in Icelandic archaeology, export laws and restricted funds/time) there were limits to which material could be accessed. The site of Alþingisreit was selected since access was possible through Professor John Hines' contacts (both for facilitating study in Iceland and the export of unusual or challenging specimens to be considered in the UK with additional reference material). Furthermore this site is multi-period, the mammalian remains had been analysed to facilitate overall bird usage, and importantly the site provided bird bone from a settlement period context. Previously analysed material will then be presented and explored in comparison with the novel Icelandic and full Scottish Island dataset.

6.1 Alþingisreit: a Multi-Period Icelandic Site

The Site

The site of Alþingisreit³¹ lies in the heart of modern day Reykjavik, with its name referring to its location near the current parliament buildings. The site produced multi-phase archaeological remains with settlements dating from the late 9th century until the 18th and 19th century. Due to its location within the city the area has seen a fairly large amount of building activity in modern years which has had a direct impact on the preservation (in particular) of the Post-Medieval material at the site. Alþingisreit is divided into four phases, with the dating based on tephrochronology and the archaeological remains. The earliest phase (IV) dates from AD 871 to roughly 1226 and provides extremely valuable information for the exploitation of wild birds in the early settlement period of Iceland (Garðarsdóttir 2010, 7-8; Pálsdóttir 2010). The settlement date proposed by historical sources is c.870, when Ingólfur Arnarson is purported to have become the first permanent settler of Iceland (with visitors and over-wintering groups preceding him). The archaeological evidence suggests the 870s are a realistic date for the start of the landnám (Byock 2001). Phase III dates from AD 1226 to c.1500, and provides information on the later Norse and Medieval period at this Icelandic site. Phase II runs from AD c.1500 to c.1800, with the latest phase (I) containing the post AD 1800 material/archaeology (Garðarsdóttir 2010, 7-8; Pálsdóttir 2010).

The majority of the archaeology excavated came from the 9th to 14th century deposits (phases IV and III). From the earliest phase there is evidence of wool processing, domestic animal slaughter, corn drying and tanning conducted within the Alþingisreit

³¹ Also called Alþingisreiturinn and Alþingisreitur.

farmstead (Garðarsdóttir 2010, 7-8 and 87). The site also produced smithing waste from all but phase I³², suggesting that iron working was an important part of its role and economy (Garðarsdóttir 2010, 251-440). It is thus informative to investigate the role of the wild and domestic avian resources through time in this setting.

The Bird Remains from Alþingisreit

The avian assemblage from Alþingisreit consisted of 239 recovered fragments of which 215 were identifiable to species or family. Birds formed a relatively small part of the overall economy, not exceeding 10% of the combined mammal/fish/bird remains in any phase. Fish rise from forming less than 3% of the total NISP in the settlement period to accounting for a third in Phase III and over two thirds in Phase II (Appendix Figure 6.2³³). The high level of identification in Alþingisreit avian remains may result from the retrieval techniques. Very few small elements or fragments were present in the assemblage suggesting that sampling and sieving strategies may have limited their recovery. Although some sieving was employed, the lack of systematic sieving would have resulted in many smaller elements being lost (Pálsdóttir 2010, 34). However the high rate of successful identification was also a result of the species composition of the assemblage which was largely comprised of birds that have very identifiable skeletal elements (such as the auks and other large seabirds, including gannet). The bird bone from Alþingisreit is of generally good condition with the material remaining strong and non-friable. However, the surface condition on the avian bone was fairly poor, meaning that in many instances taphonomic features could not be securely identified.

³² Some slag was present in Phase I indicating a continuation of metal working (Garðarsdóttir 2010, 220).

³³ Mammalian and fish data is taken from Pálsdóttir 2010. Albina Pálsdóttir also conducted initial assessment of the avian material from this site. Analysis was then restarted in full, and completed by the author of this thesis.

The bird assemblage as a whole (all phases combined) was dominated by members of the auk family, including puffin, guillemot, razorbill and also the now extinct great auk (Tables 6.1 and 6.2). Both the common guillemot (*Uria aalge*) and Brünnich's guillemot (*Uria lomvia*) are present in Iceland, but no attempt has been made to separate them here owing to the overlapping morphology and size of many elements and the condition of the osseous material (Harrison *et al.* 2008, 112). The assemblage also contained a large number of domestic fowl bones compared to many other Icelandic assemblages (36 in total), however 32 of these came from a single skeleton and the domestic fowl is only represented by four bones outside of this one individual (Hamilton-Dyer 2010, 53). Gannet, gulls and the cormorant were fairly numerous. Large shearwaters also occurred frequently in the assemblage and were represented by ten bones from either great or sooty shearwaters (*Puffinus gravis* or *Puffinus griseus*).

As in the Scottish assemblages, many of the species present in the Alþingisreit assemblage would have been exploited during their summer breeding season, such as puffin, razorbill and guillemot (Stroud *et al.* 2001a, 389-397). Iceland holds large breeding populations of seabirds, including (for example) the majority of the world's population of puffins (Garðarsson 1999, 155; Harris and Wanless 2011; Petersen 2005, 194-198). Once again the great auk would most likely have been captured when it came ashore to breed in the summer; they are known to have bred at several locations in Iceland historically and, as in Scotland, the archaeological remains indicate a wider past breeding distribution of these vulnerable birds. Although adept swimmers, these flightless birds were sitting targets on the land.

The Alþingisreit assemblage contains a fairly large number of species overall, with at least 23 present, however within this large number of species there are several from similar groups or families. For example multiple gull species are present, different duck species and possibly a variety of geese (see Table 6.1). However the assemblage overall does demonstrate a heavy focus on the auk family, with puffin being particularly dominant and having nearly double the NISP of the guillemot which occurs next frequently. Many of the species are only represented by a small number of bones, a pattern also identified in the Scottish Island landscapes, suggesting occasional use of a wider body of avian resources opportunistically and when accessible.

Alþingisreit Through Time and Space

Like at sites such as Udal or Bornais in the Scottish Islands the multiphase nature of Alþingisreit allows changes in avian resource use over time to be considered (Table 6.2 and Figure 6.1). A similar range of species were captured and used throughout the wide temporal expanse excavated at the site. Puffin continued to be the most commonly exploited bird in phases IV, III and II, but drops to a lower 5% of the NISP in Post-Medieval Phase I. The auk family makes up a large proportion of the remains in all phases; however there are some temporal variations.

The frequency of great auk in the assemblage changes dramatically. The great auk is only exploited in the earliest Norse phase of the site (IV – settlement period to 13th century) where it made up 24% of the NISP with a MNI of 3. After this phase no great auk bones were recovered. Great auks were certainly present and breeding in Iceland well after the end of phase IV (AD 1226), indeed the last known breeding pair were reportedly killed on the island of Eldey in July 1844 (Grieve 1885, 21). Therefore their absence from this assemblage is an indication of the impact that human predation had

upon local avian populations of particular species, and also demonstrates the rapidity with which the vulnerable great auks could be reduced and potentially eliminated.

Table 6.1: NISP (for entire assemblage) ordered with similar species grouped together

Species	NISP
Puffin	44
Guillemot	23
Great Auk	12
Razorbill / Puffin	8
Auk <i>cf.</i> Puffin	3
Puffin / Black Guillemot	2
Razorbill	1
Great black-backed gull	8
Herring/Lesser black-backed gull	4
Kittiwake	4
Small Gull Sp.	3
Common Gull / Kittiwake	1
Gull <i>cf.</i> Herring / Lesser black-backed gull	1
Gannet	11
Sooty / Great Shearwater	10
Duck <i>cf.</i> Eider	3
Duck <i>cf.</i> Mallard	2
Duck Sp.	1
Duck Sp. <i>cf.</i> Tufted	1
Duck Sp. <i>cf.</i> Tufted / Goldeneye	1
Eider Duck	1
Goose Sp.	3
Large Goose Sp.	2
Large Grey Goose <i>cf.</i> Greylag	1
Domestic Fowl	4 (36 inc. Skeleton)
Galliform Sp. <i>cf.</i> Domestic Fowl	2
Cormorant	4
Raven	4
Grouse <i>cf.</i> Rock Ptarmigan	3
Swan Sp.	3
Gyr Falcon	2
White-Tailed Eagle	2
<i>Cf.</i> Wader	1
Fulmar	1
Galliform <i>cf.</i> Grouse	1
Grebe Sp.	1
Large Wader	1
Medium Wader	1
Shag	1
Small Gull or Wader	1
Wader <i>cf.</i> Oystercatcher	1

Table 6.2: Alþingisreit NISP by Phase / Period

Species	I (Post 1800)	II (1500-1800)	III (1226-1500)	IV (871-1226)	Unknown	Total
Puffin	3	13	11	17		44
Domestic Fowl	34	2				36
Guillemot	9	3	7	4		23
Great Auk				12		12
Gannet		10	1			11
Sooty / Great Shearwater	5	4			1	10
Great black-backed gull	2	5	1			8
Razorbill / Puffin		1	7			8
Cormorant	1		2		1	4
Herring/Lesser black-backed gull	3	1				4
Kittiwake		1		3		4
Raven		3	1			4
Auk <i>cf.</i> Puffin		1	1	1		3
Duck <i>cf.</i> Eider		1	1	1		3
Goose Sp.			1	2		3
Grouse <i>cf.</i> Rock Ptarmigan	1	2				3
Small Gull Sp.	1	2				3
Swan Sp.		1		2		3
Duck <i>cf.</i> Mallard		2				2
Gyr Falcon	1			1		2
Galliform Sp. <i>cf.</i> Domestic Fowl		1		1		2
Large Goose Sp.			2			2
Puffin / Black Guillemot			1	1		2
White-Tailed Eagle				2		2
<i>Cf.</i> Wader	1					1
Common Gull / Kittiwake				1		1
Duck Sp.			1			1
Duck Sp. <i>cf.</i> Tufted				1		1
Duck Sp. <i>cf.</i> Tufted / Goldeneye				1		1
Eider Duck		1				1
Fulmar		1				1
Galliform <i>cf.</i> Grouse		1				1
Grebe Sp.			1			1
Gull Sp. <i>cf.</i> Herring / Lesser black-backed		1				1
Large Grey Goose <i>cf.</i> Greylag			1			1
Large Wader		1				1
Medium Wader	1					1
Razorbill				1		1
Shag			1			1
Small Gull or Wader	1					1
Wader <i>cf.</i> Oystercatcher		1				1
Grand Total	66	70	50	51	2	215

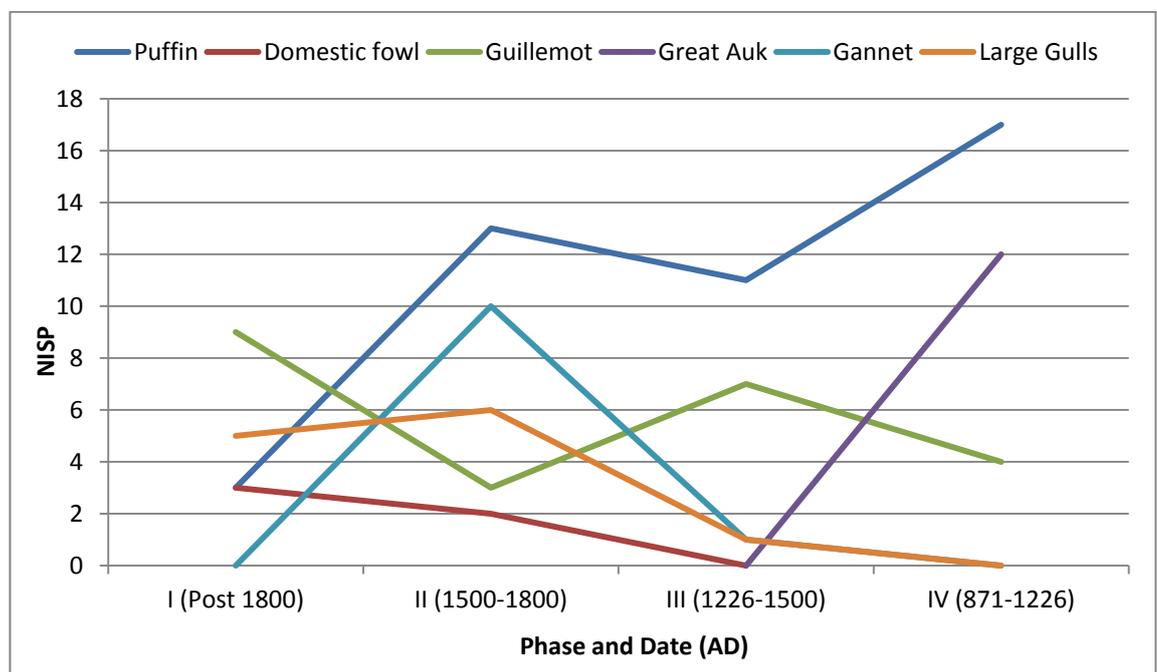
The gannet is another species which appears to have been exploited differently over time. It is absent from the earliest phase (IV), and only produced one fragment in phase III, but it is then the second most frequent species in phase II with 10 fragments (making up 14% of the NISP) and an MNI of 2. Its popularity is however short lived and it is once again absent by the latest phase. Its increased capture may be linked to the decline in availability of the great auk, as was seen at many individual Scottish Island sites and in the overall fowling/species frequencies. Like the great auk, gannets are sizeable birds which provide valuable dietary oil and large eggs.

The larger gull species (herring/lesser black-backed and great black-backed gull) are more frequently captured in the later phases (see Figure 6.1 and A6.1). One point of interest is that the proportions of guillemot and puffin act in opposition to each other. For example in Phase III puffin decreases and guillemot increases. Then in phase II the number of guillemots decline significantly and the puffins again become very prominent. Since guillemots and puffins have different nesting habitats this does not seem to be a result of a decrease in one population causing an increase of the other, but perhaps reflects a selection or change of harvesting environment by the human exploiters. Overall however puffin is more abundant than guillemot until the latest period (I) where it only has three fragments present.

Wild species fulfilled all avian needs in the Norse/Medieval periods with no securely identified domestic birds occurring until phase II. There is one possible domestic fowl bone from phase IV, but it was highly broken and fragmented preventing further identification. It is possible that it belongs to a wild Icelandic galliform such as the rock ptarmigan (*Lagopus mutus*). This possible single bone demonstrates that domestic

chickens played only a small role in early animal husbandry at Alþingisreit. Even in phase II, domestic fowl is only represented by two bones and the wild resources still dominate. In the post-1800 assemblage (I) it dominates the assemblage in terms of NISP, however as mentioned above the majority of these bones came from one individual with only two separate specimens.

Figure 6.1: Species frequencies over time (domestic fowl skeleton represented as 1)



While all of the birds identified in the assemblage are edible, some of them may not have been eaten, and others may have been captured primarily for reasons beyond food. Gyrfalcon was represented by two ulnae from two very separate phases (I and IV). Both specimens revealed faint cut marks indicative of feather removal which could suggest that these birds were used for their feathers (and other elements such as talons) after death, or even targeted for this reason. It is also possible that these raptors were killed to protect livestock, or even for food. However it is essential to consider that these raptors may have been birds kept and used for falconry, although naturally they may have

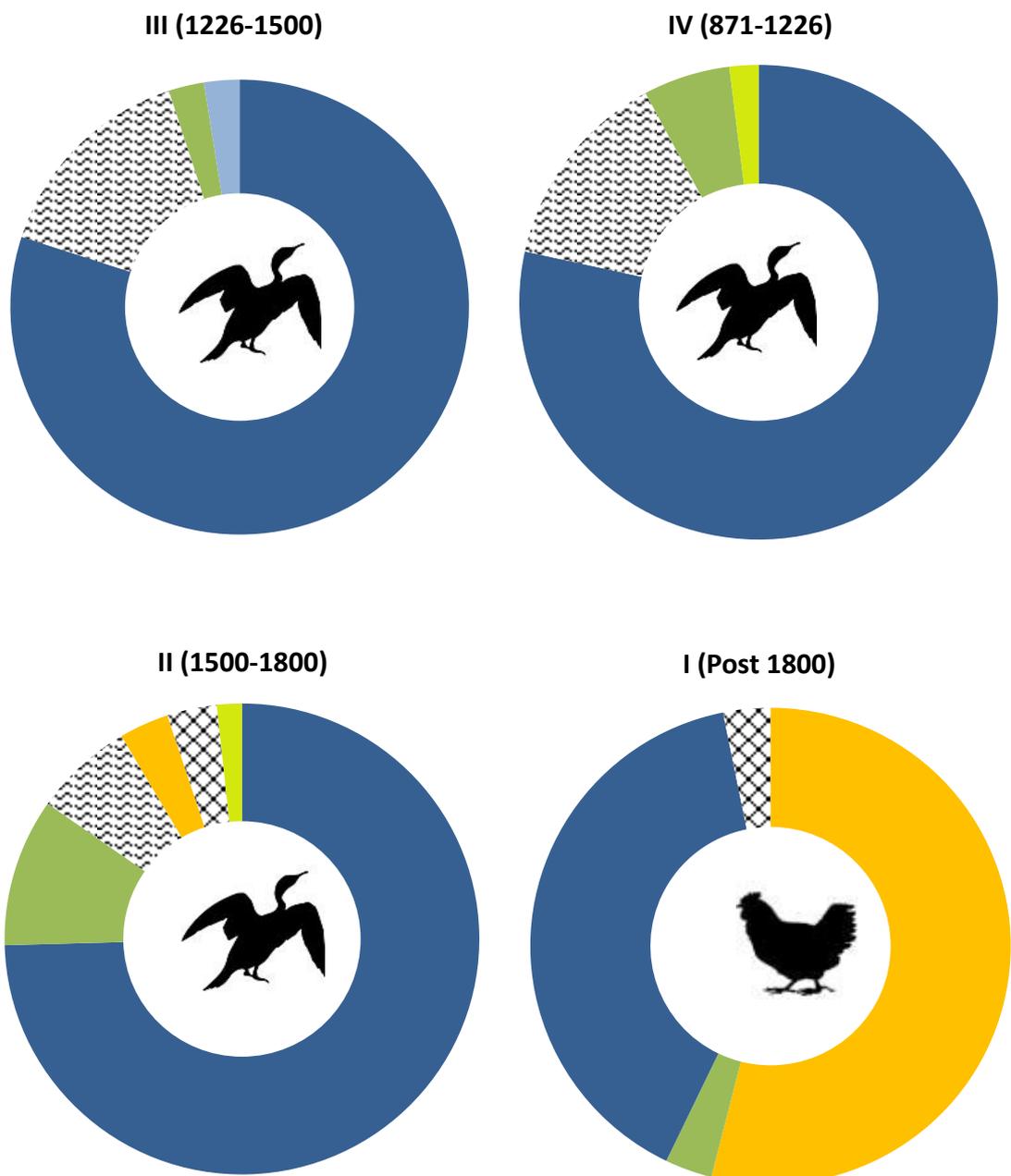
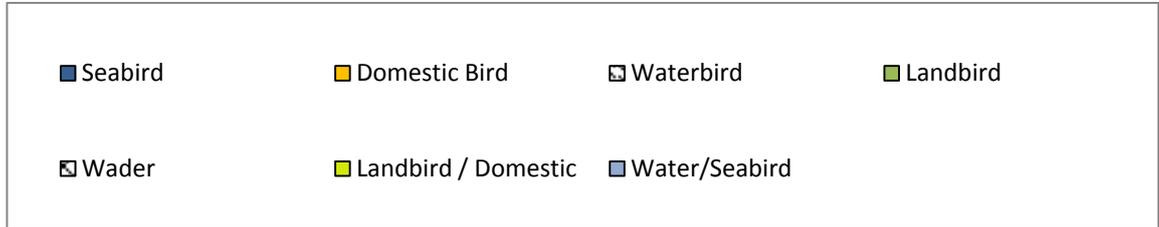
provided additional products such as feathers after their death. The Gyr Falcon was one of the most prized falconry birds of the Norse and Medieval period. It is the largest true falcon, and its size combined with its variable and striking colouration made it a very desirable bird which was often restricted to the higher levels of society (Cherryson 2002, 308; Grant 1988, 180). Other falcons such as the peregrine were also deemed appropriate for important nobility (e.g. princes) and clergy of the high rank (Oggins 2004, 115). It is likely that these bones therefore come from tame birds, either being used within Iceland or transported to other areas of Europe (Harrison *et al.* 2008, 103; Krivogorskaya *et al.* 2006, 387; Þórdarson 1957).

Groupings and Landscape Use Through Time

The avian resources show that overall the inhabitants used a number of different habitats, although many of the species most commonly exploited could have been captured in the same landscape area (Figure 6.2). As a whole, birds of the marine environment are the most commonly exploited grouping. This shows familiar use of the seascape by the past populations of Alþingisreit to acquire resources from areas including cliffs, rocky skerries, shoreline, cliff tops/islands, and possibly open water. Waterfowl make a modest contribution in all but the latest period indicating capture near freshwater. In the Norse and Norse/Medieval phases waterbirds occur most commonly after seabirds. Over time there is a shift in the avian resources used by the Icelandic populations in this environment. While the inhabitants of Alþingisreit still made use of the wild resources of the surrounding landscape, domestic fowl played a more important role in the Post-Medieval avian economy to an extent that had not previously been seen at the site (Figure 6.2). Unfortunately the lack of eggshell remains

from the site limits the extent to which this growing role of domesticates and the continuation of wild resource use can be investigated.

Figure 6.2: Avian groupings by period for the Alþingisreit material



The Taphonomic Profile

The assemblage contained a high proportion of butchered bones with 13% of the NISP displaying cut marks, and there was also a single worked specimen. This worked bone had multiple very prominent use-wear striations as if the specimen had been repeatedly rubbed against another article, and also displayed cut marks. One cormorant humerus also displayed possible use wear, but the surface condition prevented further clarification. Cut marks appeared on a range of species, including small birds such as puffins (Table 6.3). This suggests that a variety of birds were being processed for meat. The seven cut marks on puffin bones all occurred on the humerus, suggesting that the wings were being removed, again a pattern which has been noted in the Scottish material. The humerus was the most frequently butchered element overall followed by the ulna and the tibiotarsus (Table 6.4). This overall butchery pattern is similar to that observed in the South Uist assemblages where although large birds most frequently display butchery this was not exclusively so.

Table 6.3: Butchery and working by species

Species	Cut	Worked and Cut	Possible Cut
Puffin	6		1
Great auk	2		3
Great Black-Backed Gull	4	1	
Sooty / Great Shearwater	4		
Gannet	3		
Razorbill / Puffin	2		1
Gyr Falcon	2		
White-Tailed Eagle	1		1
Auk <i>cf.</i> Puffin	1		
Cormorant			
Domestic fowl			1
Galliform Sp. <i>cf.</i> Domestic Fowl	1		
Guillemot			1
Herring/Lesser black-backed gull	1		
Large Grey Goose <i>cf.</i> Greylag	1		
Large Wader	1		
Small Gull or Wader			
Total	29	1	7

Table 6.4: Butchery frequency by element.

Element	Frequency
Humerus	18
Ulna	6
Tibiotarsus	5
Scapula	3
Radius	2
Carpometatarsus	1
Coracoid	1
Femur	1
Furcula	1
Tarsometatarsus	1

The butchery marks are vital for helping to infer anthropogenic capture over accidental inclusion for certain species (for example the fulmar, which is known to nest in ruined buildings or the burrowing puffin). Both the sooty shearwater and the great shearwater are also burrow nesters meaning that their remains may enter an archaeological site unintentionally through burrowing activity. However these shearwaters do not breed in the geographical region under study, suggesting that burrow intrusion is unlikely since both species largely remain at sea outside of the breeding season (Hunter *et al.* 2000, 395-396; Stroud *et al.* 2001a, 437). Furthermore, at Alþingisreit four of the shearwaters exhibit butchery marks indicating human exploitation and modification which reinforces the stratigraphic authenticity of this more unusual food species. This is an important point to consider since records of butchery are scarce in the Icelandic data overall, and it appears that some may have been overlooked. While this author does not in any way wish to criticize these other analyses, particularly where time and resources factor into the practicalities of handling large multi-class assemblages, it is nonetheless important to stress the need to understand the differing taphonomic signatures between classes. For example the butchery styles, patterns and intensities most frequently found on mammal remains are often not appropriate for avian carcasses due to their size and smaller meat bearing capacity. As such the smaller, lighter and less frequent cut marks

characteristically found on avian skeletons may be overlooked by non-avian specialists. The same is true for some predator marks such as gnawing. The main types of gnawing commonly found on larger mammal bones have the potential to completely destroy avian material, meaning that the evidence for animal processing of birds is limited to those predators and forms that do not damage the bones irrecoverably.

The Alþingisreit assemblage contained a small number of burnt bones (3) which totalled just over 1% of the NISP. Another six fragments had possible charring but surface discolouration prevented certain identification. The species with definite burning included puffin and great auk, and the marks occurred on two humeri and one scapula. This could again suggest that the wings might have been treated in a different manner to some of the other body elements. However firm conclusions cannot be drawn from this small sample. Gnawing of the bird bones by other animals was common, occurring on around 8% of the NISP. A range of species were gnawed by carnivores but larger birds were most often targeted. The gnawing was mainly from carnivores, including some inflicted by small carnivores, but there were also 5 examples of rodent gnawing. Interestingly and somewhat unexpectedly some rodent gnawing occurred in the earliest two phases possibly suggesting that it was conducted by mice accidentally carried by the settlers. While rats have been identified in modern archaeological assemblages and are present in Iceland today, there are strong arguments to suggest that rats were not in Iceland during the Medieval period (Karlsson 1996, 276-280). Post-depositional disturbance by burrowing rodents must also be considered. The humerus was the element most commonly gnawed, which could suggest that part of the wing was discarded still bearing some flesh which would attract animal predators (see Appendix Table A6.2).

As in the Scottish material only a small proportion of the bird bones provided sex or medullary data (Table 6.5). All three were from female domestic fowl and almost certainly represent three separate individuals. Two contained medullary bone and the third was identified by the absence of a spur on the tarsometatarsus. One of the medullary containing bones came from the individual chicken skeleton which was discovered within a well feature.

Table 6.5: Sexual Characteristics

Phase	Species	Element	Identified by	Sex
I	Domestic fowl	Femur	Medullary Bone	Female
I	Domestic fowl	Femur	Medullary Bone	Female
II	Domestic Fowl	Tarsometatarsus	Lack of Spur	Probable Female

The site produced a very small number of juvenile bones (Table 6.6). Only one definitely young bird was present; a ‘galliform *cf.* domestic fowl’ from phase II. Possible slight porosity (indicating a sub-adult) was noted for gannet, cormorant and great auk; however the poor surface condition of these particular specimens prevented confident identification. This very limited ageing profile suggests that the birds captured at the site were mainly adults. The few juveniles targeted may represent more mature individuals that were selected just prior to fledging. The young ‘galliform *cf.* domestic fowl’ suggests that the Post-Medieval chickens were a sustained breeding population with some eggs being allowed to hatch to maintain the population whilst the others were presumably taken as food.

Table 6.6: Juvenile Bone

Species	Element	Age Information
Galliform Sp. <i>cf.</i> Domestic Fowl	Humerus	Immature / Juvenile
Possible Bird	Rib Fragments	Immature / Juvenile
Possible Very Large Bird	Possible juvenile rib or furcula	Immature / Juvenile
Cormorant	Humerus	Possible Porosity
Great Auk	Scapula	Possible Porosity
Possible Very Large Bird	<i>cf.</i> Furcula	Possible Porosity
Gannet	Carpometacarpus	Possible Porosity

The Alþingisreit bird remains demonstrate that in more than one period wild birds made a useful contribution to the human diet, but formed only a small part of the overall faunal economy. In the Post-Medieval periods domestic fowl also contributed to the avian resources. The species present show that several environments would have been exploited for wild birds, including sea, shore, cliffs, inland water and possibly heather/grassland. The low frequencies for several different species suggest that some of the birds were opportunistic catches. Multiple fowling techniques were probably employed.

Overall Assemblage Character in Comparison to Scottish Island Assemblages

Overall this material bears several similarities to the Scottish Island data, in which it was seen that the auk family remained an important bird resource through time and space (although the Brünnich's guillemot is not present within Britain). The great auk, when available, has been selected for exploitation in both locations due to its size (meat-per-kill) and ease of capture. Gannet, gulls and cormorant show continued use of these larger seabirds. However the single shag bone suggests that these birds were not occupying the same importance as in the Scottish Island fowling economies.

In general shearwaters are not among the most commonly captured birds at archaeological sites. In the Scottish Islands Manx shearwaters occur most frequently whilst overall shearwaters typically form under 2% of the avian assemblages, however there are sites where their presence is significantly higher. While the larger shearwaters are by no means rare or unexpected, their relative frequency at Alþingisreit is interesting. Today neither the sooty nor great shearwaters breed in Scotland, the Faroe Islands or Iceland, however they do occur there in the summer and early autumn since

they are long distance migrants who breed in areas of the southern hemisphere during the summer of that region (Marshall and Serventy 1956, 489; Pollock *et al.* 2000, 36; Stroud *et al.* 2001a, 437). Interestingly this means that (although past distributions may have been different) it is unlikely that these birds were taken from the burrow, where both species normally nest, and instead implies that they were captured at sea or from the air (Serjeantson 2009, 237). The larger shearwaters are a good food bird being greasy and fatty. When they reach the North Atlantic islands after their long migration from the southern hemisphere their fat reserves are lessened but the exhausted birds can prove easier to catch. The sooty shearwater is also known as the mutton-bird (reflecting its desirable edibility) and the species is still highly exploited during its breeding season by the indigenous peoples of the southern hemisphere, particularly in New Zealand and the surrounding area (Hunter *et al.* 2000, 395-414). As with the gannet in the Scottish Islands, the Maori exploitation focuses on the nearly mature youngsters; the plumper and heavier the better. It is estimated that around 250,000 muttonbirds are harvested each year by Maori (McGonigal 2008, 220). Where sooty and great shearwaters are captured in the Northern Hemisphere it would be adult and fledged birds being targeted.

The analysis shows a distinction between the raptors from the Scottish Island sites and the other North Sea examples. Few raptors are found in Iceland (taxonomically and quantitatively) (Beck 2013, 29), their representation archaeologically suggests tamed or specifically targeted birds. While many of the birds of prey identified from Icelandic (and to an extent Scandinavian) sites may have been trained birds, the majority of raptors exploited in the Hebrides, Orkney and Shetland do not fit the profile of falconry. The white-tailed eagle is the most commonly represented and widely distributed raptor in the Scottish Island material, and although eagles can be used as hunting birds the

contexts in which they occur archaeologically, and the historical sources signify that they were killed for other reasons including to protect livestock (a danger posed more by this species than others raptors in the area), to acquire feathers and talons, or for ritual associations. Furthermore the white-tailed eagle (and some other raptors represented in the Scottish Islands such as the red kite), are prolific scavengers and as a result would have been more likely to occur around human settlement and be intentionally killed (Baxter 1993, 78-80; Hull 2001, 131-136; Yalden 2007, 471-473).

In the Scottish Island sites many of the raptor concentrations (again particularly white-tailed eagle) come from the Neolithic which predates the known introduction of bird-assisted hunting in Britain, and where the high number of individuals represented are unlikely to represent a trained group (Cherryson 2002, 307-308). The next most common Scottish Island raptors, the short eared owl and the buzzard, are again unlikely falconry choices and the later can also be a scavenger (Cherryson 2002, 308; Hull 2005, 140). However, some species indicative of falconry are present in small numbers at Scottish Island sites (including high status sites such as brochs) indicating capture and training of birds from the local environment or trade. No pathologies associated with falconry or captivity have been identified on the Scottish Island birds, and although rare, these have been found on individuals from English sites (Cherryson 2002, 312).

Temporal Delay

As inferred previously many similar patterns are present within this Icelandic material when compared to that examined in the Scottish Islands. However there appears to be a temporal delay in certain fowling profiles. The great auk is the most commonly exploited individual species in the Norse settlement material to 13th century. However,

in the Scottish Islands it has been demonstrated that great auk numbers were severely diminished by this period, and although still exploited where possible and available, it never forms more than 3% of the Norse Avian NISP, and is only present at a restricted number of sites. This therefore suggests that in the Icelandic context landnám provided access to a previously unexploited and thus unwary body of avian resources. Whilst some of these birds may have moved to more Southerly waters in the winter months, they would not previously have been hunted in their Icelandic breeding colonies. As their populations remained undiminished by predation they would be lacking experiential fear of human hunters (not that the great auk ever learned to be rightly fearful or had the capacity to escape danger on land) (Dugmore *et al.* 2005, 28; Grieve 1885, 66; Perdikaris and McGovern In Press, 4-6). This infers that past fowling communities of the Atlantic Islands (both in Scotland and further afield) first made use of the most easily accessed and captured birds that provided the biggest dietary return, as part of a wider use of avian resources. However, inevitably this was unsustainable in the case of great auk.

Although archaeologically the gannet is one of the most regularly exploited species in North Atlantic island sites (and were often captured in large numbers); in some instances it appears to be a substitute species captured when similar easier-to-catch birds are not available. As was demonstrated in Chapter Five its presence in archaeological sites frequently increases with the decline of the great auk, and it is prominent at many of the Norse period Scottish Island sites. In Iceland therefore it also seems to become more targeted after the decline of the more easily captured great auk, albeit on a slightly delayed temporal scale.

Interestingly the Norse (and Norse/Medieval) periods at Alþingisreit were heavily seabird focused, unlike the pattern observed in the Scottish Islands, particularly in the Western Isles where there was a strong diversification of resource use. This could suggest that initially, and particularly on entering a sparsely or previously uninhabited landscape, domestic and dispersed avian species were not the target of fowling. Instead concentrated breeding seabirds are targeted (a pattern particularly seen in the Scottish Mesolithic and remote populations such as St Kilda). In such situations the maintenance of domestic fowl when initiating a settlement or familiarising with the location is an added challenge, and inefficient when the landscape affords comparable resources naturally. Domestic mammals would have provided the key introduced resource base to fall upon should the new environment not facilitate wild resource capture.

Domestic Bird Comparison

The continuing high presence of seabirds partly results from the late emergence of domestic fowl at Alþingisreit; an interestingly different trend identified via this cross area examination. In the Scottish Island sites the Norse arrival correlates with a substantial increase in fowl both in terms of quantity and width of distribution. Their complete absence at Alþingisreit until the very Late Medieval and Post-Medieval phases and their low numbers even then is in stark contrast. However even though the Norse Period in the Scottish Islands saw domestic birds playing a greater role, they never became the dominant avian resource in this period. This suggests that whilst valuable, the domestic birds were more of a luxury commodity. Transporting domestic fowl could have been both difficult and unrewarding. Any domestic birds that were present would have been valuable for egg production probably more than meat.

6.2 The Wider Icelandic and Faroese Picture

Problems of Comparison

Unfortunately some of the Icelandic and Faroese material is to an extent limited and biased by an overrepresentation of birds, fish and molluscs caused by the use of an unusual and potentially problematic quantification system. Therefore, although still very valuable, it cannot in all instances be fully compared with the Scottish Island material. For example several sites such as Undir Junkarinsflótti (Faroe), and Miðbær on Flatey in Breiðafjörður (Iceland) while attesting to be comparing NISPs of the different classes are in fact comparing the NISP of domestic and marine mammals with the raw counts of birds, fish and shellfish. This would be akin to claiming that identifying a mammal bone as ‘mammal’ is a sufficient level of quantification. For example at Undir Junkarinsflótti, the 2010 bone report stated: “As is clearly evident in this graph, domestic mammals make up a relatively small percentage of the total number of specimens identifiable to species level (NISP) in all three phases, comprising at maximum only about 6%” (Brewington 2010). However this identified to species ‘NISP’ includes unidentifiable birds, fish and molluscs. Bird is not a species. This is confusing since in an earlier paper reporting on this site (Church *et al.* 2005), these unidentifiable specimens are included in the total NISP presented in tabular form, but do not appear to be included in the graphs³⁴, and can thus be excluded where necessary since the NISP and unidentifiable bone counts are given. The Faroese and Icelandic sites considered in this discussion are outlined in Appendix Table A6.4.

³⁴ although this is not entirely clear since the graph included in Church *et al.* (2005, 188) varied very slightly from that constructed by this author from their raw figures in this publication (Church *et al.* 2005) (see Figure 6.3), even with marine mammals excluded.

Whilst the percentages mentioned in this section have been checked and corrected for in the Faroese sites and for Miðbær, Gjögur, Akurvík, Bessastaðir and Skriðuklaustur in Iceland, it is unclear how many of the other Icelandic sites represented in the graphical material may have been treated in this way since much of the raw information is unfortunately inaccessible. As such the comparisons and interpretations made here, whilst providing a valuable overview, would require further reassessment before more detailed comparisons could be made. This again demonstrates the importance of Alþingisreit in providing a comparable dataset for the Scottish Island material.

The quantification technique referred to above, which technically compares NISP with count, makes comparison of this data with the Scottish Island material problematic, however it could be a valuable tool in its own right for preventing the underrepresentation of bird remains in interclass comparisons, which can be caused by problems of survival, the lower numbers of bones per individual, and the poorer rate of successful species identification (discussed in Section 3.3.2).

Focused Fowling and Concentrated Bird Use

As explored in Chapters Four and Five, birds in general form a relatively small proportion of the overall Scottish Island faunal economy most often constituting between 1 and 10% of the combined mammal/avian NISP and between 1 and 5% percent of the combined mammal/avian/fish NISP. This in general is higher than the British average where birds make up 1 to 5% of the mammalian/avian NISP, and within the Scottish Islands several sites exhibit a more substantial use of avian resources where they form a larger proportion of their overall faunal resource use (Cartledge and Serjeantson 2012, 342). This has ranged from general settlement sites (such as Iron Age

Mound 1 Bornais on South Uist) to mortuary structures with ritual significance (such as Isbister). It is also apparent that island groups which are remote, isolated or sometimes very small frequently exhibit a high use of bird resources. This is also visible in the wider North Atlantic context.

The Faroe Islands in particular frequently exhibit a high use of avian resources as a proportion of the overall faunal economy, but the number of assemblages which have been analysed is exceedingly small (Brewington 2010, 3-5; Brewington and McGovern 2008, 27; Church *et al.* 2005, 179-181). At the Viking to Late Norse site of Undir Junkarinsfløtti on Sandoy in the Faroe Isles, birds form between around 30 and 50% of the combined mammalian, bird, fish and shellfish NISP (Figure 6.3) (Brewington 2010, 6; Church *et al.* 2005, 118). This is strikingly high, particularly when compared to the Scottish Island data with shellfish included, in which birds rarely form over 5% of the NISP (Appendix Table A5.1). Figure 6.3 shows the Undir Junkarinsfløtti taxa groupings as a proportion of the overall assemblage using both the published figures (which include non-identifiable fragments) and a reworked example using only NISP. It is worth noting here that despite the quantification differences/issues discussed above, the overall profiles and percentages are very similar due to the small representation of mammalian bone and the very large numbers of fish and birds present. This helps to suggest that even at those sites where for example birds might have been overrepresented by the inclusion of unidentifiable fragments against mammal NISPs, the overall profiles are in general reflective, accurate and useful.

Figure 6.3: Birds as proportion of assemblage from Undir Junkarinsfløtti. UJF1: 9th-12thC. UJF2: 11-12thC. UJF3: 11th-13th. Top – Original including unidentifiable birds, fish and molluscs (From Brewington 2010, 6). Bottom – Reworked chart from raw data to be comparable with Scottish Island material using pure NISP (Church *et al.* 2005, 187)

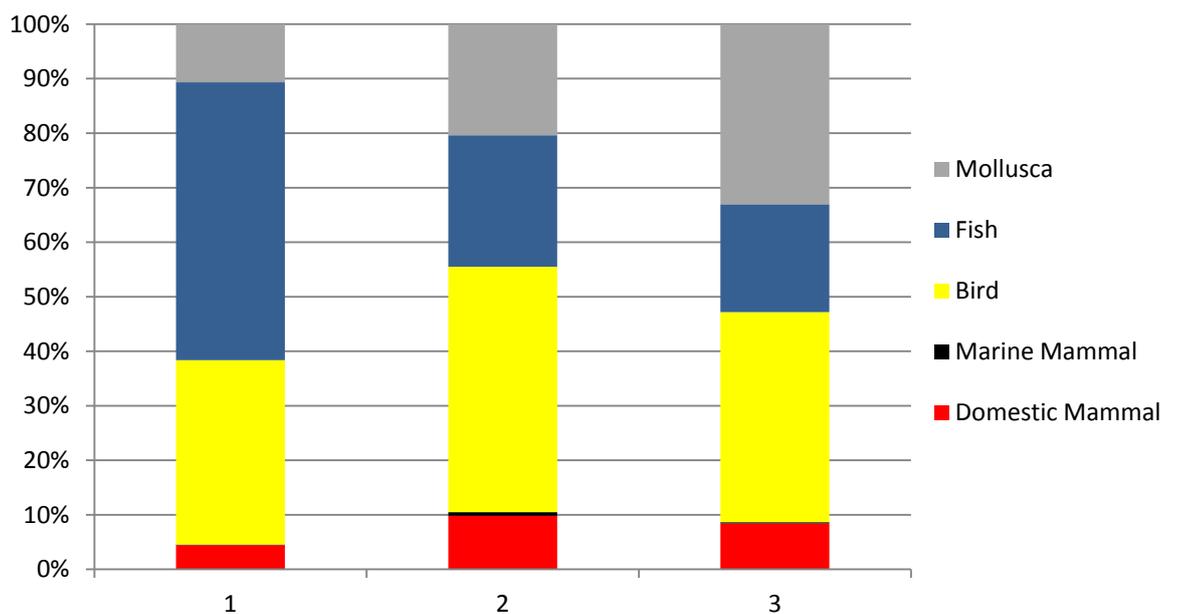
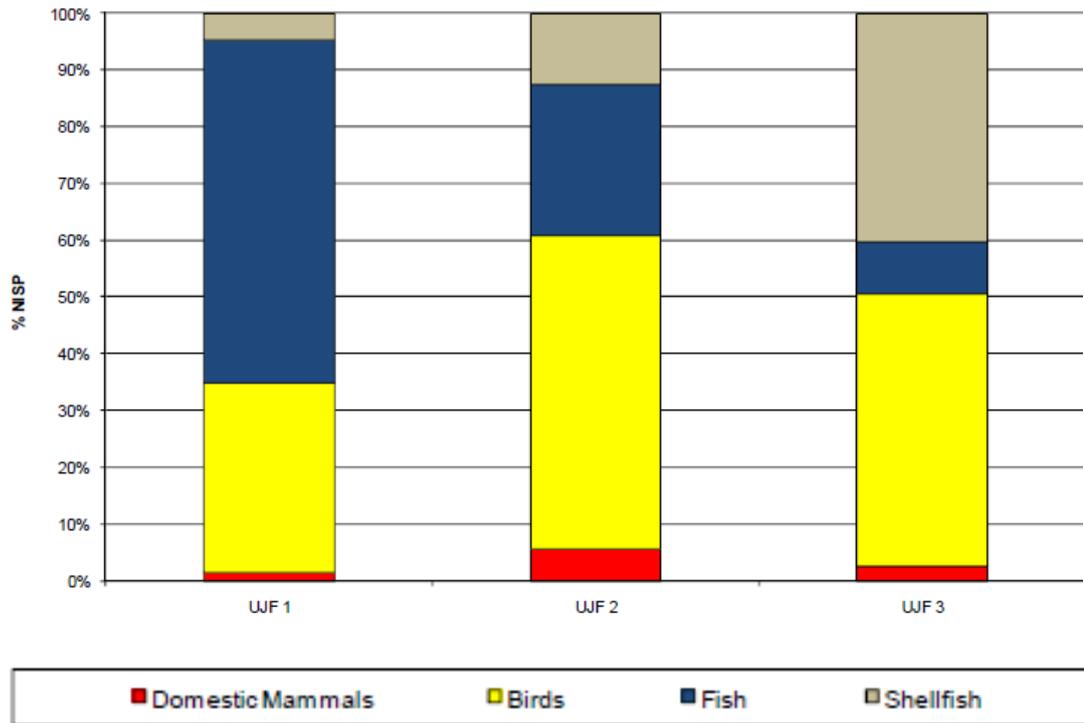
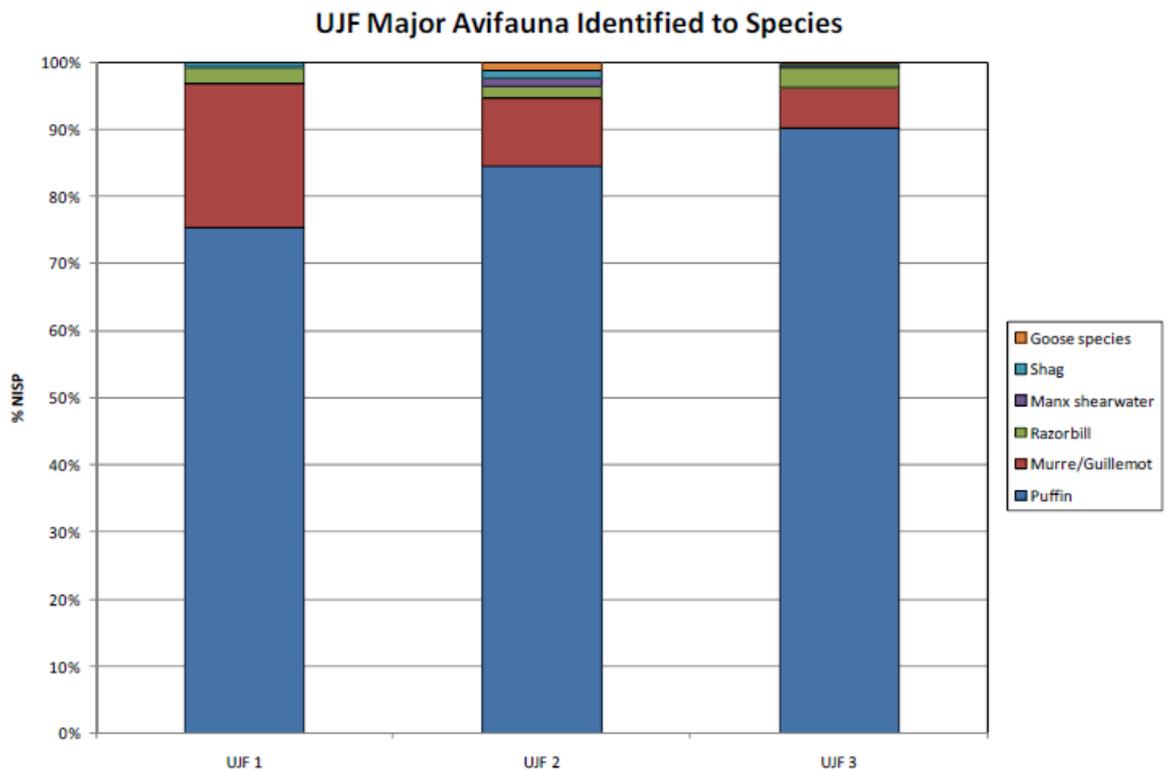


Figure 6.4: Species as % NISP from Undir Junkarinsfløtti (From Brewington 2010, 10)



Within the Undir Junkarinsfløtti bird material there is a very clear target species which accounts for 75 to 90% of the avian NISP in all periods: the puffin (Figure 6.4). Other auks make up the majority of the remaining bird NISP, with shag, Manx shearwater and geese playing a very small role. Within the faunal assemblage from the nearby Faroese Norse site of Sondum, birds also formed a large proportion of the identified remains (and the unidentified bone) (McGovern *et al.* 2004, 5). Birds accounted for 82%³⁵ of the Sondum mammalian/avian/fish NISP, and within this avian assemblage the puffin is once more dominant, forming 80% of the avian remains. The remaining avian NISP is made up mainly of guillemot; but also present are black guillemot, razorbill, eider duck, Manx shearwater, shag, gannet, gulls and geese but none have more than 4 fragments present. Unfortunately the material at Sondum was not as well preserved as that at Undir Junkarinsfløtti, with the acidic soil at this site being detrimental to its preservation; a factor which affects much of the Faroese material (Brewington and

³⁵ NISP taken from the raw data presented in McGovern *et al.* 2004 Table 3 not based on the figure presented in Brewington and McGovern 2008 (27) which includes unidentifiable birds and fish.

McGovern 2008, 27; McGovern *et al.* 2004, 5). The Viking/Early Norse site of Argisbrekka provides the only other accessible avian Faroese assemblage at present, and again here poor preservation resulted in a small overall faunal assemblage (Brewington and McGovern 2008, 27; Gotfredsen 2007, 282-297). However once more birds formed around 70% of the combined avian/mammalian/fish NISP. Here again puffin is dominant, but in this instance guillemot and razorbill follow closely behind, indicating a concentrated exploitation of both burrow nesting and cliff nesting auks (Gotfredsen 2007, 286 and 296). A very small number of goose and duck bones are also present (Gotfredsen 2007, 286). This demonstrates that concentrated fowling in the Faeroes was not limited to the easily captured puffin but formed an important part of overall subsistence practices with multiple species being targeted when necessary. Several auk bones from Argisbrekka were burnt and associated with hearth deposits suggesting that the birds were processed using fire and could have been preserved by smoking, whilst also indicating that waste may have been disposed of in this manner (Gotfredsen 2007, 285).

Such extreme dominance of an avian assemblage by a single species has been seen in the Scottish material at the small isolated Shiant Isles (Iron Age to Post-Medieval assemblages), at the remote island grouping of St Kilda (Late Medieval to Post-Medieval), and also at Mingulay (Iron Age); an island in the southern Outer Hebrides whose access is very weather dependent (Buxton 2005, 41). At these sites, and particularly the first two, the birds also form a very large proportion of the overall faunal economy. This would suggest that in these remote locations within the North Atlantic environment seabirds were of greater importance than in other settings and as such a specific species was chosen that could be repeatedly captured in large numbers.

A degree of remoteness would have naturally been associated with exploring new lands such as Iceland and the Faeroes for the first time, and by their physical setting within the North Atlantic Island landscape. Such concentrated fowling episodes also infer that much of the catch would have been preserved for consumption at later points of the year (Maclean 1992, 99). It is informative that the puffin, although a small bird, is repeatedly selected for large scale exploitation, for example in the focused fowling on St Kilda, Shiant Isles and now at Undir Junkarinsfløtti. Although within Scotland they are also important and form a large proportion of the NISP at Mesolithic An Corran, Iron Age Bostadh, and partially at Iron Age Scalloway in most of the other assemblages puffins form a small overall proportion of the fowling profile (see Chapter 5.5 and Appendix Table A5.13 to A5.15). This suggests that in these remote island groups where fowling formed a bigger part of overall subsistence the puffin colonies were extensively harvested since these birds group in large numbers and are easy to take from the burrow simply by inserting an arm or a hooked stick and pulling out the bird. These large scale exploitations also obviously occur in locations which can house sizable puffin colonies. They also infer intense fowling during the summer breeding season with minor additions at other points of the year from resident birds and visitors.

The temporal persistence of specific or multiple species within these bird-focused faunal economies also shows that the avian populations under harvest were exploited in a sustainable fashion – either accidentally or intentionally. For example at Undir Junkarinsfløtti, St Kilda, and the Shiants the same key species are caught in multiple periods (puffin for the first and last sites, and puffin, fulmar and gannet at St Kilda). In the Undir Junkarinsfløtti assemblages the dominance of puffin as a percentage of the avian NISP even increases in the latter Norse phases inferring that in situations where

birds were important economically and part of a long-term subsistence plan (rather than an additional or emergency food) care was taken to maintain the populations and not to over-exploit them (Brewington and McGovern 2008, 27). This sustained, large-scale fowling also appears to be apparent in the Scottish material where on the Shiantis for example puffins remain the dominant species from the Iron Age to the Post-Medieval period, whilst the historically documented St Kilda shows continued use of the key species mentioned above from at least the 17th to 20th centuries.

This could be achieved by taking only non-breeding birds; sparing the reproducing pairs. In Iceland and Faroe for example it is documented that puffins returning with fish clutched in their beak were not caught as this signified that they were tending young (Maclean 1992, 98; Olsen and Nørrevang 2005, 167). One could also target the juveniles rather than breeding adults. On St Kilda it is recorded that certain locations would be spared from fowling for a year; akin to leaving a field fallow (Baldwin 2005). Meanwhile in Iceland at sites in the vicinity of Lake Mývatn it appears that the breeding adult eiders and other waterfowl were rarely killed, despite concentrations of their eggshell being frequently recovered at a number of sites, perhaps indicating a sustained exploitation of eggs and feathers (McGovern *et al.* 2006, 193-194). One eider bone did contain medullary bone demonstrating that these birds were being accessed in the nesting environment which is usually located around the coast and estuarine areas of rivers (McGovern *et al.* 2006, 193). With species such as eider which lay multiple eggs in a clutch a single or pair of eggs can be removed from each nest providing a sizable food harvest whilst also ensuring that some young survived and sustained the population (Armour-Chelu 1985, 23; Groundwater 1974, 83-85). However, this appears to be a restricted phenomenon. Elsewhere in Scotland and the North Atlantic Island

landscape lower, and in some instances declining, bird use and over exploitation is visible.

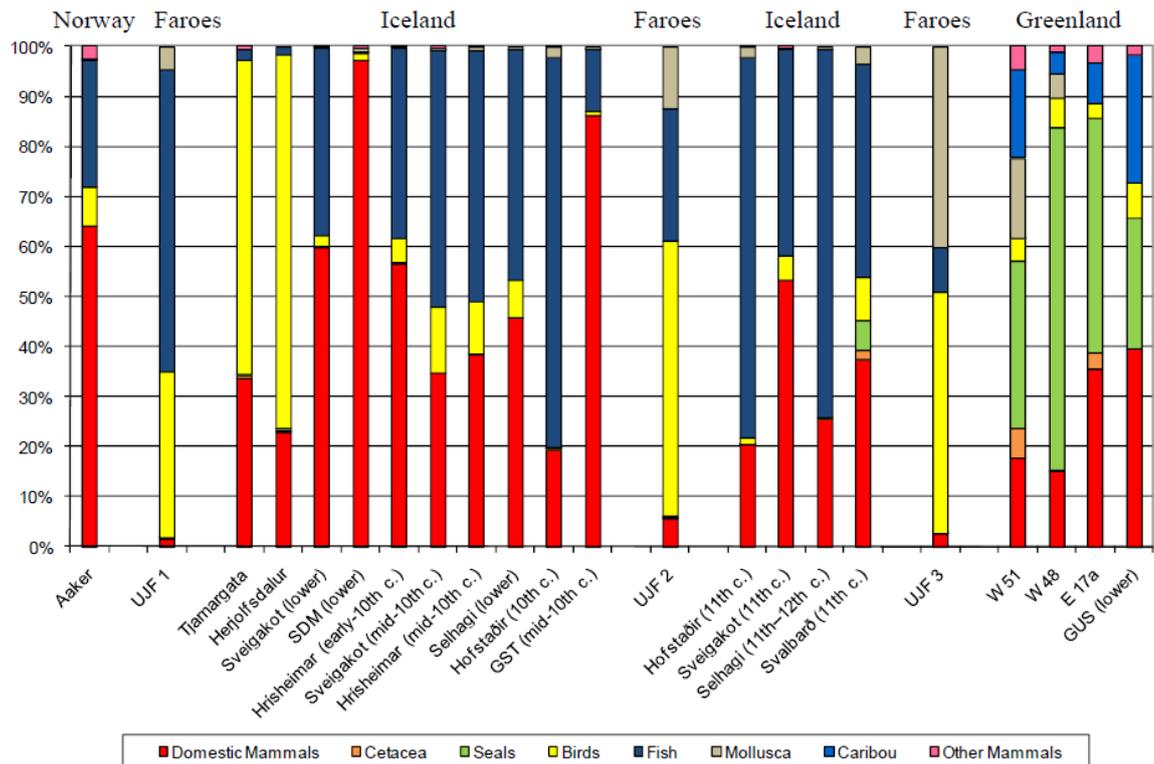
Further Afield - Iceland

In Iceland it is visible that at some settlement period sites birds also form a high proportion of the overall faunal assemblage; at 9th and 10th century Tjarnargata 4 (Reykjavík) and Herjólfsdalur (on the southerly island of Heimaey) they account for around two thirds of the overall NISP (Figure 6.5) (Amorosi 1996, 207-229; Brewington and McGovern 2008, 25; Dugmore *et al.* 2005, 28; Vésteinsson *et al.* 2002, 106). At both of these sites birds were an important part of early subsistence in the area, however this bird dominance is not seen in the 9th-10th century assemblage from Sveigakot (a poor, marginal smallholding inland near Lake Mývatn) (Figure 6.5), nor in the 9th to 13th century material from Alþingisreit where they formed a moderate 10% of the earliest combined avian/mammalian/fish NISP data³⁶ (Garðarsdóttir 2010, 45; Pálsdóttir 2010, 15; Vésteinsson 2001, 4-7). Inland at the cave site of Surtshellir-Víhishellir a very unusual Viking Age (dated to late 9th-10th century AD) faunal assemblage was recovered which consisted entirely of domestic mammals with no wild resources present despite being near freshwater where birds and fish could have been acquired (Ólafsson *et al.* 2006, 398-399). This occupation is suggested by the authors to be from bands of outlaws (Ólafsson *et al.* 2006, 395-405). Both Sveigakot and Surtshellir-Víhishellir would have had especially limited access to food sources, with less opportunity for dietary diversity. The material from these Icelandic sites suggests that whilst in some instances wild birds were exploited in large numbers it was not universal and could even reflect subsistence challenges faced by specific settlement

³⁶ Shellfish data not available for this site as not all of the samples have been fully analysed (Garðarsdóttir 2010, 45).

groups. The exceedingly high avian component at Tjarnargata 4 and Herjólfsdalur in Iceland, and at the Faroe Island sites discussed above is unseen in the Norse period sites from the Scottish Islands (see Chapter Five Figures 5.8 and 5.9 for re-familiarisation).

Figure 6.5: Classes as % NISP from North Atlantic Sites (From Brewington 2010, 6)



As such the data can help examine the differing impact that Viking/Norse settlement had on wild resource use in different areas; for example habited or previously unsettled. In the pure landnám conditions of Iceland and the Faroe Isles birds are repeatedly (but not always) initially essential to the island populations. Whereas in the already occupied Scottish Island landscapes there appears to be a less dominant exploitation of bird resources and instead domestic mammals and fish make up the majority of the assemblages, with the birds providing a valuable addition. Such patterns of resource use may result from multiple conditions. Firstly the occupied Scottish Islands would have already been established as arable and pastoral economies. Domestic livestock would

have already been present in the locality facilitating less intense reliance on transported animals and wild resources whilst also providing more opportunities for trade, exchange or forceful acquisition of domestic mammals. Secondly, the uninhabited Faroes and Iceland would have contained previously untouched avian populations which would have been both unwary of human predators and would have not faced the same rigours and impacts of prior exploitation experienced by Scottish Island birds which had been hunted since at least the Mesolithic (the Icelandic and Faroese birds would have been untouched in these specific locations, although migratory birds may have been exploited elsewhere or even at sea).

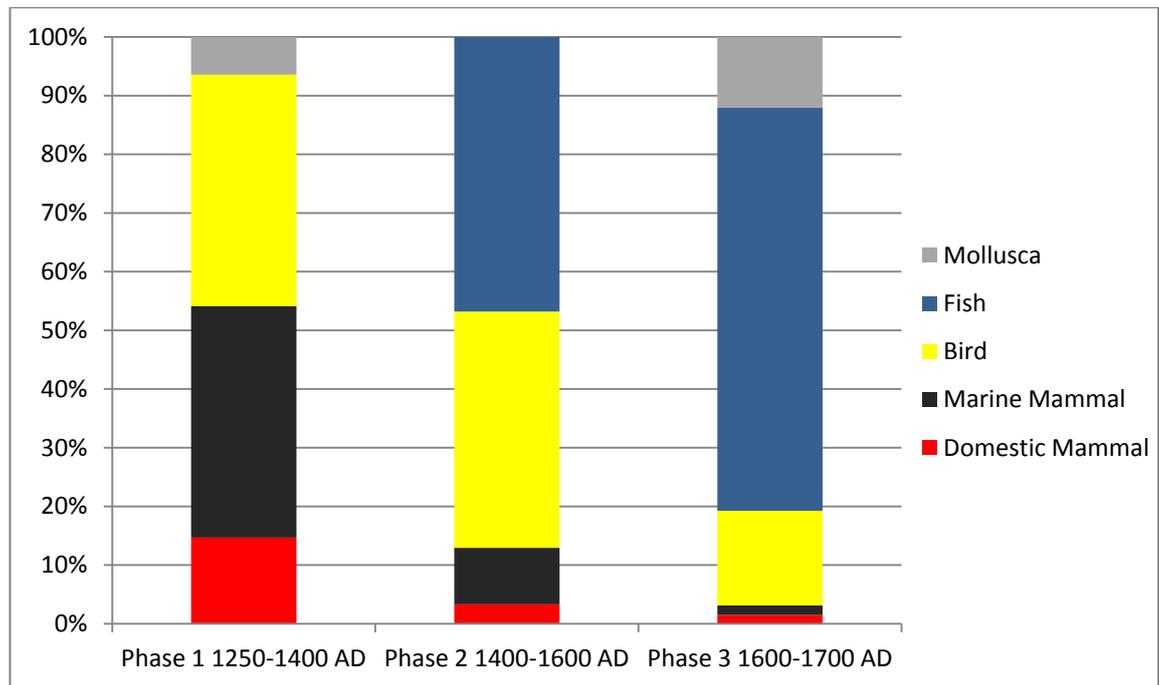
However, whilst there is a temporal persistence in the large-scale usage of birds in the Faroe Islands, this does not appear to be the case in Iceland. As demonstrated in Figure 6.5 from the 10th century in Iceland, birds form a relatively minor part of subsistence strategies in terms of NISP compared to the Faroese examples, although in a few examples they do form around 10% of the combined mammal/fish/avian/molluscan 'NISP' (Figure 6.5, sites Sveigakot and some of the Hrisheimar assemblages). This would infer a rapid decrease in the use of avian resources in the Icelandic context after the initial settlement period which may have been caused both through selective choice or through a decline in the availability of certain avian resources resulting from intense over-exploitation during a concentrated period of time (Brewington and McGovern 2008, 24-27; Perdikaris and McGovern 2008, 195). In addition to those sites depicted in Figure 6.5, the birds at Alþingisreit decline to form less than two percent of the mammal/avian/fish NISP in Phases II (AD 1500-1800) and III (AD 1226-1500). However interestingly at this particular site in the Post AD 1800 assemblage birds rise again to around 10% of the NISP even when the chicken skeleton is excluded (See

Appendix Table A6.2). This is partially a result of the small Post AD 1800 assemblage but may also reflect an increased use of domestic birds. Meanwhile at the Late Medieval (15th) fishing farm of Gjögur and fishing booths of Akurvík in north-west Iceland birds once again form a low proportion of the overall assemblage at below 1% of the mammal/avian/fish NISP despite their proximity to bird habitats (Krivogorskaya *et al.* 2006, 383-388). At 14th century Gásir and Late Medieval Bessastaðir (a high-status manor) birds once more form a very small component of the wider faunal assemblage at around 1% of the combined NISP (see Figure 6.7 and Appendix Figure A6.3-A6.4) (Harrison *et al.* 2008, 106).

This overall decline after settlement period is not visible in the Scottish Viking to Late Norse material, implying a more consistent use of the avian resources which although on initial settlement is lower than many Icelandic assemblages, then forms a similar and in some sites higher proportion of the overall assemblage with birds constituting over 5% of the avian/mammal/fish remains more regularly within the Scottish sites (Figures 5.1-5.11).

A rare exception to lower Icelandic bird use post-settlement period is the site of Miðbær on Flatey in Breiðafjörður (according to Perdikaris and McGovern (2008, 194-195) this is the only post-settlement period site currently analysed to display such a high avian use). Flatey is a small low-lying island in a bay in the northwest of Iceland (Amundsen 2004, 203). This island site exhibits a high use of the avian resources with them totalling around 50% of the combined mammalian/avian/fish/mollusc NISP in both Phase 1 (AD 1250-1400) and Phase 2 (AD 1400-1600). However by the later Phase 3 (AD 1600-1700) the bird remains had decreased to forming less than 10% of the combined NISP (see Figure 6.6).

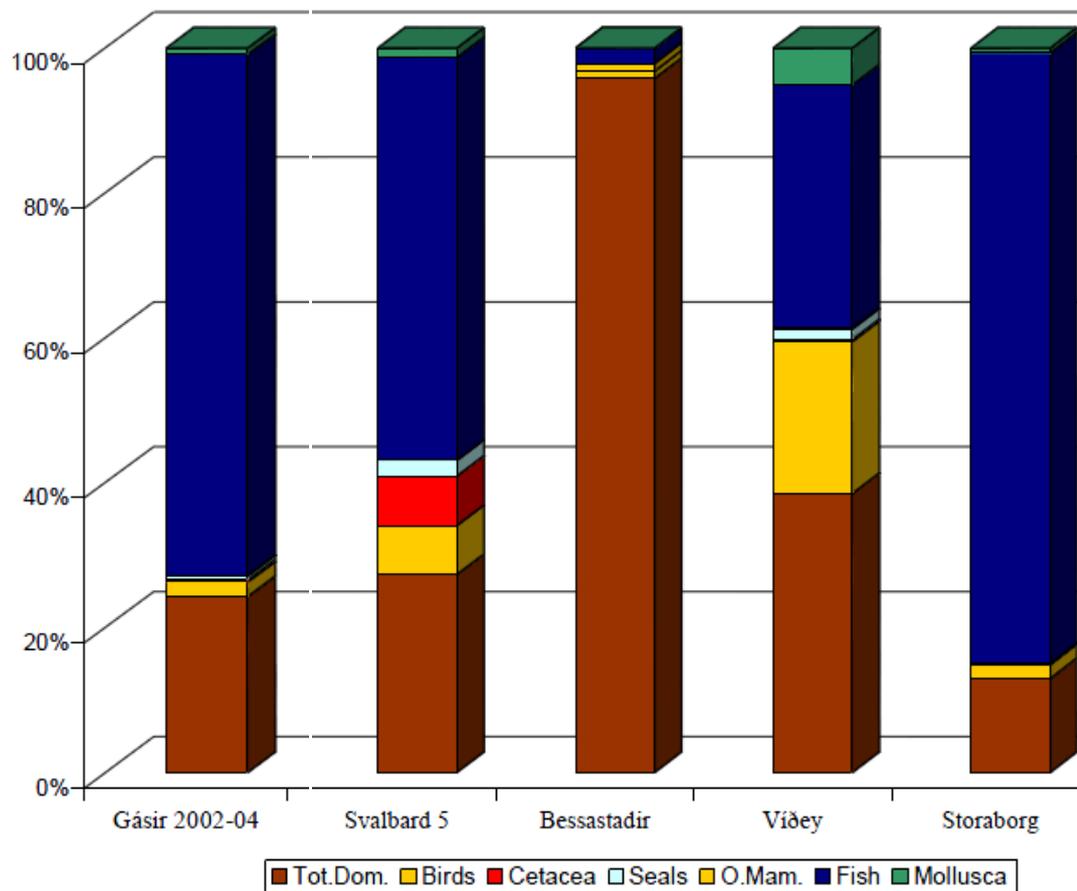
Figure 6.6: Classes as % combined NISP from Miðbær on Flatey, Iceland (based on data from Amundsen 2004).



This site suggests that (as was seen in the Scottish Islands) location and marginality can play an important role in the scale of avian resource use. The small island nature of Miðbær appears to have extended the longevity of large-scale bird use in comparison to the assemblages found elsewhere in Iceland. The island was used regularly for more commercial fishing in the 16th and 18th centuries, as such the increase in fish in the later periods and the decrease of domesticates and wild birds could indicate a focus on the fish resources with wild birds being used for consumption by the fishers; whether caught by accident or intentionally (no domestic birds were present) (Amundsen 2004, 203 and 206). It appears that birds may have also formed an unusually high 20% of the remains at the Late Medieval monastic site of Viðey in Reykjavík (Figure 6.7), perhaps indicating a more avian focused resource base at this particular type of site (although full information was not accessible and the data may include counts). Interestingly auks

are the dominant group at this site again with puffin being most numerous; auks are much more numerous than waterfowl and gannet is also present and indicating an occasional concentrated use of seabirds in this later period (Amorosi 1996, 414-415), so it is possible that this is a potentially unusual assemblage. By comparison, at the monastic site of Skriðuklaustur birds form less than one percent of the combined mammal/fish/bird remains, a proportion that is more regularly seen at this date (Hamilton-Dyer 2010; Pálsdóttir 2006).

Figure 6.7: Icelandic Late Medieval taxa as % NISP (from Harrison 2006, 8: modified)



However, overall two very different patterns of bird use can be seen over time in the Icelandic and Faroese avian material. The Icelandic sites, after initial sporadic intensive exploitation of avian resources, lower to a level similar to that observed in Norse

Scottish Island sites. Meanwhile the Faroes exhibit continued high use of birds in a manner that is akin to both early prehistoric (e.g. Mesolithic) and geographically/economically isolated Scottish Island sites such as the Shiantis or St Kilda.

Species Profile

The Icelandic (like the Faroese) assemblages reveal an enduring heavy use of the auk family. This is particularly visible at the settlement period sites/phases of Herjólfsdalur, Tjarnargata 4 (both of which exhibited a high avian proportion) and Alþingisreit (Amorosi 1996, 207-229, 638). At Herjólfsdalur guillemot and puffin are dominant (Amorosi 1996, 638; Hermanns-Auðardottir 1989, 121-126; Hermanns-Auðardottir 1991). At Tjarnargata 4 guillemot is dominant, accounting for 35% of the entire faunal NISP and over 70% of the avian NISP, but in this instance, the great auk is interestingly the second most common individual species accounting for 12% of the entire faunal assemblage and approximately a quarter of the bird remains (Amorosi 1996, 461). A small number of puffins and glaucous gulls are present (Amorosi 1996, 461). The avian species profile at Tjarnargata 4 suggests not only that the settling population was making use of a range of habitats (i.e. gentle rocky skerries/shore and cliffs), but that they were targeting the unwary and easily captured great auk at this early point in Iceland's occupation.

As discussed above the auk family also forms a large proportion of the Alþingisreit remains through time and auks are also the dominant birds at Miðbær. Within the Miðbær assemblages puffin was prolific accounting for 56% of the AD 1250-1400 avian NISP, 93% in 1400-1600 and 89% in 1600-1700. This shows a heavy use of the ground nesting birds on and around the island of Flatey. The remainder of the Miðbær

avian fauna is comprised of shag and cormorant. This exceedingly focused use of birds reflects the natural abundances. Puffins breed upon the grassy islands within the Breiðafjörður area such as Flatey, and around 95% of Iceland's breeding shag population nest in this area, with cormorant colonies also located around the bay (Amundsen 2004, 206). Both the shag and the cormorant will occupy islands and rocky areas of the shore making this location ideal breeding territory (Baldwin 2005, 16). This would indicate that like in the Scottish Islands, locations holding significant populations of certain seabirds (e.g. the Shiant) result in less diverse avian assemblages, despite other species also being available, inferring that it was not necessary or desired to diversify fowling practices in these specific Icelandic locations, and abundant species chosen for ease of capture.

Within the fish dominated assemblages from Gjögur the small avian component was predominantly guillemot with a few gulls and puffin. Interestingly the only bone not from an auk or gull at this site came from a Gyrfalcon, a species that was also identified at Alþingisreit, which could indicate falconry or capture of these birds for trade (Krivogorskaya *et al.* 2006, 386-387). At Akurvík gulls and auks were again dominant with gannet, cormorant and duck represented in small numbers (Krivogorskaya *et al.* 2006, 386-387). These sites imply the population may have also been taking seabird resources whilst fishing; it is also possible that diving seabirds could have become accidentally snared in fish nets.

Several Gyrfalcon remains were also present in the Late Medieval assemblage from the 14th century seasonal trading site of Gásir where there is documentary evidence to support the exportation of these birds from this area to other locations in

Europe/Scandinavia (Harrison 2006, 17; Harrison *et al.* 2008, 103; Krivogorskaya *et al.* 2006, 387; Þórdarson 1957). Gásir's assemblage again displays a strong auk focus (primarily guillemot followed by puffin), but eider ducks are the dominant species perhaps mirroring the increased use of waterfowl seen at some Scottish Island sites from the Norse period; particularly those in the Outer Hebrides (Harrison 2009, 9). Again gulls make a contribution to the avian economy as do swans.

The monastic site of Skriðuklaustur is (as Hamilton-Dyer notes) unusual in that there is a high use of swans, whose wings were removed (Hamilton-Dyer 2010, 29-33 and 53). Some auks, cormorant, gulls were again present, as was a raptor and a small number of waders. Only a single domestic fowl bone was present, again indicating that domestic birds were not an important or large part of the avian resource use (Hamilton-Dyer 2010, 53). Interestingly in the later period of Medieval Europe swans were frequently considered as high status, royal birds, and as such in particular locations their consumption was controlled, but this is unlikely to have been the case during the settlement period (Harrison *et al.* 2008, 112). However, swans at the trading site of Gásir and monastic Skriðuklaustur may indicate some high status consumption was taking place (Harrison *et al.* 2008, 112). However, the use of swans in the Scottish Isles does not appear to reflect this pattern, despite it being seen in Medieval England (Albarella and Thomas 2002, 24-28).

At Late Medieval Bessastaðir in the Reykjavik area eider and mallard were dominant but auks, gulls, geese, cormorant/shag and a diver were present (Amorosi 1996, 724). It is thus possible that in Iceland an increased use of waterfowl is visible in the Later

Norse and Medieval period, following a similar pattern to that observed in some of the Scottish Island sites but with a degree of temporal delay and locational variation.

The ill-fated great auk suffers a decline in use and thus presumably availability and numbers after the initial settlement period of Iceland. Overall the great auk does not occur frequently in the Icelandic material even though the auk family was an important part of the fowling profile. Interestingly in the auk dominated material from the Faroese sites no great auks were present in the small number of assemblages available. This again suggests that by the Norse period the species as a whole had suffered a decline in numbers and distribution. It may also indicate some degree of movement of these bird populations around the North Atlantic environment if the birds in Iceland and Faroe Islands had been affected prior to Norse settlement of these areas. The great auk is documented as being highly pelagic outside of its breeding season and it is possible that the same population of birds may have moved between the Scottish Islands and the more Northerly locations; however unfortunately this is impossible to fully investigate (Grieve 1885, 66; Mudie 1835, 273-724).

Auks even occurred at sites further inland and close to freshwater where the inhabitants were exploiting landbirds in large numbers, such as those in the Mývatn area (see Appendix Table A6.3). This infers either travel to the coast to acquire them or their trade as food resources (McGovern *et al.* 2006, 193). These sites in the area surrounding Mývatn Lake exhibit a dominant use of ptarmigan which would indicate that these birds were being taken from heaths and uplands around the sites, probably with a winter focus when they gather in their winter feeding grounds, with birds moving from lowlands (Hull 2001, 146-147; McGovern *et al.* 2006, 193).

Overall a use of seabirds, landbirds and waterfowl can be seen in Iceland, with a specific but occasional use of raptors and in particular the Gyrfalcon. Seabirds, and specifically auks remain important through time and space, but are particularly used in the settlement period. At inland sites waterfowl and landbirds such as the ptarmigan are regularly selected for exploitation, but even in these instances seabirds are still present indicating a wide acquisition area for resources, as was identified in the Scottish material where certain species such as the gannet and the guillemot would have been taken from locations beyond a particular site. However in the wider North Atlantic Island landscape the presence of domesticates is low and does not gain the same prominence in the avian assemblages witnessed in the Scottish Island assemblages. This implies once more that the presence of domesticates in the Late Iron Age Scottish material is significant and may reveal a merging of avian resource use patterns between local and incoming peoples.

Out of Scandinavia

The Norse settlers who moved into the Scottish Islands, Faroes and Iceland would have brought with them fowling practices from Scandinavia. In brief, avian data from the continent suggest that the Norse peoples were familiar with exploiting seabirds, waterbirds and landbirds in their home environment and as such would have been familiar with the type of resources on offer, and often the specific species encountered in the Scottish Islands. However one bird which may not have been recognized by the Norse incomers is the great auk. Whilst there is strong evidence for a relatively large presence and use of great auks in several Mesolithic and Neolithic sites in Norway and Denmark (such as Klintsø) there is debate as to the extent of its later breeding range (Grigson 1989, 60-72; Serjeantson 2009, 258; Serjeantson 2001, 44-46). Although the

great auk's presence around Norway and this area of mainland Europe would not have been entirely unknown, it may have been an occasional visitor by the Norse period and may also have only been located on offshore islands (Orton, 1869, 542; Parkin 1894, 7). This would again have contributed to the intense persecution of its already lowered numbers when encountered in the Scottish Islands, and particularly Faroese and Icelandic contexts, both due to ease of capture, potential unfamiliarity with the specific resource and also a degree of novelty of such a large and productive bird.

Avian resource use in the Scandinavian area is part of a temporally long tradition with a range of similar species being exploited. For example at the Pitted Ware culture site of Ajvide on Gotland in the Baltic Sea auks were prominent as were cormorants and ducks (Mannermaa and Storå 2006, 437). This pattern is also visible at the Norwegian Iron Age Chieftain's Farm of Aaker where both freshwater and marine birds were used (Perdikaris and McGovern In Press, 5). The Norse use of ducks on the continent and apparent familiarity with a range of wild species from teal to mallard or eider could therefore account for the diversification and increased use of these birds in several Scottish contexts.

6.3 Closing Summary

This chapter has illustrated that although the Scottish Islands share many characteristics with the wider North Atlantic Island landscape (and beyond), there are some distinct differences in the use of birds as an overall component in the dietary economy and in the species profiles identified. Domestic birds do not appear within Iceland and Faroe to the degree seen in the Scottish Islands showing different livestock management

practices and interactions with the wild resources. A greater dependence on avian resources is observed in the Faroese material supporting hypotheses formed in Chapter Five regarding the role of island marginality and housed avian populations on overall bird use. The comparison has also suggested that settlement in previously occupied areas, compared to virgin territory, created different initial patterns of bird use, and indicates that for Icelandic and Faroese settlers the wild resources were essential in initiating habitation in these locations, whereas in the Scottish Islands birds were part of a wider and potentially more stable and familiar economic profile. In all areas though a continued use of seabirds is observed with auks, cormorant/shags and gulls being important, repeatedly captured species. Species such as the auks imply a degree of concentrated summer exploitation which would have also afforded access to young birds and to eggs. The next chapter therefore considers the use of eggs via novel and existing data to investigate seasonality, past avian distributions, and eggs as a food source.

CHAPTER SEVEN

COUNTING BIRDS BEFORE THEY HATCH



7.0 Introduction

The chapter introduces the study of eggshell and the pre-existing data. It then details the results of SEM analysis of eggshell material from Late Iron Age, Pre-Norse/Pictish and Norse Bornais. These results are then used to explore and develop the bone data, and eggshell identified through a new mass spectrometry technique.

7.1 Examining Eggshell

Examining the micromorphological features of eggshell using the SEM (Scanning Electron Microscope) in order to identify it to species has been employed archaeologically since the early 1980s (Keepax 1981). Sidell developed Keepax's work into a specific list of criteria to aid identification, implemented this for a wide range of species, and also published photographic reference material to allow analysis without the presence of a physical reference collection (Sidell 1993, 1993a, 1995 and n.d.). Her work also provided more in-depth analysis of the morphometric internal surface characteristics of the mammillae. Eastham and ap Gwynn (1997, 85-94) extended the use of SEM analysis by developing a computer programme to recognise species-specific traits of the identifiable morphometric criteria. Overall the technique was successful and when tested on modern samples it had an accurate identification rate of around 70% (Eastham and ap Gwynn 1997, 85-94). When applied to the archaeological material from Skara Brae the computer identification process was repeated when a successful identification was achieved, and although not entirely consistent in its results, the method still provided valuable data (Eastham and ap Gwynn 1997, 85-94; Serjeantson 2009, 173-177).

However, in general, despite its potential for season and habitat reconstruction, eggshell examination has suffered from limited application and development, and even where analysis has occurred it has rarely been examined in conjunction with avian bone material from the assemblage. Combining both data sources can help to elicit information on species management, resource/habitat use and collection/hunting habits. The technique has its drawbacks which go some way to explaining its limited use in the zooarchaeology of the Scottish Islands. Firstly it requires a site to have favourable preservation conditions for eggshell. Secondly excavation must have been conducted to a standard which facilitated the collection of eggshell in the first instance, the site itself should be well sampled, and the resultant material thoroughly processed and contextualised (phase, location etc.). This identification technique is also relatively time consuming and requires a degree of preparation (see Chapter 3.4.2 for methodology). It also requires access to an ultrasonic tank for cleaning the shell, facilities to mount and coat the shell for use in the microscope, the SEM itself, and a specialist that can use the SEM and ideally has some knowledge of avian remains or bird biology. In terms of achieving accurate identification to species, as with regular zooarchaeological identification of bone, there is always some level of subjectivity and human error possible within the specialist's observation of the identifiable characteristics. However, SEM analysis remains a fairly accessible technique since it can be done via photographic reference resources and does not need specific scientific knowledge.

A new technique of eggshell identification is currently being developed by John Stewart (a PhD candidate at the University of York) with the aim of providing a tool that is cheap, quick and definitively accurate through the use of mass spectrometry. This technique (from here on in referred to as ZooMS) was first developed for application on

bone (see Buckley *et al.* 2009 and Collins *et al.* 2010). The process uses peptide mass-fingerprinting to identify the bone or eggshell taxonomically (see Stewart *et al.* 2013 for full details on the eggshell method and its initial application). This technique's application to eggshell allows large quantities to be processed quickly and cheaply, with minimal preparation required, and also benefits from needing only very small samples of material. Most importantly mass spectrometry eliminates the subjectivity inevitably encountered from visual observation under SEM by a human analyst. The ZooMS technique has now been applied to eggshell from a range of Medieval, Norse and some earlier sites and appears to be accurate over a large timescale, with only minor decreases in the number of successful identifications occurring with extended temporal degradation (Stewart *et al.* In Prep.). However whilst this technique has already proved its practical worth, it is still in its preliminary stages of development and application, and as such has limitations. Continuing to build and expand a larger resource base is essential for developing and extending this work to allow the identification of a more diverse range of species (Stewart *et al.* 2013, 1799). As with SEM analysis, ZooMS also requires good preservation and recovery of remains, however ZooMS also requires greater access to scientific knowledge and equipment both to process the material and interpret the results.

DNA work also has the potential to give a very precise species resolution, but it is more time consuming, expensive, resource intensive and destructive than ZooMS (Stewart *et al.* 2013, 1798). The preservation of aDNA is also a limiting factor in its application (Oskam *et al.* 2011, 2589-2595). Consequently, ZooMS offers an important development in eggshell analysis.

Thus, using mass spectrometry instead of microscopy ensures a more confident species identification (which is not based on visual or computer aided observation of identifiable features and various measurements). However the nature of the proteins upon which ZooMS relies means that in some instances SEM is still able to offer a higher level of species resolution. The ability to distinguish between different species of geese, ducks and certain seabirds (such as shags and cormorants) via ZooMS is very limited; for example domestic and wild geese cannot be separated. However the mammillae structure of greylag geese and domestic geese (for example) are very different under SEM, with the former being granular in appearance and the latter more angular – although when after domestication these differences occurred needs further research (see page 417) (Sidell 1993, 16-17). Although identification by SEM has a greater margin for observer error and uncertainty of identification, for archaeological interpretation it is important to be able to separate wild from domestic anatidae, and to also be able to identify the variety of different ducks, geese, and gulls present, and differentiate birds such as shags and cormorants. Greater specific species identification allows for fuller comparison with the bone remains and deeper understanding of landscape use and seasonality. While neither technique is perfect this demonstrates that SEM analysis still has an important role alongside new techniques and infers that collaborative work will be valuable for accurately extracting the greatest amount of data from the archaeological avian eggshell.

The author of this thesis and John Stewart are in collaborative contact. Stewart has now analysed a large proportion of the Bornais eggshell via mass spectrometry (courtesy of Professor Niall Sharples and Dr Jacqui Mulville; and partially aided by this author). His analysis has already been initially compared with the author's bone work (Stewart *et al.*

In Prep.) and both within this thesis and potentially in future work the two eggshell analysis techniques of SEM and ZooMS will be compared. This is providing a very valuable future extension to the work conducted here both in terms of developing the mass spectrometry technique but also in providing more avian data to be used in conjunction with the bone reports to help reconstruct resource use in these locations. Finally, multi-strand analyses can also serve as a critical and informative comparison between these two methods of identifying eggshell.

7.2 Existing Eggshell Analysis from the Scottish Islands and Wider Island World

Archaeological eggshell was recovered/recorded at a small number of Scottish Island sites. These are: (Neolithic) Skara Brae, (Neolithic) Quanterness, (Neolithic) Midhowe Cairn, (Neolithic to Iron Age) Howe, (Late Bronze Age to Early Iron Age) Cladh Hallan, (Beaker to Norse) Rosinish, (Neolithic to Post-Medieval) Udal, (Norse) Cille Pheadair, (Norse) Quoygrew, (Norse) Beachview Burnside, (Norse) Snusgar, (Norse) Bornais, and (Medieval to Post-Medieval) St Kilda. Of these only Quanterness, Midhowe Cairn and Skara Brae had any form of species information or identification attempted, of which Skara Brae had the only detailed and comprehensive examination. This is now joined by identified material from Late Iron Age and Norse Bornais (Mounds 1, 2, 2A, and 3).

The eggshell from the Scottish Islands is therefore exceedingly patchy in terms of its analysis. When the ability to identify eggshell via SEM was novel and exciting a handful of sites were analysed, and in particular those which are or were considered of great importance were selected for examination, in part due to the greater opportunity to secure funds for such analyses (such as Skara Brae). Analysis otherwise was sparse and

if conducted only applied to one or two pieces of shell, namely from two Neolithic tombs (Quanterness and Midhowe Cairn). The newly developed mass spectrometry technique has extended this sample by examining large samples of material from a small number of sites from the Scottish Islands including, Quoygrew, The Udal, Snusgar and now Bornais (these will be discussed separately below). However, prior to this it was not practically possible to analyse such large quantities of eggshell both through time and sample preparation cost.

Table 7.1: Eggshell by species from previously analysed Scottish Island sites

Site Name	Species
Skara Brae	Fulmar
Skara Brae	Gannet
Skara Brae	Manx Shearwater
Skara Brae	Cormorant
Skara Brae	Teal
Skara Brae	Shelduck
Skara Brae	Pintail
Skara Brae	Golden Plover
Skara Brae	Common Gull
Skara Brae	Lesser Black Backed Gull
Skara Brae	Great Black Backed Gull
Skara Brae	Razorbill
Skara Brae	Guillemot
Skara Brae	Black Guillemot
Skara Brae	Puffin
Quanterness cairn	<i>cf.</i> Gannet or Guillemot
Midhowe Cairn	Possibly pigeon or owl. Identification method not described

From the limited pre-existing data (Table 7.1) it is possible to see that a wide range of species are represented even within this small sample. The Quanterness eggshell, although not identified to exact species, indicated the use of at least one key seabird during the breeding season. Since neither the gannet nor the guillemot would have used the tomb as a natural nesting site this supports the use of cliff nesting birds at their breeding colonies for both meat and eggs. The examples from Midhowe Cairn are unfortunately unclear and uninformative, however the results suggest that raptors or *Columba* sp bred on the structure, or that their eggs were intentionally included.

Season, Species and Landscape

As mentioned, Skara Brae is a rare example of pre-existing eggshell analysis, and furthermore it can be usefully compared to the avian bone material also present at this site. At Skara Brae a range of bird eggs were used, the majority of which came from the key species exploited for meat (Eastham and ap Gwynn 1997, 88-93). This suggests that in many cases breeding colonies were targeted before the hatching of young, in which case eggs and adults may have been the chosen resource, partly explaining the low presence of juveniles in many of the archaeological avian assemblages (see Chapter Five). The presence of gannet and guillemot eggs indicates fowling activities on cliff and ledges. Meanwhile the puffin, Manx shearwater, and shelduck eggs reveal use of burrow environments, and species such as teal indicate capture from around freshwater. The variety of gulls present infer the capture of birds from machair, grassland or agricultural land. The presence of eggs from smaller non-seabird species such as the golden plover indicate once again that some of these waders were taken in the summer months. The golden plover nests on moors (particularly heather), damp grassland and blanket bog, indicating capture in these environments (Byrkjedal and Thompson 1998, 113-114 and 199; Stroud *et al.* 2001a, 254).

The Egg but not the Chick: Discrepancies in Species Representation?

Perhaps most interestingly at Skara Brae some species are only represented in the eggshell material and not in the bones record, implying differential resource use based on specific species. A similar pattern has also been seen at Viking to 12th century sites around Lake Mývatn in North-East Iceland, (aforementioned in Chapter Six) where maintained and sustainable use of waterfowl eggs has been identified through the

integration of bone and eggshell analysis (McGovern *et al.* 2006, 187). The sites lie next to a large shallow lake which houses both fish and migratory waterfowl (McGovern *et al.* 2006, 188). Today these birds are present in the area in large numbers with over 15,000 pairs breeding in the vicinity of the lake. As mentioned in Chapter 6.2 the bones of waterfowl were rarely recovered from the range of sites in the Mývatn area. However eggs appear to have been an important resource. Specific eggshell concentrations which appear to indicate individual eggs were found at Hofstaðir, Hrísheimar, Selhagi and Steinbogi, which provide some small insight into frequency and quantification (McGovern *et al.* 2006, 193-194). As outlined in Chapter Three eggshell is virtually impossible to quantify but concentrations can provide a potential insight into scale, and in case of Hofstaðir (for example), in a single 2 by 2 metre feature 37 egg concentrations were recorded (McGovern *et al.* 2006, 194).

SEM analysis of the Icelandic material from Hofstaðir, Hrísheimar and Selhagi revealed that waterfowl accounted for the majority of eggshell features, with additional quantities of ptarmigan and some fragments from auks such as guillemot. However, unlike with the waterfowl, ptarmigan was represented zooarchaeologically by a large number of bones. McGovern *et al.* note that in terms of eggshell concentrations recorded in the ground, when identified to species, there were 100 waterfowl egg concentrations to each bone (2006, 194). This demonstrates that whilst waterfowl eggs were repeatedly eaten the birds themselves were killed infrequently (McGovern *et al.* 2006, 194). This could reflect a sustainable approach to waterfowl exploitation by taking eggs from a species but not the young or breeding adults so as not to damage the breeding population irrevocably.

7.3 New Bornais Eggshell Analysis - SEM

Sample Information

The eggshell analysed for this study came from the Late Iron Age and Norse site of Bornais on South Uist, from which the Mounds 2 and 2A bird bone was analysed as part of this thesis and has been discussed in Chapter Four. The excellent preservation, sampling, and post excavation processing at this site provided a very large quantity of surviving and recovered eggshell. Importantly the material was also securely phased and located, facilitating phased analysis of Late Iron Age, Early Norse, Middle Norse and Late Norse material. As such it is very much suited for comparison with the large avian bone assemblage. The quantity of eggshell also facilitated examination over an extended time period, with eggshell being selected from the Late Iron Age, Pre-Norse/Pictish, Early Norse, Middle Norse and Late Norse periods. Eggshell from all four mounds was selected for analysis (Mounds 1, 2, 2A and 3). Mounds 2 and 2A produced the largest bird bone assemblages and the greatest quantity of eggshell remains at c. 20,000 shell fragments (Sharples, pers. comm.). Eggshell from Mounds 2 and 2A was selected from contexts which had also produced identifiable avian bone for each phase (Table 7.3).

The Pre-Norse/Pictish context (2128) was selected in the hope that the presence of domestic fowl eggshell could be identified since context 2128 contained an immature ‘Galliform *cf.* Domestic Fowl’ bone. Although domestic fowl are in use prior to this point (from the Iron Age), they are generally limited in numbers and only really expand significantly with the Norse arrivals. This context also produced a bone from a white-tailed sea eagle. Although it is highly unlikely that any eggshell from this species would be present, it proved an interesting possibility.

The other contexts were selected based on type and date. In total 19 specimens were analysed by SEM. The 20th specimen was unfortunately too damaged for inclusion, despite appearing well preserved under optical microscope.

Table 7.2 shows the species represented by bone in the contexts selected for eggshell analysis from Mound 2 and 2A. This sub-sample and the overall avian bone analysis shows that a diverse range of bird species were utilised; predominantly seabirds but also waders waterfowl and domesticates, some of which may thus be represented in the eggshell.

Table 7.2: Table showing species present by bone material in contexts selected for eggshell analysis from Bornais Mound 2 and 2A by phase.

Species	PN/Pict	Early Norse			Middle Norse		Late Norse	
	2128	969	1257	1523	1602	2627	1394	1640
Cormorant		2	2					
Domestic Fowl				2			1	1
Large Grey Goose <i>cf.</i> Greylag		1	1			2		
Carrion Crow / Rook								3
<i>Cf.</i> Goose Sp.								3
Razorbill				1			1	1
Herring / Lesser Black-Backed Gull				1				1
Small Wader Sp.			1				1	
<i>Cf.</i> Domestic Fowl								1
<i>Cf.</i> Small Wader							1	
Duck Sp.				1				
Galliform <i>cf.</i> Domestic Fowl	1							
Galliform Sp.			1					
Gannet					1			
Great Northern Diver		1						
Greylag Goose		1						
Large Duck Sp.			1					
Large Duck Sp. <i>cf.</i> Mallard		1						
Large Gull / Skua						1		
Manx Shearwater				1				
Oystercatcher		1						
Red-Breasted Merganser			1					
Shag / Cormorant			1					
Small Passerine Finch Size			1					
White-Tailed Eagle	1							

Table 7.3: Eggshell samples shown by mound, phase and contextual information.

Mound	Context	Sample	Block	Phase	SEM Sample No.
1	482	9124	CB	Late Iron Age	10
1	482	9125 & 9126	CB	Late Iron Age	11
1	463	9058	CG	Late Iron Age	12
1	341	5599	CF	Middle Norse	8
1	305	8581	CF	Middle Norse	9
2	2128	11805	BAF	Pre-Norse/Pictish	15
2	1523	7228	BBD	Early Norse	6
2	1257	9471	BBD	Early Norse	16
2A	969	9253	GAA	Early Norse	13
2A	1602	7042	GBG	Middle Norse	14
2	2627	11382	BCC	Middle Norse	17
2	1394	7921	BED	Late Norse	18
2A	1640	NA	GEC	Late Norse	5
3	606	5925	DB	Middle Norse	2
3	606	5925	DB	Middle Norse	19
3	614	8067	DD	Late Norse	1
3	610	5945	DD	Late Norse	3
3	604	5909	DD	Late Norse	4
3	669	8692	FB	Late Norse	7

The Eggshell Results

A trial was run using carbon to coat a specimen to elucidate if this cheaper method would be sufficient. Whilst the guides to eggshell analysis and multiple papers state that the specimens were coated in gold, they do not expressively state that carbon is not viable (Eastham and ap Gwynn 1997; Sidell 1993, Sidell 1995, Sidell n.d.). While the main characteristics of the shell structure were still visible, the resolution was too poor to be able to allow the identification to species. For example, while many of the mammillae could be counted, most of their identifying features could not be seen (Figure 7.1). Gold coating is therefore necessary to ensure accurate observation of the surface characteristics. With gold coating basic features of the mammillae can be seen even at 30x magnification; and this also facilitates identification of the stage of egg development through clearer observation of the mammillae reabsorption over a larger spectrum of the egg's surface (Figure 7.2) (Beacham and Durand 2007, 1610-1615).

Figure 7.1: Carbon coated at 200x magnification

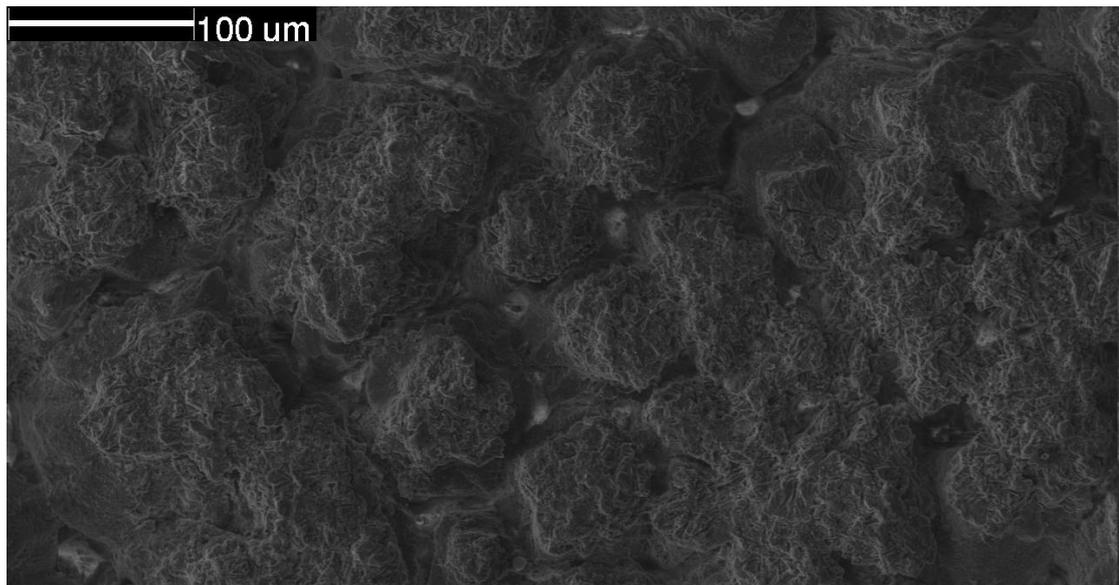
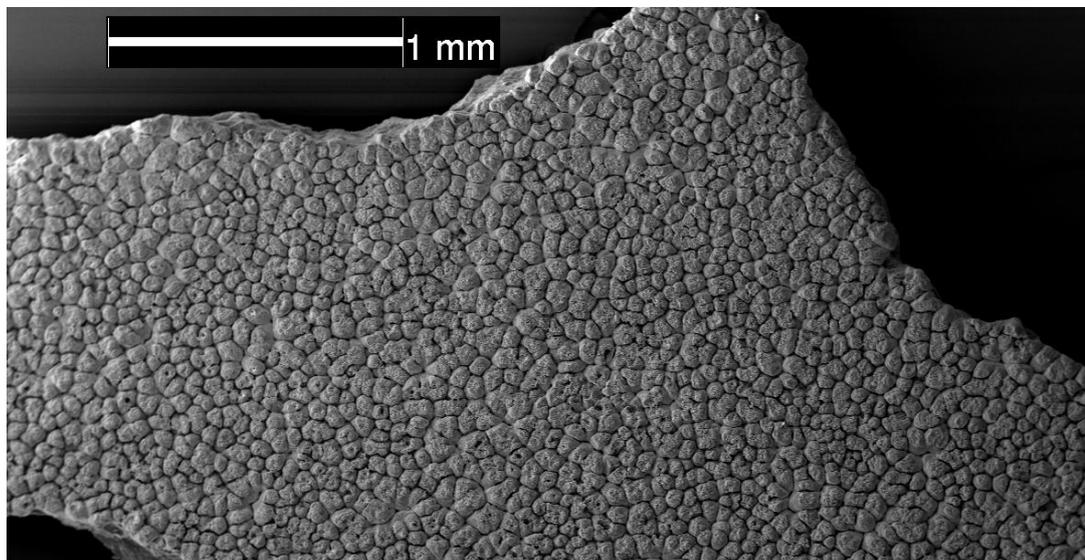


Figure 7.2: Internal eggshell surface structure (gold coated). The size, shape and general spacing of the mammillae can be seen, as can the fissures (specimen 8), at 30x magnification.



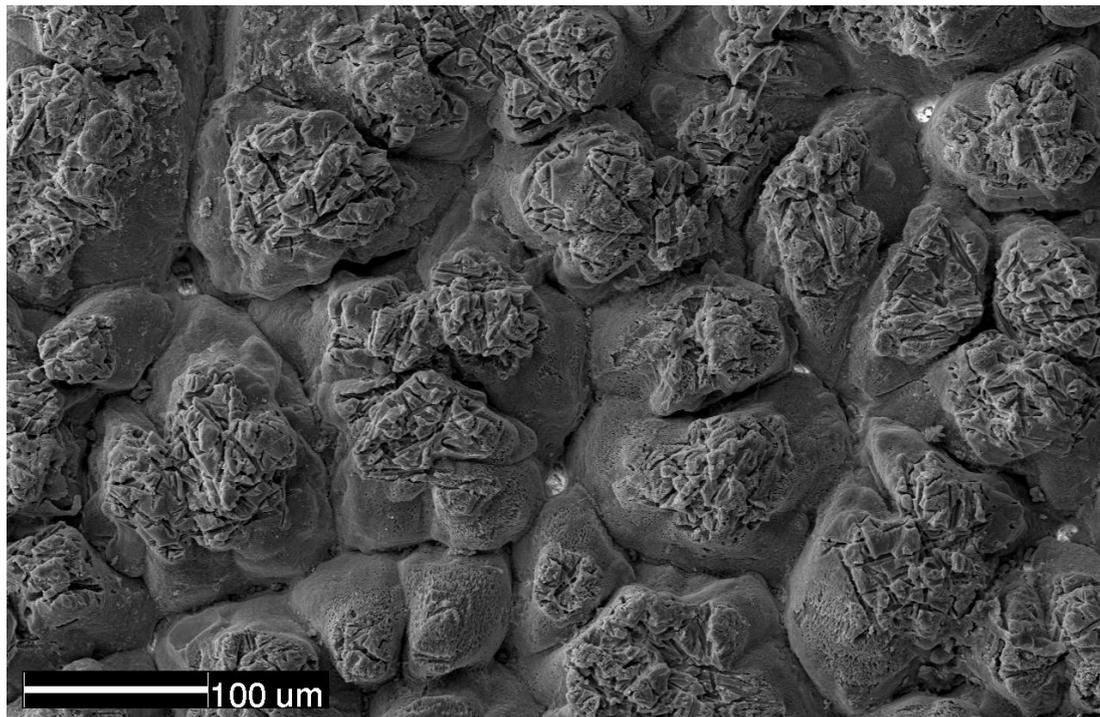
Hatching Profiles: Egg or Bird?

None of the fragments examined were from hatched eggs and the majority of the eggshell analysed from Bornais (Mounds 1, 2, 2A and 3) came from specimens that were very clearly unhatched. Of the 19 fragments examined the majority were newly

laid eggs at a very early developmental stage with no signs of reabsorption, six were approaching or showed the very first stages of mammillae reabsorption (with a very small concavity on the mammillae surface), two were around halfway through their incubation and two were late in their developmental sequence (see Chapter 3.4.2 for developmental staging). This suggests that the vast majority of eggshell ending up on the Bornais site came from eggs used as food, rather than representing intrusive material or intentionally hatched domestic birds.

When collecting wild bird eggs it is often difficult to know how long the egg being taken has been incubated and as such the developmental state of the bird inside, particularly if the targeted species can relay. If a bird population was observed to have only just laid, or if the eggs had previously been collected from relaying species, eggs early in development could be selectively secured. To our western modern minds the presence of a foetus within the egg could be unpalatable, but to 19th century occupants in the Scottish Islands this was in fact a sought after taste experience (Harman 1997, 208; Martin 1953, 35; Wilson 1842a, 45). The domestic fowl eggs at Bornais are all from newly laid eggs suggesting that these were used (or preserved) soon after lay. With the cessation of incubation the reabsorption stops since the chick is no longer using the food reserves or preparing for hatching. The wild species meanwhile show a wider range of developmental stages implying that the collection of these resources may have occurred over an extended period of the nesting season, rather than intensive acquisition at its onset. Taking the egg later from a relaying species will again delay its next lay and eventual departure.

Figure 7.3: Unhatched eggshell from Late Norse Period Bornais (Sample 18 at 200x).



Species Present

Both domestic and wild birds are present in the Bornais eggshell material. Unfortunately many of the fragments were not identifiable to species but still provide some valuable insights into avian resource use to be used independently and in combination with the large ZooMS analysis conducted by Stewart which is explored below (*et al.* In Prep.). As such the species that are discussed in this section are in most cases assigned with a degree of error (Table 7.4 and A7.1). Within the small sample selected for SEM analysis the presence of domestic fowl, gulls, auks, geese and some potential other seabirds was identified (Table 7.4 and Appendix Table A7.1).

Domestic fowl are represented in all of the Norse phases and clearly were an important and reliable source of eggs. All of the domestic fowl fragments were newly laid. Domestic fowl also occurred in the Pre-Norse/Pictish material supporting the presence of the possible juvenile domestic fowl identified in the bone material. Interestingly both

cf. domestic geese and *cf.* wild geese were represented in the Norse SEM material, indicating that at least some of the bones identified as ‘Large Grey Goose *cf.* Domestic’ were probably domestic and from managed flocks of geese. It also demonstrates that wild geese continued to be used for both meat and eggs even after the introduction of their domestic counterparts, and highlights the difficulties associated with identifying domesticates in contexts where their wild relations are prevalent. Domestic geese may have thus (like chickens) been kept primarily as a sustainable source of eggs with the wild geese in this environment being used as a key meat resource, which did not require feeding or tending, and as such were less of a resource investment. Interestingly a ‘*cf.* domestic goose’ is one of the few fragments which was relatively late in its development, perhaps indicating an accidental death of an egg which was being intentionally incubated, or less regular egg collection than compared to chickens.

Table 7.4: Species Present in the Eggshell Material by Period

Iron Age	Pre-Norse/Pictish
Auk <i>cf.</i> Razorbill Damaged but <i>cf.</i> Razorbill <i>cf.</i> Gull Sp	<i>cf.</i> Domestic Fowl
Early Norse	Middle Norse
Large Gull sp. <i>cf.</i> herring <i>cf.</i> Herring Gull <i>cf.</i> Domestic Fowl	Domestic Fowl Small gull <i>cf.</i> common <i>cf.</i> shag or hybrid goose? <i>cf.</i> puffin? <i>cf.</i> Domestic Goose <i>cf.</i> Domestic Goose
Late Norse	
<i>cf.</i> Domestic Goose Possibly <i>cf.</i> Great Auk <i>cf.</i> Wild Duck <i>cf.</i> Greylag Goose <i>cf.</i> cormorant or Domestic Fowl – Not certain <i>cf.</i> Domestic Fowl	

The wild species represented within the small eggshell sample suggest that birds were acquired from within the vicinity of the site and from further afield. The auk material

contains razorbill/guillemot which do not breed on South Uist today, and the lack of suitable habitat implies that they never bred on the Uists. The puffin may have been taken locally and again supports harvesting of the burrows. This specimen exhibited the very first stages of reabsorption. It is harder to recognise and track when burrow species have laid compared to those whose nests are open. Interestingly, despite the great auk being entirely absent from the Norse bone assemblage there is one eggshell fragment that might possibly come from this species. The internal surface characteristics of this specimen most resemble guillemot but the fragment is much thicker than the usual guillemot range. Whilst this may be an unusually large guillemot, it must also be considered that perhaps the occasional pair of great auk were still breeding around South Uist in the Late Norse Period.

Gulls occur in both the Iron Age and Norse material, and interestingly both common and herring gull appear to be present despite herring gull being more frequently represented in the bone material. This could indicate that a range of gull species' eggs were taken from the nest, and that the larger adult gulls could have been exploited year round as they scavenged around a settlement. One gull *cf.* herring gull was at a later stage of development, demonstrating that eggs may have been taken across the incubation period and not just when immediately laid. Wild duck was present, but no domestic ducks were identified.

Some problematic specimens were present which could not even be confidently assigned to family, but which may provide evidence for the exploitation of shag and cormorant (resident species) in the breeding season at the nesting site. The potential cormorant specimen, although resembling cormorant in terms of its inner surface form,

is minutely thinner and has notably fewer mammillae/mm² than characteristic of the species (Sidell (1993, 23-25). Some internal characteristics could also resemble domestic fowl. This is a complex specimen which cannot be identified further. The potential shag is interesting. This fragment resembles shag both in terms of its internal characteristics and mammillae ratios, but it is around a millimetre thicker than the shag values suggested by Sidell (1993, 24). Very tentatively it could even potentially be from a hybrid domestic and wild goose, which would explain the slightly granular membrane facets and its thickness. However for these specimens and for the potential great auk no confident approximation can be made without comparison to a much extended reference base, which at present is not available.

Morphological changes may have occurred between present day eggs (used to create the reference material) and the eggs of birds in the past. Domestication had clear changes on the eggshell's internal surface for, but how long this took to occur is debatable. However, the longer a bird is exposed to selective breeding, theoretically the greater divergences in form could be present. (Eastham and ap Gwyn 1997, 89, 91-93). As such comparative work between SEM and ZooMS analysis could help investigate such changes. A specimen whose conformation is not diagnostic based on visual and metric observation could then be submitted for ZooMS analysis to provide information on the species represented by this form of internal surface characterisations and other measurements. Potentially in a wider context such work could also trace the changes that occurred with domestication and the timescale that it occurred over, whilst in the context of the Scottish Islands it may be able to inform upon (e.g.) interbreeding of domestic and wild goose populations

Limitations and Further Application

Confident identification is one of the key problems of visual observation, particularly when factors such as degradation and the degree of hatching/reabsorption can obstruct, obscure and damage the characteristic features used for identification. Individual variation can also complicate some of the metric criteria used such as shell thickness and pore counts. For example, within a handful of eggshell studies examining domestic fowl significant variation in eggshell thickness was noted, which arises both from individual variation and differences between specific breeds (Keepax 1981, 322; Serjeantson 2009, 174; Sidell 1993, 13). Since eggshell formation results from minerals laid down by the female bird individual variation is to be expected based on dietary stresses, migration or if the bird is relaying due to egg loss. The stresses of repetitive laying at various points of the year must also be considered for domestic fowl, which can again create variation in the characteristics used for identification. ZooMS will often only produce a broad taxonomic identification such as 'goose', however it can handle material that is inaccessible to visual examination (such as damaged specimens), is not complicated by individual variation (in e.g. thickness), and furthermore/thus it provide a certain non-subjective result.

Another problem with microscopic analysis is that time and money can be wasted on preparing and processing a fragment that is ultimately unidentifiable due to structural deterioration of identifiable characteristics. With the development of the ZooMS technique, more specific and focused targets for SEM identification could be selected in the future. For example, if ZooMS identified large amounts of goose in a particular context, specimens could then be targeted for SEM work to identify if these are domestic or wild birds.

7.4 ZooMS for Eggshell

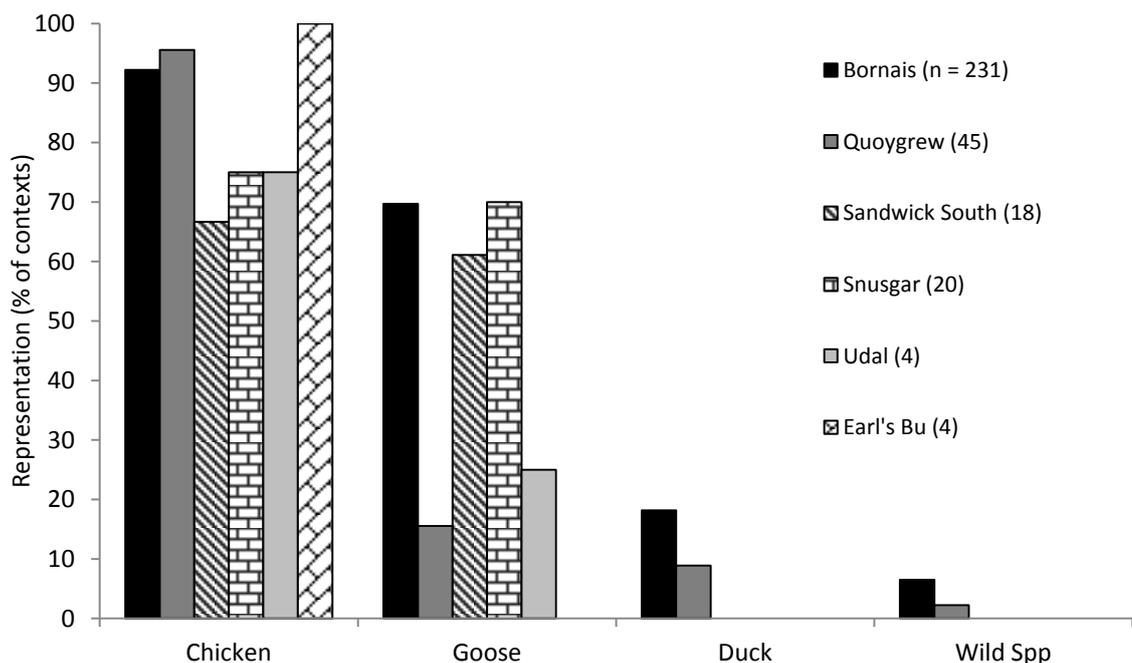
The work being conducted by John Stewart for his PhD has provided eggshell analysis of some Scottish Island sites on a previously impossible scale. The large quantity of fragments which this technique can handle provides unparalleled datasets for consideration. Eggshell from Bornais, Udal, Quoygrew, Sandwick South, Snusgar and Earl's Bu has been analysed by ZooMS. With the exception of the Udal and Bornais all of these sites are Norse. Udal (as previously discussed) has occupation from the Neolithic to Post-Medieval period, while Bornais has both Late Iron Age and Norse occupation. The eggshell assemblages present at each site vary considerably in size, and as a result so do the total number of fragments analysed. Bornais and Quoygrew produced the greatest quantities of eggshell (Stewart *et al.* In Prep.). As noted above, Bornais Mounds 2 and 2A alone produced over 20,000 fragments (Sharples pers. comm.) of which over 10,500 fragments have now been analysed (Stewart *et al.* In Prep.). At Quoygrew produced a much smaller, but still comparatively large, assemblage of 991 fragments which were submitted for analysis (Stewart *et al.* In Prep.). The other sites analysed by Stewart and considered here produced considerably smaller assemblages but still prove very valuable for wider contextualisation of the Bornais and Quoygrew data by increasing both the number of sites considered and the geographical range. Of these Snusgar³⁷ provided 188 fragments for analysis from the 2010 excavations, Udal produced a small 79 fragments with only 6 from securely Norse features, a similarly small assemblage was present at Earl's Bu, and at Sandwick South just 172 fragments were recovered, facilitating exploration of egg resource use in Shetland (Stewart *et al.* In Prep.).

³⁷ Unfortunately the full bone material was not available for inclusion in this thesis, but the partial information available will be considered here and in the discussion.

Results

It is clear from the ZooMS analysis that domestic fowl eggs were the most widely distributed and frequently occurring form found in the Norse sites (see Figure 7.4 – the ZooMS dataset is kindly available for comparative inclusion in this thesis by expressed permission of John Stewart). Goose and duck (which may include both wild and domestic birds) occurred next most frequently in terms of contexts containing them. Quoygrew’s egg use appears to be very focused on domestic fowl, with much lower representation of geese, ducks and purely wild species. In the Norse ZooMS data non-anatidae wild birds are only represented in the large assemblages from Bornais and Quoygrew and even here they occur in under ten percent of the eggshell producing contexts from these sites (all phases combined) (Stewart *et al.* In Prep.). Overall the wild species were mainly gulls and auks.

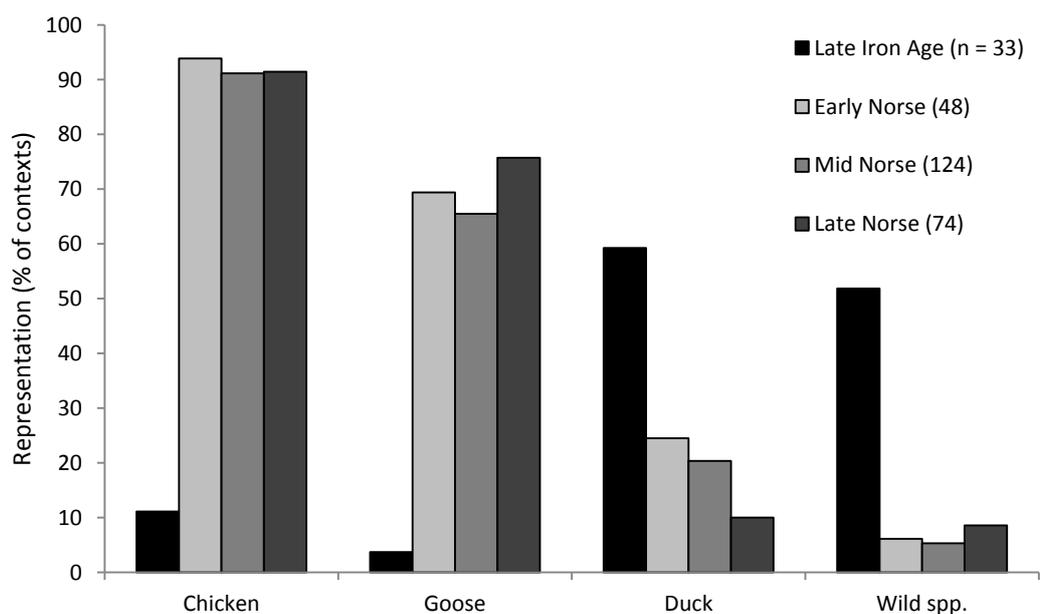
Figure 7.4: Eggshell species presence given as % of number of eggshell bearing deposits. Norse levels combined. From Stewart *et al.* (Inc. Best) In Prep., by kind permission).



Bornais – A Wider Temporal Picture

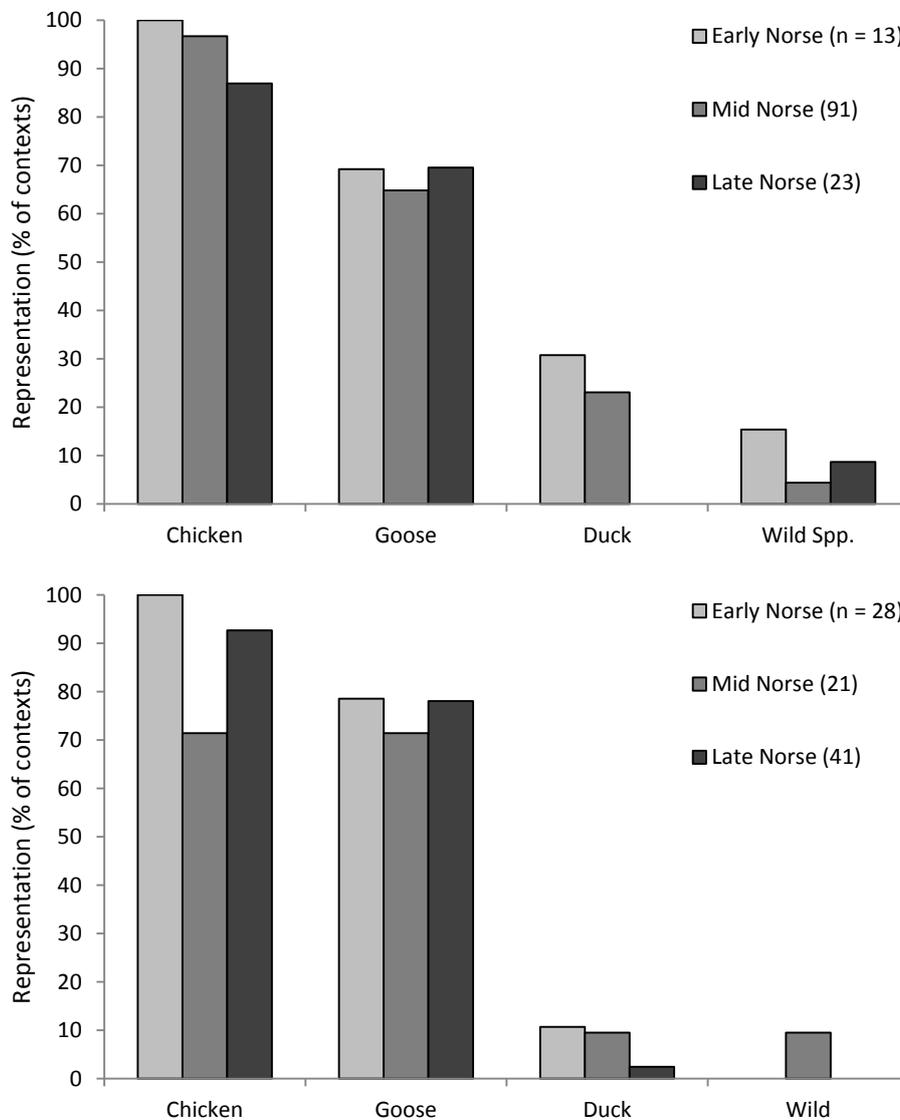
Within the ZooMS data for Bornais it is clear that there is a distinctly different use of eggs in the Iron Age and Norse period. The Iron Age material exhibits a much higher use of wild species including gulls, auks, swan, curlew and also a greater use of ducks, the majority of which are likely to be wild (Figure 7.5) (Stewart *et al.* In Prep.). The avian bone assemblage from Iron Age Bornais (as seen in Chapter Four) contained ducks that were *cf.* teal, mallard, shelduck and eider, but none that resembled domestic duck (Cartledge and Serjeantson 2012, 195). The only duck in the SEM material was *cf.* wild, which would again suggest the majority of duck were wild birds, and would help to explain their decreased presence in the Norse material where domesticates and in particular chickens are most prominent. In the Iron Age eggshell, a very low presence of domestic fowl and geese (wild or domestic) is present, indicating that although chickens were present in the vicinity their distribution and numbers were small.

Figure 7.5: Bornais eggshell species occurrence given as a % of eggshell bearing contexts (all mounds combined). (From Stewart *et al.* (Inc. Best) In Prep., by kind permission).



The presence of domestic birds in the Late Iron Age at this site is particularly interesting since none were present in the bone data and in Mound 1 they were not numerous even in the Norse material (See Chapter Four Figure 4.18). (Bone and eggshell data will be combined in more detail below).

Figure 7.6: Bornais Mounds 2 (top) and Mound 2A (bottom) eggshell species occurrence given as a % of the number of eggshell bearing contexts by phase (From Stewart *et al.* (Inc. Best) In Prep., by kind permission).



Within the Norse Period at Bornais it is clear from the ZooMS data that domestic fowl provided a repeated and important source of eggs. Geese were also key in egg provision with their shell occurring in nearly as many contexts as domestic fowl (although with geese multiple species may be represented within this one grouping). Geese occur more widely in Mound 2A than Mound 2, suggesting some difference in resource use across different areas of the Bornais site. Duck eggshell occurs at a greater number of contexts in the Early Norse period and declines through time, again inferring that these are mainly wild birds (Stewart *et al.* In Prep.). Overall this indicates that in the Norse period the increase of domestic fowl identified in the bone material represents a population that was kept mainly for eggs. It also implies that although wild species continued to be used for eggs and remain dominant in terms of bone frequency, their eggs were perhaps less targeted than in earlier periods.

Other Non-Norse Sites

In addition to the Iron Age information at Bornais, it is interesting that the earlier phases of occupation at the Udal also exhibit a higher use of wild species (including a possible great auk), indicating that Norse domestic bird management significantly altered avian egg use in the Scottish Islands (Stewart pers. comm.). It is also relevant to note that the Post-Norse material at Udal also had less domestic birds than the Norse sites (Stewart *et al.* In Prep.).

7.5 Eggshell Discussion

The Bones and the Egg: Comparison of SEM and ZooMS data with the Bone

Material

The eggshell analysed by ZooMS and SEM indicate a high use of wild and probably wild resources in the Iron Age with a small domestic contribution. This is followed by domestic dominated egg use in the Norse period, despite the bone data from the sites showing a continued and dominant use of wild resources (see Chapter Five).

Bornais

The Iron Age bird bone from Bornais is heavily dominated by large gulls including the herring gull / lesser black-backed gull and the great black-backed gull; the presence of larids in the wild eggshell is therefore expected and shows that some exploitation of these birds and their eggs took place around their nesting sites (Best and Mulville 2014; Cartledge 2005, 145; Cartledge and Serjeantson, 2005). Two auk fragments (*cf.* razorbill) were identified in the SEM data and auks were present in the ZooMS material, despite them making up less than 1% of the Late Iron Age bone remains. Using SEM to identify this auk material to razorbill/guillemot rather than puffin or other small auk indicates that the few bones came from birds accessed at the nest site, rather than being caught from the sea or sky.

Stewart's ZooMS analysis also identified Iron Age curlew eggshell (Stewart *et al.* In Prep.). Curlew was the most commonly occurring wader in the Iron Age assemblage, and the presence of its eggshell infers that it was breeding in the Scottish Islands during the Iron Age. This is particularly informative since the curlew is in large a winter visitor

to coastal areas, and until the 1960s none were recorded breeding in the Outer Hebrides despite suitable habitat being available (Burton and Fuller 1999, 18). From the 1960s small breeding populations have appeared on North Uist, and then Harris and Lewis (Burton and Fuller 1999, 18). This would suggest that in the past curlew may have bred more widely in the Western Isles, and have been more akin to their Northern Isles distribution which contains a breeding population and a significantly swollen winter body (Stroud *et al.* 2001a, 312-314).

In the Norse period at Bornais seabirds still form the largest proportion of the bone remains, but as part of a more diverse fowling economy which makes increased use of waterfowl (such as ducks and geese), waders and domesticates (Best In Prep.; Best and Mulville 2014). Although gulls, gannet, waders, shag, cormorant and auks remain an important part of Norse fowling at Bornais, as indicated by the bone remains, their presence in the eggshell record indicates a relatively minor provision of these resources. Geese form a large proportion of the bird bone assemblages from Early to Late Norse Mounds 2 and 2A, complementing the overall eggshell data. Many of these are wild greylags with a small number of probable domesticates (Best In Prep.; Best and Mulville 2014); both of these were identified in the SEM material, but with more examples of *cf.* domestic goose despite most of the bones being from wild greylags.

At Bornais, domestic fowl are conspicuous by their inconsistent presence within the Norse assemblages. Although they are an important resource (whose presence has dramatically increased in the Norse period) they do not dominate the avian bone assemblage. For example, no chicken bones were identified from the Iron Age deposits in Mound 1, while only small amounts were identified from the Mound 1 Norse levels

(Cartledge 2005, 145 and 177; Sharples, 2005). Overall the Norse period at Bornais sees a comparatively dramatic increase in chicken bone in Mounds 2, 2A and 3, with them occurring most frequently in the Late Norse period, but even at this point they only form just over 11% of the bird bones (Best In Prep.; Best and Mulville 2014). This is in contrast to the eggshell data in which chicken was very prominent, occurring in high proportions of the eggshell containing contexts (Stewart *et al.* In Prep.).

It is visible therefore that domesticates play a large role in egg provision despite wild birds remaining the primary meat providers both overall and (for geese) within family. The importance of repeated lay outside of the naturally defined breeding season must be considered with domestic birds in terms of their large representation. However, it is not clear to what degree domestic birds were able to relay in the Later Iron Age and Norse Periods and as such what their egg yield would have been; extending lay beyond the confines of natural season signifies a high degree of domestication but it is also dependent on climate (Serjeantson 2009, 267; Stone 2006, 148-161; Slavin 2009, 41-42). However, the high proportion of females containing medullary bone identified at Bornais provides evidence for a highly extended egg laying range. Domestic geese are also able to lay multiple times a year (although often not as many as domestic fowl), and their eggs can also be incubated by chickens if live young are desired (Albarella 2005, 253; Serjeantson 2002, 41; Serjeantson 2009, 298; Slavin 2009, 38). It is also important to consider differential deposition of domestic and wild material. With domestic birds kept as livestock there is also potentially more opportunity for eggs eaten by predators to remain within the vicinity of a site.

Bornais Mound 2 contained a greater range of duck species in the bone remains,

perhaps correlating with their increased representation in the ZooMS data for the Early and Middle Norse phases of this area.

Domestic Birds

As mentioned, the presence of domestic fowl eggs in the Iron Age contexts of Bornais is interesting since they were not represented in the bone material (Stewart *et al.* In Prep.; Cartledge and Serjeantson). On both South Uist and within the other Hebridean islands a small scale, piecemeal adoption of domestic fowl has been identified via the bone remains at other sites, demonstrating that these birds were present in the locale. As such the eggshell at Bornais could have come from birds that have simply been lost from the surviving assemblage. With small eggshell fragments the possibility of intrusion via soil movement must also be considered. However, there is also the possibility that egg resources could have been traded on South Uist in the past. The eggs at Bornais in the Iron Age may therefore have been acquired from other sites such as Late Iron Age Dun Vulcan, also on South Uist, or from the Udal on North Uist.

A Fertile Landscape and Its Use

Eggshell is one of the very few avian indicators that can be used to show direct engagement with the nesting site, since while the relative abundances of certain species and the assessment of knowledge of their ecological niches can be used as a proxy they are all limited by their conditional status. Juvenile bone as explored can indicate nest activity, but in some cases the timing of fusion is complex and ambiguous (Serjeantson 2009, 36-43). Eggs can therefore indicate that adult birds may have also been taken from their nesting environment rather than captured at sea, from the air, or from scavenging activities such as beach combing.

The Bornais eggshell indicates that eggs were being taken from around fresh waterbodies (swan and wild ducks and geese), from the burrow (puffin), and from cliff ledges (razorbill) (Baldwin 1974, 61-64). Gull eggs would have been from open nests in a variety of locations: on dunes, grassland, skerries, around inland water, rocky shores and cliffs (Cramp *et al.* 1974, 121; Cartledge and Serjeantson 2012; Heinzel *et al.* 1992: 150; Webb *et al.* 1990, 179). The possible shag and cormorant identified would have nested upon rocky areas of the shore, often at the base of cliffs with shags also favouring dark nooks or ledges and the cormorant also frequenting stacs (Baldwin 2005, 16).

7.6 Closing Summary

The pre-existing and novel eggshell analysis has demonstrated that a range of wild species were accessed on the nest, providing evidence for a wide use of landscape and resources during the summer breeding season. Egg collection has both targeted species that only came to land to breed (such as the auks) and also those that could have been repeatedly harvested at multiple points of the year. Analysis has also shown that domestic birds were being used on a small scale in the Late Iron Age for eggs, and that in the Norse period domesticates provided a much larger and dominant egg resource.

CHAPTER EIGHT

DISCUSSION

Avian-human Relationships of the Past



8.0: Introduction

This chapter assimilates, develops and discusses the key themes identified via the avian bone and eggshell material outlined in the preceding results chapters. This discussion contextualises the archaeological results within the wider tradition of fowling in the North Atlantic environment – both archaeologically and historically. Firstly this chapter presents an overview of bird use through time and space in the Scottish Islands, and expands upon the use of modern bird data as a proxy to infer past behaviour. Key changes in species distribution and the resultant human exploitation are then considered.

The character of fowling economies in the Scottish Islands can then be explored, with both focused and diverse exploitation becoming visible. This leads into examining the fowling landscapes under use and the range of capture techniques potentially employed. The contribution of non-meat products including feathers, falconry, oil/fat, eggs, skin, bone and guano is also addressed. Beyond this, the more intangible and symbolic aspects of bird use and the avian-human relationship are recognised, including weather prediction, symbolism, navigation and landnám, alongside issues of avoidance and taboo in bird use.

8.1: Bird Use Through Space and Time in the Scottish Islands

The archaeological data from the Scottish Island sites indicate that birds were part of life and subsistence from their earliest occupation and that their use continued into the recent past. This tradition of fowling, and particularly seabird exploitation, persisted into the 19th and early 20th century for communities on islands such as St Kilda and Mingulay (Buxton 1995, 82-83; Maclean, 1992, 90-109). The social and symbolic

importance of seabird fowling (in addition to their dietary usage) is exemplified in the continuation of this fowling tradition; even today the men of Ness on Lewis in the Outer Hebrides have special dispensation allowing them to annually cull young gannets on Sula Sgeir (Beatty 1992; Hull 2001, 95). The preserved young gannets are known as ‘guga’ and are considered both a culinary delicacy and an integral part of the islanders’ history and identity. The archaeological avian dataset detailed in this thesis is part of the wider British fowling tradition which is evidenced from very early points in its occupation, such as the Lower Palaeolithic great auk remains found at Boxgrove, right through to the present-day hunting of sports birds such as pheasant (Baldwin 2013; Poole 2010, 159-160; Yalden and Albarella 2009, 21 and 35). However the bird populations within Britain today have to contend with different pressures and advantages than those in the past. These are discussed below to contextualise the modern populations used for comparison, and to examine the flexibility and range of stimuli that may have affected bird populations in the past.

The Present and the Past: Changed Distributions and Inference

Some of most influential and important changes affecting fowling and bird populations in Britain have been implemented in the later 19th and 20th century; in particular with the 1954 ‘Wild Birds Act’ and the 1981 ‘Wildlife and Countryside Act’ which outlawed the killing, taking or injuring of wild birds (with certain exceptions) and the collection or holding of their eggs. An earlier incarnation of this bill passed in 1869, the Preservation of Seabirds Act, was the first legislation to protect birds in the United Kingdom. However although it limited the exploitation of certain species between the months of April and August, it still allowed the capture of unfledged birds, and did not regulate bird-taking outside of the breeding season (Baldwin 1974, 98-99; Buxton 1995,

82). It was also difficult to implement when communities such as those on St Kilda and Mingulay were still very dependent on bird resources taken during the breeding season (Baldwin 1974, 98-99; Buxton 1995, 82). A special exemption was granted for St Kilda, but the Mingulay population continued with their (already declining) fowling, preserved from punishment by the remoteness (real and perceived) of their situation (Buxton 1995, 82-83). The 1880 Wild Bird Protection Act extended cover to a much wider range of species, but still did not restrict egg taking (Baldwin 1974, 98-99; Bassett 1980, 1).

These control measures are valuable for examining the archaeological data since they helped to remove the immense pressures of unremitting, unsustainable, intense persecution of birds on a commercial scale in the 18th to early 20th centuries that took place for business, pleasure (hunting and egg-collecting) and for fashion (e.g. plumage) (Baldwin 1974, 98-99; Baldwin 2012, 51; Bassett 1980, 1; Buxton 1995 82-83). Thus legislation helped return some bird populations to levels and locations that may more accurately reflect past distributions (although appropriate care and critical consideration must still be exercised when using modern data as a proxy for season, breeding behaviour and feeding habits etc.).

Our knowledge and understanding of past avian distributions and behaviours is very limited (even for relatively recent periods); and consequently much is inferred based on modern populations. It is therefore essential to use the archaeological data available to help recreate these past populations more accurately to understand human interaction with them, rather than relying on educated assumptions; even if this means challenging preconceived ideas. The past presence of species in locations where they are now absent is a complicated and sometimes controversial topic (for example reintroducing the

white-tailed eagle to areas in Britain where they had been lost) (Lockie and Stephen 1959, 43-50; Serjeantson 2010, 151-154; Whitfield *et al.* 2009, 110-120). It is therefore also vital that species are not naively excluded from having ever been present within a particular geographic area, just because it has not frequented that area within the documented past – a point demonstrated by the previously unreported Fea's petrel identified at multiple Scottish Island sites (Serjeantson 2005, 233-244).

Modern avian monitoring and recording projects have demonstrated that bird populations can react drastically, flexibly, rapidly or gradually in response to a myriad of triggers which should be considered when examining archaeological variations. For example, temperature fluctuations can impact (positively and negatively) upon the timing of birds returning from wintering grounds, the commencement of the breeding season, coinciding availability of the necessary food sources, and consequently as a result the hatching and fledging of young (e.g. Barrett and Rikardsen 1992, 24-32; Barrett *et al.* 1987, 73-83; Byrkjedal and Thompson 1998; Durant *et al.* 2004, 388-394; Fisher and Waterson 1941, 204-272; Glahder, and Walsh 2006 640; Halupka *et al.* 2008, 95-100; Harris and Rothery 1985, 243-250; Linhart *et al.* 2012, 186-192; Owen and Salmon 1988, 37-45; Stroud *et al.* 2001a).

Such work demonstrates that a large range of anthropogenic and non-anthropogenic factors could have influenced the availability and quantity of birds available to past human exploiters and resultantly the archaeological record. Such stimuli may have included the loss of forestation on the Western Isles which largely vanished by around 2500 BC, the formation of the machair around the region of 5000-2500 BC, or periods of increased storminess which occurred at multiple times in the past including 1800-

1300 BC and AD 300-700 (Edwards and Whittington 2003, 63-70; Parker Pearson *et al.* 2004, 24-26). Increased pastoral and arable farming would also alter landscape form and use.

The Archaeological Avian Profile of the Scottish Islands

A Flight Through Time

The archaeological data assimilated in this thesis demonstrated that birds were a permanent part of life in these island locations. Even when their overall dietary input may have been small, their presence was an integral part of life in these landscapes which contain a diverse range of species, many of which mark the seasons with their movements.

The dataset has revealed that whilst there are some similarities between fowling economies, bird resources can be very idiosyncratic; reflecting both the specific landscape context and the choices of the human fowlers. In all periods and locations wild bird were the main contributors to the avian resource base, and of these seabirds are the most constant and frequently captured group of birds exploited. In most instances the archaeological bird remains indicate that bird-use was part of a year-round fowling calendar, but one which frequently had a focus on birds coming to land in the spring and summer to breed.

In the Mesolithic dataset, which is the earliest and only hunter-gatherer avian material in the Islands, there is a strong focus on summer fowling of pelagic seabirds during their nesting period, particularly in the Inner Hebrides where the vast majority of the Mesolithic data originate from. The Northern Isles site of West Voe shows a strong

usage of the resident shag, however juveniles indicate that this resource was also largely taken in the summer months. This reveals that the Mesolithic human inhabitants were making strategic use of concentrated avian populations, maximising resource use and implies that eggs would have also been a valuable resource. The extreme summer focus indicated by sites such as Sand which displays an intense use of razorbill and guillemot could infer that in these pre-farming societies access to dense breeding bird colonies was essential for immediate and potentially delayed (preserved) subsistence. Concentrated species use gives evidence for specific, targeted fowling events, and infers that although a range of species were used to supplement the diet at various points of the year (particularly at sites such as Cnoc Coig), effort was focused on large-scale avian resource collection in the summer.

From the Neolithic onwards the wild avian resources are being used in conjunction with a domestic mammal resource base, but one that was still devoid of avian domesticates until the Mid/Late Iron Age. The Neolithic avian profiles present a much wider use of birds than in the preceding Mesolithic, inferring that the birds were now taken in a wider range of fowling events, that were less focused on a single point of the year. Although the Hebridean dataset is very small it indicates that auks remained important avian resources, and that other seabirds such as shag and gannet were also key food species. Meanwhile in the Northern Isles a diverse and seemingly dual avian resource use is exhibited. Auks, gulls, shag, cormorant and gannet remain key food species, with minor contributions from waterfowl and waders. However the Northern Isles' mortuary contexts in particular exhibit an exceedingly high use of raptors, with a substantial use of the white-tailed eagle. At Isbister (the Tomb of the Eagles) this specific use of raptors is seen to continue into the Bronze Age when a substantial number of individual birds

were deposited in a phase of reuse. This raptor use on such a level is not seen after this point; later use of varied birds of prey indicate differing applications, either in falconry, for feathers, or culling to protect livestock (Hull 2001, 132).

Use of the white-tailed eagle in the mortuary environment suggests a symbolic relationship and association with the dead in the Neolithic and some Bronze Age contexts. Although feeding mainly on marine foods such as fish, the white-tailed eagle is a prolific scavenger that will strip human flesh and scavenge the dead; indeed in later periods it was associated with the dead of the battlefield (such as in Anglo-Saxon and Norse poetry) (Baxter 1993, 78-80; Yalden 2007, 471-473). This author also entertains the interpretation that the movement of these spectacular, large birds around the sky may have held significance in transcending boundaries and the movement between life and death.

The Bronze Age material shows some very different patterns of bird exploitation both between island groups and individual sites. The Northern Isles assemblages (aside from the aforementioned white-tailed eagles) show a continued use of gulls and auks (particularly the great auk), and gannets. The Hebridean material is dominated by Cladh Hallan's focus on gannets, but also has significant use of auks (including some high puffin use), shag and cormorant, alongside a smaller contribution from waterfowl and gulls. The Bronze Age fowling shows a mixed use of resident birds and those that would have been targeted during the summer breeding season, and that in several cases may have been acquired at some distance from a specific site. The Bronze Age assemblage from Cladh Hallan also produced an unusually large assemblage of worked bones, unrivalled in any of the avian assemblages considered in this thesis. This

suggests that birds may have been an important resource beyond meat, with their bones being valued for tool/item production, and potentially holding symbolic significance.

The Iron Age avian material shows that whilst both the Northern Isles and the Hebrides continued to make high use of seabirds, they were more dominant in the Hebrides, whereas Iron Age fowling in the Northern Isles incorporated a greater number of ducks and geese, indicating different patterns of resource use and movement around the landscape. Interestingly, whilst auks, shag, cormorant and gulls continue to form a large proportion of the assemblage in both island groups, the Northern Isles display a much higher usage of gannets. Although gannets occur at a large number of sites in both island groups, they are more frequent in the Northern Isles assemblages regularly. This suggests that in the few Hebridean cases where they do form a higher proportion of the NISP they were acquired from colonies at some distance to the site, whilst in the Northern Isles more populations may have been available locally in order to facilitate larger usage on a more regular basis. Despite greater gannet usage, the Northern Isles also show a higher use of landbirds such as red grouse, again indicating less exclusive seabird focused fowling than in the Hebrides and implying greater use of birds at different points of the year, whereas much of the Hebridean material indicates summer focused capture.

The Iron Age in both the Northern and Hebridean Islands sees the first introduction of domestic birds into the avian resource base, indicating the first step in a changed relationship with the wild birds. The earliest introduction occurs in the Middle Iron Age in the Northern Isles, and potentially in the Hebrides, and both island groups have a small number of domestic birds present by the Late Iron Age. These birds are only

present in small numbers indicating that at this point in time their presence was not merely or primarily as a source of meat but was probably focused on egg provision and potentially status display and sport (Poole 2010, 158; Serjeantson 2000, 499). The Northern Isles (and in particular, Orkney) show a more diverse Iron Age domestic profile with a small representation of probable domestic geese and possibly ducks. The evidence indicates that the first (Middle Iron Age) domesticates occurred at high-status broch sites, again suggesting that their presence was of some importance socially and economically to the islands. The SEM and ZooMS eggshell evidence (Stewart *et al.* In Prep.) shows that domestic fowl eggs were present in Pre-Norse/Pictish and Late Iron Age contexts at Bornais where they are not represented conclusively in the bone material, indicating that domestic fowl introduction was small in scale and could potentially have involved local movement or trade of egg and bird resources between Scottish Island sites (i.e. within South Uist). However, whilst the islands were seeing the arrival of new, domestic birds in this period, they also witnessed the substantial decline of the great auk, which by the Late Iron Age was becoming rare and forming a much lower proportion of the fowling profile.

The small number of Pre-Norse/Pictish assemblages help provide another insight into fowling at the end of the Iron Age in the Scottish Islands and the approaching transitional period. The assemblages vary from site to site, but often have a dominant species. At Buckquoy on Orkney this was the gannet (again indicating a high use of this large pelagic seabird), and at Old Scatness the shag was particularly prolific indicating potential year round usage.

The Norse period saw some of the most dramatic changes in avian resource use within

the Scottish Island context. The domestic fowl (along with smaller numbers of geese and ducks) played a much increased (but in no way dominant) role in Norse economy; they were almost certainly being kept primarily for eggs but also provided valuable meat and feathers. Their arrival and larger adoption would have changed relationships with wild resources to a degree. The presence of a captive egg-laying population would have lessened the need for wild egg harvesting. Resultantly long-distance (and local) fowling trips could have been delayed in order to target young, nearly fledged birds rather than wild eggs. This theory (proposed from the bone data) has been supported by the small SEM and much larger ZooMS eggshell analysis which indicated that domestic fowl occupied a very prominent role in Norse egg provisioning, with minimal contributions from wild species such as auks and gulls (Stewart *et al.* In Prep.). Geese and ducks are, after domestic fowl, the most widely represented eggs in Norse contexts, and although the bone data did not show the same level of diversification in the Norse Northern Isles as identified in the Outer Hebrides (which displayed an intensified use of waterfowl and waders), geese form an important part of the Northern Isles eggs at sites such as Quoygrew and Snusgar. The SEM analysis indicates that both wild and domestic geese were present, inferring an interchangeability of resource use, and also suggesting that there may have been interbreeding and crossovers between wild and domestic stock; a point which may be supported by the very tentative identification of a potential hybrid eggshell fragment³⁸.

The increase of domestic birds in the bone record raises questions regarding their role and why they were kept. As geese do not lay as regularly as chickens it would be illogical to keep these birds primarily for eggs, particularly in a location with wild geese

³⁸ (although this specimen was not assigned any confident identification).

species present year round. However domestic geese may have been kept primarily for resources such as feathers which can be harvested multiple times a year without killing the bird, with eggs and meat as valuable by-products (Albarella 2005, 253; Serjeantson 2002, 39 and 44). The lack of medullary bone in any of the archaeological Scottish Island geese suggests that their laying season was not extended to the degree of domestic fowl (and as such that eggs were not the main focus of their keep), and also implies that a sizable proportion of the goose eggshell identified in Stewart's ZooMS analysis may come from wild birds in a mixed goose-egg acquisition strategy that incorporated wild and domestic geese. Although keeping domestic geese for meat in a location rich in wild birds may seem counterintuitive, geese fatten easily when their mobility is restricted and as such could have been an important reliable food resource to supplement the diet at points of the year when other resources may be limited (Serjeantson 2002, 41).

The existence of semi-domesticated flocks must also be considered for geese and perhaps ducks. The practice of taking and hatching eggs from wild greylags (which would return to their raise location after breeding each year) has been documented in the Inner and Outer Hebrides in the 19th and early 20th century (Elwes and 1869, 22-32; Gray 1871, 340; Harvie-Brown and MacPherson 1904; Serjeantson n.d., 80). This provides a local flock for meat, without having to maintain a breeding population (and more wild eggs could be taken should a flock fail).

The Norse data also revealed that by this point in time across the Scottish Islands the unfortunate great auk's numbers had been rapidly and thoroughly decreased to the point where it is rarely present in the Norse bone remains. This large and very vulnerable to

capture bird was initially exploited on the settlement of Iceland, but once again its numbers appear to decrease rapidly despite the virgin nature of its location, indicating a substantially reduced population around the North Atlantic area. By contrast there is an increase in gannet usage, particularly in the Northern Isles where they appear to have been accessed in this period at offshore stacs and cliffs. It is unlikely that in the Norse period many gannet populations remained on the Orcadian main islands (despite the data indicating that they once bred more widely around the Scottish Islands) and increased seafaring and fishing activities might have facilitated greater access to its nesting locations (Serjeantson 2001, 44-48). The relationship between the avian resources and increased fish processing and trading in the North Atlantic area is complex, but birds may have been accessed intentionally as part of an overall increase in marine resource use (particularly in the Northern Isles), or they may have been caught accidentally by fishing equipment.

The Norse settlement of the Scottish Islands did not exhibit the intense use of avian resources (as part of the wider faunal economy) identified in the early material from Iceland and the Faroe Islands. This indicates that on entering new locations the wild avian resources could provide essential nutrition, both as part of a wider, planned subsistence strategy and as a buffer or emergency resource which may have prevented malnutrition during difficult episodes. The intense use of auks in the early phases, particularly in the Faroe Islands, indicates a degree of planned exploitation during the summer months and implies that birds may have been preserved for the oncoming winter. The osteoarchaeological data also indicated that within the Scottish Islands new fowling patterns were combined with existing ones in a natural manifestation of the

resources available at several points of the fowling calendar which were a valuable component within an already established farming setting.

Interestingly, despite the notable increase of domestic fowl in the Scottish Island Norse bone data, their adoption in the Faroe Islands and Iceland was limited. Furthermore, whilst the Scottish Norse eggshell reveals a high use of domestic birds for egg provision, Icelandic sites revealed a high use of wild resources; the reasons for which may be manifold. The effects of such northerly locations, with their resultant long periods of darkness, on the laying regimes of the domestic birds, and particularly chickens, are not entirely understood at present. The bone and egg data suggest that they may not have thrived viably in these northerly locations.

The Medieval and Post-Medieval dataset indicates that whilst bird use in the Scottish Islands continued, it began to develop a more extreme spectrum of usage. At locations where seabirds were essential to subsistence, such as St Kilda and the Shiantis and also at Mingulay (as indicated by the historical data), the birds were exploited in ever larger numbers, fuelled by increased trade demand from the mainland in addition to the native population's food requirements. The part payment of rent in bird products also helped to bolster continued fowling in these locations. However in other settings birds were still used but formed a lesser part of overall subsistence practices and became increasingly varied from site to site. This indicates occasional use of the avian resources when needed or when convenient, possibly with less targeted capture.

The failure of domestic birds to even approach the levels of wild bird-use in all periods indicates that even after the introduction of domesticates the wild resources remained

valued and specifically chosen for exploitation. This helps to counteract the assumption that birds were an insignificant resource. Whilst the islands themselves are liminal in that they occupy a curiously ambiguous location between land and sea, and the wild birds are liminal in terms of their season specific presence and movement between land, sea and sky; their use within the economy of the Scottish Islands is not liminal or limited in itself. Instead the birds occur with a regularity of exploitation that infers their mainstream and consistent use through time and space; as part of a wider subsistence and economic profile. They were clearly a characteristic part of life and subsistence in the Scottish Islands and one which could provide a staggeringly diverse range of resources. Their symbolic role should not be underestimated; by living in the Scottish (and other North Atlantic) Islands human populations were automatically sharing their environment with a wide variety of bird species whose presence or absence could change a landscape dependant on the time of year, herald the change of seasons, predict variations in the short term weather, and even reveal the presence of fish to human fishers. Martin (1753, 29) states that the gannets' movements indicated the presence of herring.

Changing Distributions and Populations

The avian bone material (and the eggshell data when examined in conjunction with the bones) has indicated several changed distributions of bird populations in the past. Whilst these variations are interesting on an ecological and natural history level, archaeologically they have the ability to depict what resources were available to human hunters and can inform upon overexploitation and anthropogenic habitat variation.

The most visible and detrimental variation in avian distribution was that of the great

auk, particularly since it culminated in its eventual extinction. As already discussed this large, flightless bird was vulnerable on the land, which it only visited to breed. Its range of nesting locations were limited and dictated by the bird's physical inabilities, however the archaeological material indicates that it once bred much more widely than is documented in the historical sources, which in many instances were recording a much diminished population in its last throws of existence. Their pelagic nature outside of the breeding season means that despite juvenile bone only being recovered from Papa Westray, Sanday and Mainland Orkney and Outer Hebridean South Uist, the osteoarchaeological distribution indicates that great auks were breeding at multiple coastal locations in the Inner and Outer Hebrides, Orkney and Shetland. However although the great auk played an important role in Mesolithic, Neolithic and Bronze Age fowling, and continued to be exploited in large numbers in the Early to Middle Iron Age, by the later Iron Age a clear reduction in its availability is visible. The ill-fated bird is only represented at a handful of Norse sites and makes a very small contribution to this period's fowling profile. The pressures of sustained exploitation, its failure to escape from danger and inability to relay should its egg be taken all contributed to this species' spiralling decline. The restricted number of breeding locations to which it could retreat would have also resulted in poor nesting and fledging.

Its unusualness also contributed to its decline, particularly in the Post-Medieval period and recent past; both through superstition and symbolism, and via antiquarian collection as a curiosity. For example, the last great auk in Britain was reportedly killed off of Stac Armin, St Kilda in 1840 by the island's inhabitants who believed that the bird was in fact a witch. Harvie-Brown and Buckland (1888) elucidated further information; fowlers on the stac tied this unfortunate specimen in their bothy to stop it wandering off,

however a storm rose up and believing that the bird had summoned it to strand them on the stac, they beat it to death (Fleming 2005, 138; Gaskell 2000, 142; Love 2007, 26; Maclean 1992, 100). Although this unfortunate event killed one of the last remaining great auks, it is valuable for revealing folklore and ritual beliefs in avian-human relations.

Examples such as the great auk serve to illustrate that the archaeological evidence extends our understanding of particular species, and just because records may not indicate the past presence of a species in a particular area, this does not necessarily mean that it was absent. Gannet, like the great auk, appears to have bred more widely in the past, before its breeding contracted into a small number of large colonies, mainly on offshore stacs and islands (Serjeantson 2001, 48-50).

The great auk exemplifies decline on a wide geographical scale. However the archaeological dataset also provides evidence for regionalised change. On South Uist the resident shag and cormorant play a very important role in the avian economy, providing a repeated resource, particularly in the Iron Age where shag is prevalent. The cormorant is very numerous in the Norse period, while the shag makes up a much lower proportion of the remains. Furthermore, the majority of the shag remains from the Norse period come from one site, Cille Pheadair, whereas in the Norse Bornais assemblages cormorant dominates the Phalacrocoracidae. Serjeantson has suggested that this decline in shag use at Norse Bornais, compared to Iron Age Bornais where it was quite numerous, may have resulted from localised overexploitation resulting in a diminished population (Cartledge and Serjeantson 2012, 228). Cille Pheadair is located further south on the island, in an area which has more stony beaches and skerries suitable for

supporting shags (and cormorants). Both return to land each night to roost and whereas cormorants do come inland, shags are more exclusively marine (Webb *et al.* 1990, 124). This may suggest that the marine shag was more regularly encountered at the southern end of Uist. Alternatively it may suggest that the Cille Pheadair population may have conducted trips to shaggeries on southern islands such as Mingulay (Buxton 1995, 14; Stroud *et al.* 2001a, 55). This possibility is partly supported by shag focused avian assemblages from these most southerly islands in the Outer Hebrides (see Chapter 5.4). Larger cormorant use may also be related to greater use of waterfowl and freshwater areas.

It has also been demonstrated that the fulmar, a very opportunistic nester in terms of the habitats it occupies, bred more widely in the past. It is suggested that a range of factors including persecution and intensified land use contributed to the contraction of its breeding range. It is also possible that birds may have been caught when following boats hoping for fish waste; although the lack of increase in the Norse period and the presence of some subadults may refute this. Unfortunately more work is needed on age in relation to skeletal fusion; since although from the St Kilda bone assemblage fulmars appear to exhibit some skeletal porosity at fledging in mid-August, they might be fully ossified when leaving natal grounds in November (Harman 1997, 210; Maclean 1992, 93). Fisher (1952) suggests that the post-19th century fulmar population expansion was fuelled by the oily offal provided by intensified whale and then fish processing. A wider past distribution does not contradict nor is contradicted by Fisher's proposal; indeed such an anthropogenic catalyst may have been needed to help fulmars return to (and expand upon) a more original distribution: a pattern seen in birds such as graylag geese, which have been bolstered by introduced populations.

The collated dataset also indicates that the burrow-nesting puffin probably bred more widely in the past than they do today, but it also appears that in some instances special trips were conducted to colonies (maybe on offshore islands) to acquire them. Puffins were more commonly exploited in the Hebrides than the Northern Isles, which may reflect a greater use of suitable environments such as the machair in the past (Stroud et al. 2001a, 400). On South Uist puffins occur at a range of sites, but today none are known to nest in the locality, despite the machair being a suitable environment for tunnelling. Birds that are nervous around people may be displaced by increased human activity, although in general puffins are not easily disturbed birds. They are frequently described (in both ethnographic and ecological material) as inquisitive and lacking fear towards humans; they have even been seen curiously investigating a noose containing a trapped puffin only to become ensnared themselves (Maclean 1992, 97-98). This is a severe weakness for their self-preservation, but beneficial for repeated human fowling, which may be partially responsible for their large use in several settlement period sites in Faroe and Iceland, and their continued exploitation in locations such as the Shianta and St Kilda. Other birds such as gulls potentially using the machair may have been more easily disturbed (Cartledge and Serjeantson 2012, 232). Introduction and increases of rodents and mammalian predators would have also threatened ground-nesters – including domestic cats and dogs (Manchester and Bullock 2000, 845-851; Mitchell *et al.* 2006, 765-766; Serjeantson 2014).

Ground-nesters including puffins (and certain gulls) are also vulnerable to increased cultivation or grazing. These grazing animals and crop production may have damaged fragile environments such as the machair rendering it less suitable for nesting, and nests and eggs could be trampled by livestock. The fertile machair would have been a prime

location for cultivation and associated ploughing activity. The area is still cultivated today (i.e. on the Uists) and only careful management and knowledge of the landscape ensures stability. Natural events such as storms could also render areas permanently or temporarily unsuitable for nesting or feeding birds. Whilst arable and pastoral farming no doubt impacted upon some avian species, tending animals and crops would have facilitated opportunistic capture of a range of species when moving around the landscape; a trend which may be evidenced in diverse avian assemblages. Localised declines in puffin and large gull use are visible within the Late Iron Age and Norse material from South Uist. Puffins form a lower proportion of individual assemblages in the Late Norse Period compared to the Early Norse, suggesting that local pockets of breeding birds may have been eliminated or moved to other sites. This may result from concentrated exploitation, however destabilisation of the machair could also have been a contributing factor. In the 14th century AD South Uist's machair appears to be abandoned in favour of inhabiting the stable blacklands, which may indicate that it was already exhausted and unstable by this point, and temporarily unsuitable for people and fauna (Sharples and Parker Pearson 1999, 41 and 58-59). The Norse period correlated with a period of decreased storminess, perhaps facilitating greater initial avian use of the machair and associated habitats for e.g. waders (Parker Pearson *et al.* 2004, 24-26).

Other species exhibiting different past distributions enabling them to be utilised by human populations include crane being more widely distributed and breeding, and curlew breeding in the Western Isles. Others such as the common and velvet scoters and the unusual Fea's petrel may represent previously different distributions, or vagrants which were targeted (or accidentally caught) when they appeared (Serjeantson 2005, 233). Seaducks and petrels are just some of the species that may get caught in fishing

nets or baited hooks (Kies and Tomek 1990, 23-27; Serjeantson 2014). The Bewick's swan, a winter visitor to Britain, may have had a more northerly past range as is indicated by its presence in Mesolithic Cnoc Coig in the Inner Hebrides and Early Bronze Age Tofts Ness on Orkney (Stroud *et al.* 2001a, 65-67).

Geese are repeatedly targeted through time and space in the Scottish Islands, although their overall contribution to the economy is often small, particularly before the Norse period. Of these the wild greylag is the most prolific individual species and probably accounts for the majority of unidentifiable geese. They have been recovered from several sites in the Outer Hebrides and Orkney, in small numbers on Mesolithic Oronsay, Inner Hebrides and potentially on Shetland at sites such as Iron Age Scalloway and Norse Old Scatness.

The greylag is Britain's only native breeding goose which until the 19th century was distributed widely across the country (Trinder *et al.* 2009, 2). As mentioned there are three distinct populations in Britain (Hearn and Frederiksen 2006, 498). There are the native, resident British birds, mainly restricted to the North West of Scotland and the Western Isles (Bowler *et al.* 2005, 61; Stroud *et al.* 2001a, 88). These are the remainders of the once more distributed native population; a distribution which has been identified in the archaeological data collated in this thesis (Hearn and Frederiksen 2006, 498). These resident British greylags breed and winter here and are sedentary; although the most northerly may move away from the coast to (for example) farmland during winter (Owen *et al.* 1986, 375; Stroud *et al.* 2001a, 88).

In winter, migrants from Iceland join the British population (an archaeological increase

in greylag use may therefore result from a less summer focused fowling profile) (Bowler *et al* 2005, 61; Owen and Salmon 1988, 37-38; Stroud *et al.* 2001, 88-89). There is also a second sedentary, resident population in Britain of feral birds intentionally reintroduced in the 1930s-1970s, to re-establish groups in areas that lost natives (through persecution, animal predation and habitat loss) (Hearn and Frederiksen 2006, 498; Mitchell *et al.* 2010, 1-2; Owen and Salmon 1988, 37-38; Paterson 1991, 243-252; Trinder *et al.* 2009, 2).

Figure 8.1: Distribution of breeding greylag geese in Scotland from records 1968-72 (Mitchell *et al.* 2010, 3 after Sharrock 1976)

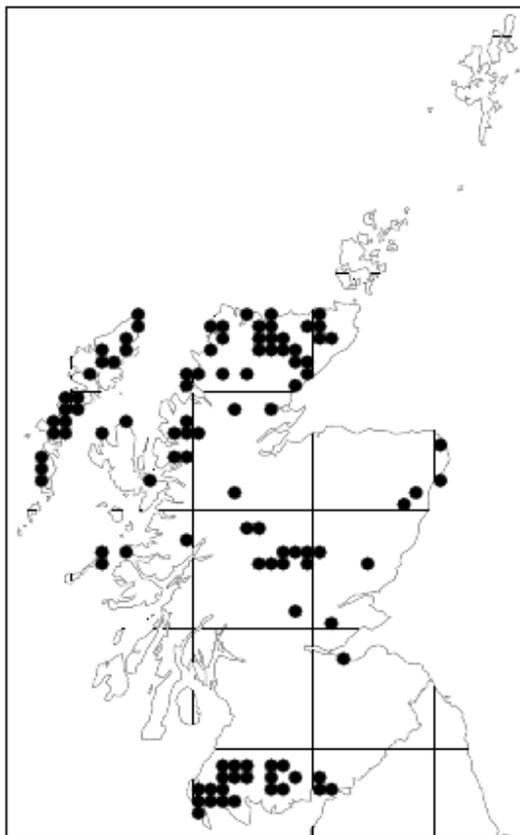
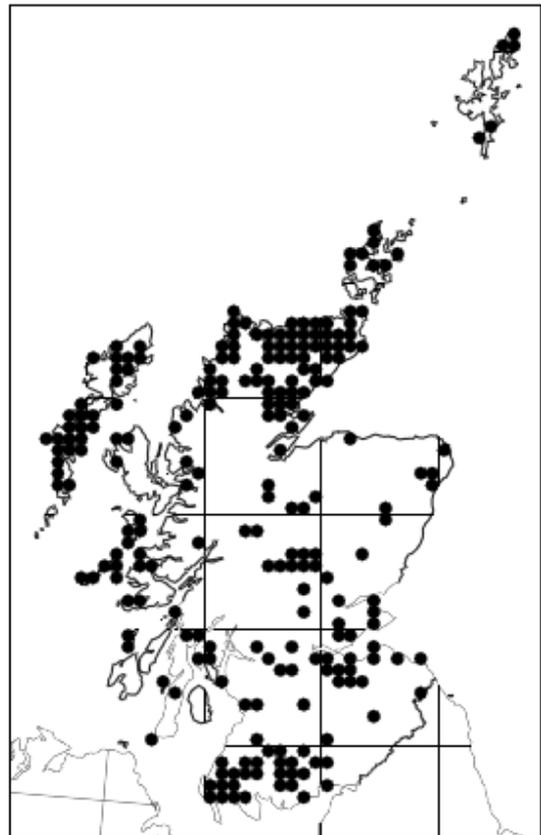


Figure 8.2: Distribution of breeding greylag geese in Scotland from records 1988-91 (Mitchell 2010 *et al.* 2010, 3 after Gibbons *et al.* 1993)



The 'native resident' and 'feral' greylag populations are becoming less discrete with more regional overlap (Hearn and Frederiksen 2006, 498-499; Stroud *et al.* 2001a, 88).

In the past 30 years both sedentary populations have grown in size and breeding range; (see Figure 8.1 and 8.2) (Mitchel 2010, 2-3; Trinder *et al.* 2009, 2-3). The native population has even expanded beyond its traditional (pre-decline) range, in areas which have no historical presence before the 20th century such as Tiree (Bowler *et al.* 2005, 61). The archaeological bone has indicated a small but strong presence of greylags in Orkney from the Neolithic to the Norse period and beyond; whereas in the recent past their presence was minimal (Figures 8.1 and 8.2).

Characterising Fowling: Targeted, Dual, Opportunistic and Occasional

The character of bird exploitation in the Scottish Islands naturally varies to a degree from site to site. However, the assemblages frequently reveal a fowling economy that is both focused and diverse with one or two intensively targeted species and a large number of species only exploited in small numbers. This can be characterised as dual focused fowling. The assemblages frequently have a seabird focus and the dominant species are most commonly large seabirds such as gannet, shag, cormorant, auks and gulls, some of which would have been caught beyond the vicinity of a specific site. The avian ecological diversity of the Scottish Islands is reflected in the archaeological assemblages which are taxonomically diverse and have high numbers of species present; such as Late Bronze Age Cladh Hallan with a minimum of 34 or Middle Iron Age Howe which has nearly 60 species represented³⁹. This range of species, many of which are represented by less than five fragments has illustrated that fowling could also be flexible and opportunistic; responding to available resources and differing economic demands at multiple points of the year. Activities such as fishing could have yielded accidental catches, or intentionally entangled and hooked birds; such catches may only

³⁹ The number of species within this assemblage from Howe is likely to be even higher, but potentially over-ambitious identification of small passerines has been taken into account for this site and the figure adjusted.

be represented by small numbers of bones (MacPherson 1897, 478 and 482; Serjeantson 2014).

Life on the Edge: The Patterns of Marginalised Islands

However, it has also been seen in the Scottish Island data (and to a degree further afield) that island size, marginality and accessibility affect the extent, focus and duration of fowling. At the two most isolated archaeologically inhabited small island groups in the Scottish landscape (St Kilda and the Shiantis) an enduring relationship with the wild avian resources was observed archaeologically. Historically, Mingulay also fits this profile and the Iron Age Mingulay assemblage also indicates a focused, significant avian contribution. Although Mingulay sits within the main chain of the Outer Hebrides, its access can be unpredictable; in the late 19th century Father McDonald was prevented from returning to Barra for seven weeks by sea and weather conditions (Buxton 1995, 41; Carmichael 1940, 4-5; Howells 1969, 86-101).

At sites such as these where access to other human populations and resources was to an extent limited by location, birds may be of greater importance in terms of subsistence and economy, and as a result fowling intensely focused on specific species that were reliable, well understood and could be exploited in large numbers. Today, the Shiantis have the second largest breeding puffin population in Britain, whilst St Kilda houses the largest breeding populations of gannets, fulmar and puffins (Stroud *et al.* 2001a, 32-33, 47, 397 and 400). These communities were making use of the most logical resources, and seemingly maximizing them in a sustainable way, as suggested by their temporal endurance. Capturing these birds when abundant in the summer would have also

allowed preservation for the harsh winter months when other resources may have been restricted.

8.2: Capture Locations and the Landscape of Fowling

The results have demonstrated that at the majority of sites numerous habitats were used for bird acquisition through time and space, but within a fowling economy that was seabird focused. Habitats used included freshwater, rocky shore, muddy shoreline, estuaries, at sea, cliffs, agricultural land, moor/marsh and the machair. Furthermore, at multiple sites birds were being captured both locally and further afield.

As mentioned the gannet appears to have a dual profile of exploitation. Small numbers indicate local capture from small breeding groups, opportunistic capture in other contexts (e.g. at sea), or potentially trade. Meanwhile large-scale focused capture infers trips to larger breeding colonies. For example, at Iron Age Howe, red grouse was prominent and gannet, although not dominant is also well represented. However, the nearest moors favoured by red grouse would have been about 3km away and the nearest cliffs suitable for gannets around 6km from site (Bramwell 1994, 153; Cramp 1980, 392). The archaeological and ethnographic data suggest that gannets would have been mainly targeted at breeding grounds, when these highly pelagic birds come ashore. Today there are no gannetries near Howe (e.g. on said cliff), however the frequency of gannets at Howe (while important) is not of a size to indicate long distance fowling trips. As such it suggests that other breeding colonies may have been located closer to site, but have since vanished due to over-exploitation or environmental change.

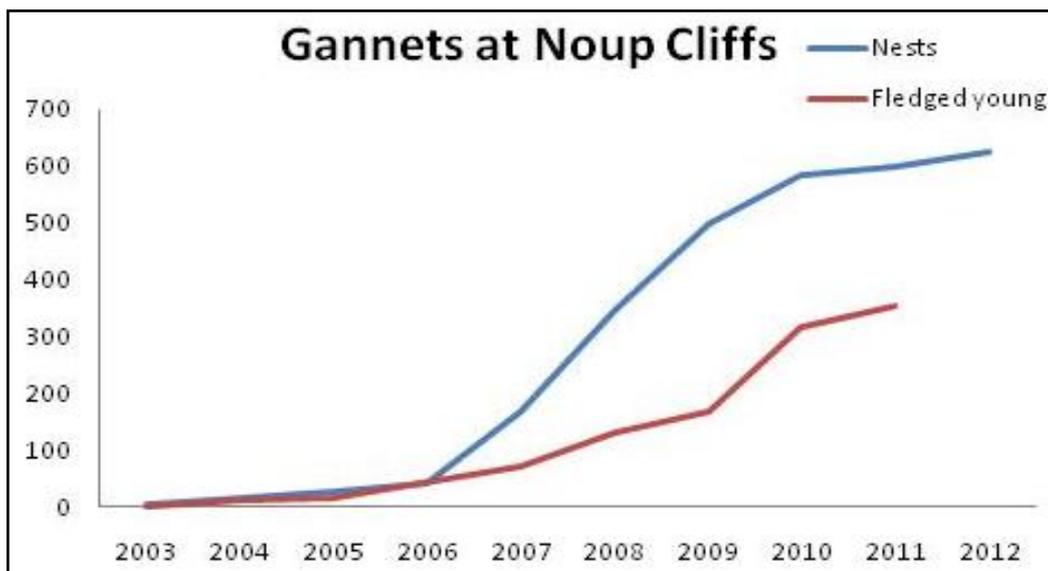
The archaeological material has indicated that gannets were an important resource, particularly in the Iron Age and Norse period of the Northern Isles. However, until 2003 nesting gannets (excluding occasional vagrant pairs) in Orkney were found only on Sule Stack and Sule Skerry which lie some 51-60km out to sea (Bramwell 1994 154; Stroud *et al.* 2001a, 45). But recently Noup Cliff on Westray became established as a breeding colony and is continuing to grow, providing evidence that locations such as this could have held and lost gannets in the Northern Isles' past (Figure 8.3). A solitary chick was also hatched on the Barra island of Berneray in 2011; the first on record in this location (Luxmore 2011, 1). This demonstrates that some Hebridean islands with cliffs and grassy cliff-tops could also have provided a valuable past resource base for exploiting seabirds such as the gannet, indicates that suitable environments are unoccupied but some are being recolonised, and most significantly supports the likelihood of isolated pairs and small groups breeding in a variety of locations archaeologically.

If targeting colonies some distance away, capture late in the breeding season would maximise chick and adult resources. Juvenile gannets are comparatively rare in the Scottish Island material. Experimental work conducted by Serjeantson (1998, 30) on modern guga skeletons indicated that at the time of fledging the gannet chick was ossified skeletally and adult size, with only very minor indicators of immaturity such as slightly less well-developed articular ends. As such, if birds were captured just prior to fledging (when at their largest and fattiest, and with downy feather) there may be little archaeological evidence of juvenility, particularly when coupled with post-depositional degradation. Alternatively adult gannets may have been taken on return to the Scottish Islands from their wintering grounds. They occupy their colonies in March, but some may arrive in the area from the end of January (Harman 1997, 210; Maclean 1992, 92;

Martin 1953, 30). Although the old birds are not as fat and nutritious as juveniles, and are tired from migration, if food resources had been stretched over the winter their appearance may have been eagerly anticipated and exploited, despite them being more difficult to catch when not nest-sitting (Low 1813, 107).

Repeatedly snapped gannet humeri from Snusgar indicate some repetitive processing reminiscent of the modern *Sula Sgeir* fowlers. This could suggest that gannets were being processed at the kill site and transported (Griffiths and Harrison 2011, 321-326.).

Figure 8.3: RSPB Noup Cliff gannet increases shown by nests and therefore pairs (RSPB assessment WWW19).



Hebrides: Landscapes of Potential Fowling

It has been suggested in this thesis that puffins probably bred more widely in the past. Today in the Outer Hebrides puffins are found on the uninhabited southern isles of Berneray and Mingulay, a SPA for this species (Stroud *et al.* 2001a, 400). Puffins may have been taken from Berneray and Mingulay in the past by people from other Hebridean islands, but any inhabitants may not have tolerated strangers coming and

taking their resources. Cliff-nesters may also have been acquired from St Kilda itself, or via trade from locations such as this. Martin describes the Monach Isles (also known as Heisker) and the Heisgeir (or Haskeir) Rocks to the North in the 17th/Early 18th century as abundant with birds and holding significant populations of moulting geese, puffins, shags and guillemots⁴⁰. These are only about 10-13km west and northwest of North Uist and could easily have been accessible by boat for capturing birds (Martin 1716, 60-71; Serjeantson n.d., 75; Stroud *et al.* 2001b, 327).

The Flannan Isles sit about 32km west of Lewis and today support important breeding colonies of puffin, razorbill, guillemot, kittiwake, petrels and fulmar. This is another location which may have been accessed by past inhabitants of the Northern Hebrides (Stroud *et al.* 2001b, 273). Other potential locations for inhabitants of the Northern Hebrides would include North Rona and Sula Sgeir, which today and in Martin's time housed gannets, auks and gulls (Martin 1716, 25; Stroud *et al.* 2001b, 343). Eider is recorded by Martin as being on Heisker and Rona and Sula Sgeir (Martin 1716, 25-71).

Northern Isles: Landscapes of Potential Fowling

Fair Isle is situated almost midway between Shetland and Orkney and today is known for its breeding colonies of gulls, auks, skuas and terns and for migratory populations (Hunter 1996, 23; Stroud *et al.* 2001b, 262). Although this location has been settled since the Bronze Age, unfortunately no archaeological avian assemblages were

⁴⁰ Martin Martin is a valuable source of information on fowling, culture and nature in the Scottish Islands. His account of St Kilda (which he visited in 1697, reprinted 1753) provides some of the earliest documented traditions of bird exploitation in the Scottish Islands. He also composed a long manuscript on the Western Isles (Martin 1716) which outlines the landscape, nature, economy and various cultural details. Martin's writings are particularly valuable as he was a native of Skye and a Gaelic speaker, and as such he could converse with the St Kildans and other island inhabitants in their own tongue and gain a more accurate insight into their activities and way of life (Love 2007, 25). However, naturally there are biases and inaccuracies within the work; for example Martin's Protestant belief conflicted with the vestiges of Catholicism found on St Kilda (Robson, 2007, 30).

available for inclusion in this analysis (Hunter, 1996; Kruse 2011, 17). Historically, the importance of fowling for its inhabitants, both for meat and feathers, is documented into the 19th century. Writing in 1680, Kay records that in addition to seabirds, young falcons were being caught for export; and that both seafoal and raptors were of high value to the islands despite the risks of fowling (Bruce 1908, 55; Hunter 1996, 23). Fair Isle may also have played an important role in Orkney and Shetland's past fowling economies, with specific fowling trips conducted to this location. On a clear day Fair Isle can be seen from Orkney and Shetland, providing a visual contact with this potential resource base and also acting as a key stepping stone for mariners navigating between Orkney and Shetland (Kruse 2011, 17).

Many of the small islands in the Northern Isles hold and almost certainly held valuable seabird colonies such as puffins, guillemot and gulls at North Hill bird sanctuary on Papa Westray/Papay (Orkney), or on the small Calf of Eday (Orkney) that today houses many cormorants and which archaeologically produced a large cormorant assemblage (Hamilton-Dyer 1998, 155; Platt 1937a, 153-154; Stroud *et al.* 2001b, 240). Copinsay in the east of Orkney is an ideal breeding area which may have been visited for species such as guillemot, gulls and potentially fulmar (Stroud *et al.* 2001b, 248). Foula, meaning 'Bird Island' (from the Old Norse Fuglaey), lies 20km west of Shetland and was probably a valued source of avian resources including shag, guillemot, razorbill, puffin, fulmar and skuas (Mills 2011; Stroud *et al.* 2001a, 32-33, 53-55, 341-343, 389-400). Around Shetland, islands like Noss and locations such as the cliffs and stacs at Hermaness and Saxa Vord on Unst would have been likely locations for targeted gannet exploitation and other breeding seabirds (Stroud *et al.* 2001a, 44-46; Stroud *et al.* 2001b, 348 and 385).

8.3 Capture Techniques: A Bird in the Hand is Worth Two in the Bush

The range of exploited species identified in this thesis indicates that in all periods a wide range of capture techniques would have been practised to take the birds from various locations within the landscape. Birds can be caught with or without the assistance of specialist equipment, but the methods employed can be varied. The earliest archaeological avian material from the Scottish Islands' Mesolithic clearly illustrates that the Inner Hebridean population was specifically targeting summer breeding auks, and particularly the cliff nesting guillemot and razorbill; which would have involved a degree of risk. Razorbills do occasionally nest in burrows (like the puffin, and may even take puffin burrows) (Connell 1887, 125; Plumb 1965), but in general they prefer cliff sites with crevices and nooks (Baldwin 2005, 16; Petersen 2005, 200). In this context the presence of razorbills alongside guillemots (which were more numerous) also infers that cliffs and ledges were the primary site of capture (Figure 8.4). Whilst the St Kildans were famed for using ropes which they guarded preciously, the men of Mingulay were known for generally traversing the sheer rocks and cliffs equipment-free (Buxton 1995, 81). In 1871 Carmichael recorded that the Mingulay fowler Roderick MacNeill was able to move along the sheer cliff-face wherever he could insert a finger into the rock (Buxton 1995, 45-46; Carmichael 1900, 326). The St Kildan ropes were for hundreds of years made from rawhide thongs coiled together, or horsehair and later hemp covered in rawhide to prevent them fraying on sharp rocks (Otter 1827, 197; Maclean 1992, 104; Martin 1753, 54). Wild animals such as deer could have provided suitable hides if the Mesolithic fowlers chose to make and use fowling ropes.

Figure 8.4: Fowler using a rope on the cliffs of Chukotka, Russian Arctic taking guillemot eggs (WWW20 and 21).



Other birds taken by cliff fowling across time and island group would have included the regularly exploited gannet, and in some contexts the fulmar. The archaeological data

indicated that fulmar bred more widely in the past, probably in small numbers in a range of locations. The fulmar is very flexible in its choice of habitat and as such outside of St Kilda (its large primary colony) the birds were probably found on ruined structures, ground nests and stony areas of the shore, in addition to cliffs (Baldwin 2005, 16). Shags and cormorants may be found on areas of the cliff, including caves and rocky sprees at the base, and cormorants will also occupy flat-topped stacs; birds such as kittiwakes may nest on lower alcoves and ledges of cliffs (Baldwin 2005, 16; Kearton 1898, 249; Webb *et al.* 1990, 213).

Figure 8.5: Cormorants nesting on a rocky area of the shore, sometimes located at the base of cliffs; note some guillemots are also present (Kearton 1898, 251).



With or without ropes cliff work could be dangerous and there are several enduring stories, mainly emanating from St Kilda, of ropes breaking or fowlers slipping and plummeting to their deaths (Harman 1997, 222-223; Maclean 1992, 103; Maclean 1838, 12; Martin 1716, 294). But the continuing use of cliff-nesting birds throughout time in the Scottish Islands indicates that the population considered bird resources worth this

risk. The increased use of gannets in the Northern Isles, particularly in the Norse period reveals that offshore stacs, cliffs and island tops were being harvested, and infers a calculated use of this resource and knowledge of how to work the habitat. The high use of gannets at Late Bronze Age to early Iron Age Cladh Hallan also infers that the South Uist inhabitants were travelling to breeding grounds. It is important to emphasise that colonies of breeding seabirds can provide a glut of resources; thus seasonally the Hebrides and Northern Isles can produce great quantities of food, more than needed for immediate subsistence. Consequently these resources could be preserved, emphasising that even small or isolated islands are not necessarily lacking in food. Birds can also act as a buffer should there be an emergency lack of food; both through storage of surplus stock when concentrated exploitation allows, and also by using avian arrivals throughout the year, for example, winter visitors.

Having reached the bird, a rod with a noose on the end is one of the simplest and easiest tools to aid capture in a variety of habitats, from cliff and shore to machair and freshwater (Figures 8.6 to 8.9 and 8.11). The noose slips over the bird's head trapping it. It means that birds can be reached from a small distance with less accidental disturbance. SEM analysis indicated that the Iron Age auk eggshell from Bornais on South Uist, included razorbill/guillemot, demonstrating that cliffs and rock faces continued to be exploited by the islanders in multiple periods for both birds and eggs. Eggs can be taken from such areas of the landscape by hand, hoop net or grab (19th/20th century Orkney), spoon-like device (Foula), and in other locations (such as Ailsa Craig in the Firth of Clyde) a hooked stick was used (Baldwin 2005a, 121). They could then be moved in baskets, creels, bags, or stashed in items of clothing (Baldwin 1974, 65-6; Baldwin 2005a, 122; Harman 1997, 221).

Figure 8.6: Top: Norman MacQueen snaring a fulmar (A. MacDonald: School of Scottish Studies collection, taken from Harman 1997, Plate 38). Bottom: Modern day fowler on Sula Sgeir about to take a guga (Beatty 1992).

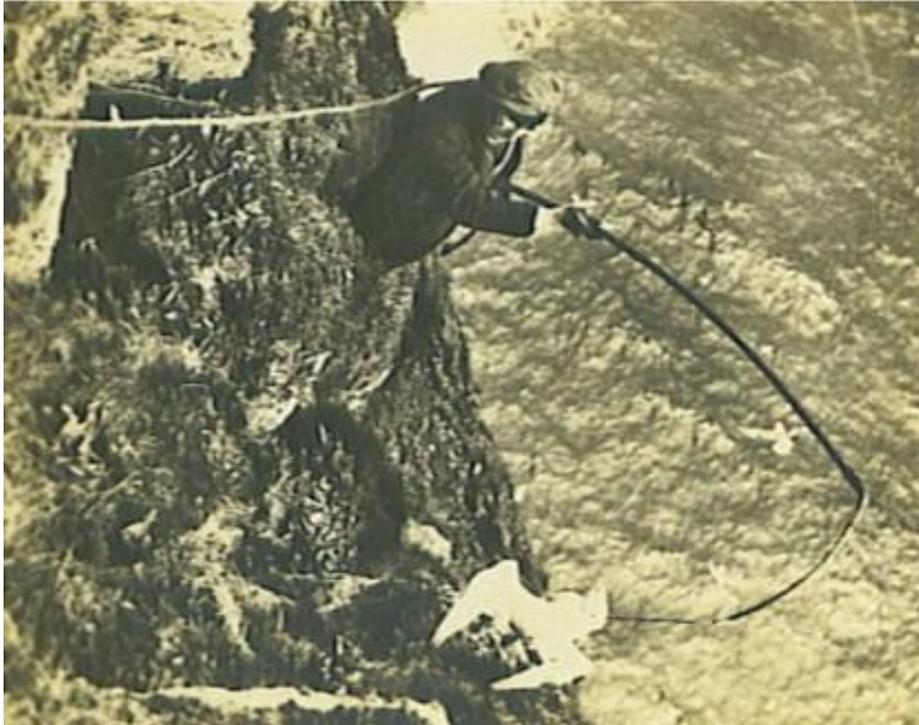


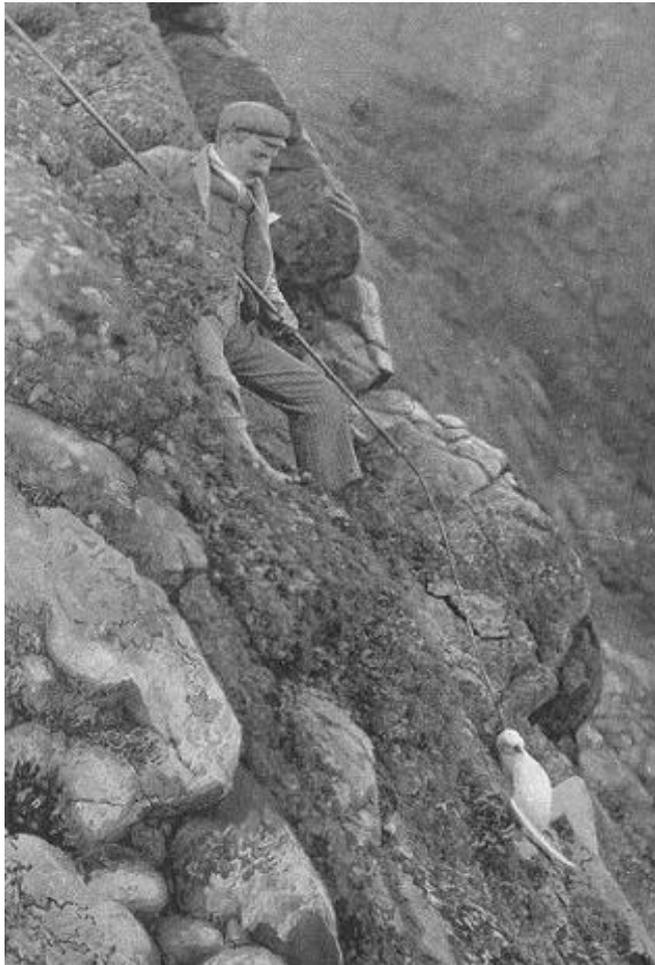
Figure 8.7: Finlay MacQueen snaring puffins with a fowling rod and noose (R.L. Atkinson: School of Scottish Studies collection, taken from Harman 1997, Plate 39).



Figure 8.8: Sula Sgeir guga hunters in 1954. Image shows a development of rod and noose in which modern rod now has a metal jaw on the top (J. MacGeoch: School of Scottish Studies Baldwin 1974, Plate 2D).



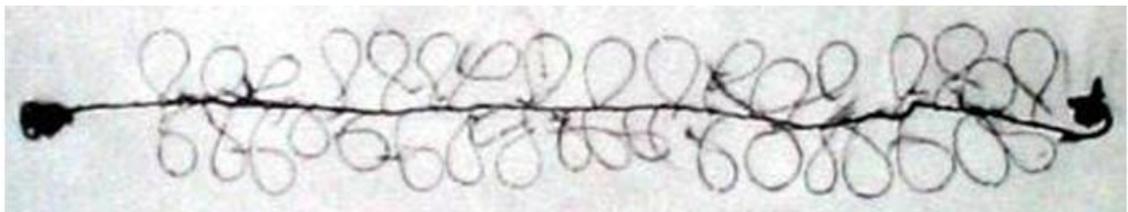
8.9: Ferguson fowling on Borrera – note the rod and noose (Kearnton 1898, 85)



The rod and noose can be used for a range of species. Historically in the Scottish Islands, Iceland and Faeroes nets were also used to catch birds. Nets could be stretched across burrows or the entrances to roosting caves (Baldwin 2005a, 128). Particularly in the Faeroes and Iceland hand-wielded nets, resembling a gigantic lacrosse racket, were used to swipe birds from the air in an upwards stroke; sometimes referred to as sky-fishing (Figure 8.12). Armed with this net (known by the Faroese term *fleygastong*) the fowler could catch up to 700 birds in a day (Maclean 1992, 98). In the Hebrides a similar technique was exacted with an oar or pole (Baldwin 2005a, 133; Sibbald 1818, 79; Smith 1879, 82).

Many birds may be taken by hand, including those of the burrow (Figure 8.11); dogs can also be useful, particularly for puffin. Figure 8.10 depicts a 19th century example of a multi-noosed horsehair snare or gin, in this instance used for catching puffins on St Kilda (Kearton 1898, 112). Once snared the puffin or other bird is held more tightly the more it struggles (Martin 1753, 30). These are indiscriminate, catching breeding and non-breeding birds, and any variety of species that venture near (Maclean 1992, 98). Such unattended, indiscriminate fowling techniques could theoretically be one factor in explaining the large number of species represented archaeologically by only a small number of bones.

Figure 8.10: Multi-noosed puffin snare used on St Kilda (Kearton 1898, 112)



The archaeological material from the Outer Hebrides, and South Uist in particular, contains large numbers of waders. The lower use of waders in the Northern Isles appears to be a direct reflection of the landscape determining avian abundance. The extensive machair distribution on South Uist is partially responsible for this island having one of the highest densities of breeding waders in the world (Hepburn 1977, 13-15; Stroud *et al.* 2001, 23; Stroud *et al.* 2001b, 370). Waders are easiest to catch when flocking in winter; individuals can be notoriously hard to target. Golden plovers (a heavily captured species at Cille Pheadair) are considered very good to eat, but very difficult to catch, therefore netting from flocks would be the most likely capture method for these species (Bramwell 1994, 154; Vesey-Fitzgerald 1946, 164)⁴¹.

⁴¹ The extent of hand-net adoption historically in Scotland is debated (see Baldwin 2005a, 132-135); however net technology is likely to have been implemented in several ways to catch waders and other small birds.

Figure 8.11 Left: Dunga Hans Pauli taking puffins from the burrow on the Mykines, 1934 (WWW22 and 23). Right: Pre-20th century St Kilda rod and noose (Macpherson 1897, 475)

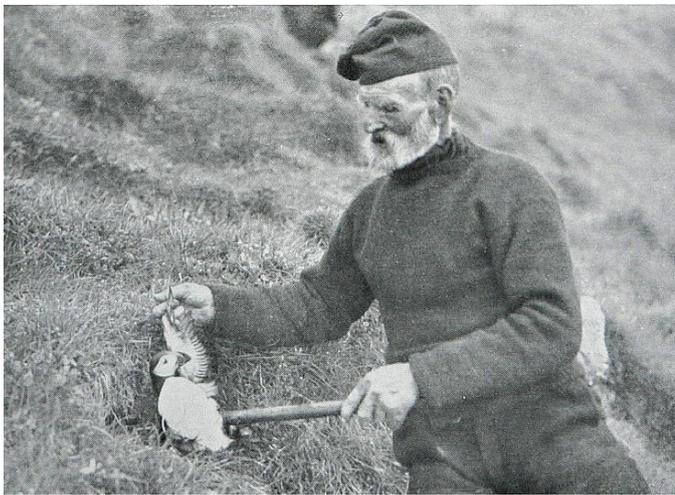
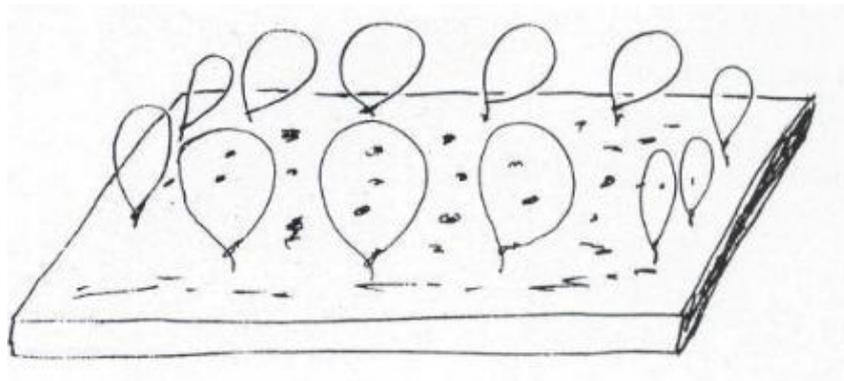


Figure 8.12: Man using a *fleygastong* on Mykines, Faroe in 1934 (WWW24)



The archaeological dataset has indicated that winter fowling could be a smaller but important subsistence activity. The recent historical/ethnographic material of the Northern Isles documents the word ‘snaafowl’ meaning ‘small birds that come in winter’, and these were snared using the ‘snaa fowl brod’ an example of which is known from Fair Isle, and a similar form described for Fetlar, Shetland (Eastham, 2005; Fenton 1997, 522; Reid-Henry and Harrison, 1988, 220; Svanberg 2001, 34-36). This was a board with nooses attached, placed on the ground (sometimes in the snow) with grain scattered around (Figure 8.13). The birds pecking for food would stick a leg or head into the noose and become trapped. These, like the gins are indiscriminate and unattended, and may have captured several species at once.

Figure 8.13: An example of a snare board with horsehair loops, in this instance from Lapland (From Svanberg 2001, 35)



Other ingenious methods range from disguising oneself as a guano covered rock, to flicking water at sleeping shags (who thinking a storm had come went to sleep); demonstrating that the past inhabitants of the Scottish Islands had a wealth of tools at their disposal (Baldwin 1974, 71; Wigglesworth 1903, 58).

8.4 Non-Meat Resources: Beyond the Flesh

Egg Harvesting and Re-lay Potential

The archaeological eggshell material has demonstrated that eggs would have made a valuable contribution to island diet. Multiple harvests could have been taken from several wild species such as the auks (razorbill/guillemot, puffin) identified in the Iron Age and Norse Bornais eggshell. This would have increased the total eggs available and also delayed fledging and eventual departure of migrant birds (Lysaght 2005, 107). However, not all species can relay, and even for those which can it is determined by food availability, parental skill and the point of the breeding season at which the loss occurs (de Forest and Gaston 1996, 1501-1503; Harman 1997, 210; Hipfner 2001 1077; Hipfner *et al.* 1999, 988-998; Martin 1753, 23). The fulmar has been identified archaeologically and documentarily as an important resource for the St Kildans. It will not relay if its egg is taken. Ecologically laying a single egg increases the chance of no young surviving; however access to greater food resources and parental care helps ensure chick survival (Amadon 1964 105-106; Serventy 1973, 3). So important were the young oily fulmars to the St Kildans that in the 18th century it was forbidden to take eggs of breeding fulmar and great pains were taken not to disturb the birds pre-slaughter (Fleming 2005, 89; Steel 2011, 56). Potentially the island populations may have managed their wild resources by taking from relaying birds.

Oils and Fats

The value of oil and fat as both a dietary contribution and a resource in its own right should not be underestimated. Seabirds in particular provide large quantities of fat and oil for their body size, and juveniles are frequently very fatty and can be larger than

their parents before and during fledging. The guga can weigh up to 4250g before fledging and 3650g during, whereas an adult gannet weighs 2941-3120g (Harman 1996, 99). Wintering birds (and resident species) could have provided fresh meat and valuable dietary fat and oil at a time of the year when other resources may have been limited. It has been demonstrated that in these liminal, marginal island landscapes the wild avian resources are a repeatedly targeted contributor to diet and economy, and as such birds are more than a minor convenient addition.

The fulmar possesses about half a pint of a foul-smelling oil which they spit at intruders as a defence mechanism when scared (Heinzel et al. 1992, 24; Maclean 1992, 94). Fulmars need to be caught with care so as not to lose the precious oil; holding the distal wing prevents them from spitting. Several petrels produce this oil, and some shearwaters (most burrow-nesting shearwaters do not). It is found in adult and juvenile birds and contains approximately 9.6 kcal a gram making it nutritious (Warham 1977, 84-88). Fulmar oil is also a very good source of vitamin A and provides some vitamin D (Fisher and Waterson 1941, 257). All this would make the fulmar a desirable catch even in small numbers.

Seabird oil could have been put to a variety of uses such as leather/skin working; liberal applications of fulmar oil ensured suppleness of the St Kildan fowling ropes (Harman 1997, 212; Smith 1879, 36). It also can be used as fuel (i.e. for lamps) and prevents lice and bugs infesting bedding (Maclean 1992, 95; Steel 2011,70).

Birds of a Feather

Feathers are a versatile product which can be used for decoration, insulation, fletching etc. and also may have symbolic or ritual uses. Even the aforementioned fowling rod used on many Scottish Islands in the recent and probably more distant past had its noose stiffened by braiding gannet quills into the horsehair, making it easier to slip over a bird (Kearton 1898, 80). Feathers may also have been a tradable material in the archaeological past. Historical accounts in the Scottish Islands and other locations, such as Lundy, mention feathers forming part of the islands' export economy, being used as part payment of rent and other goods (Maclean 1992, 98; Martin 1716, 16). Cuts indicative of feather removal have been identified in a range of contexts and species; illustrating a varied use. These include Gyrfalcon from Alþingisreit in Iceland, crow/rook from Late Iron Age Cladh Hallan and potentially herring-gull from Middle Norse Bornais.

The eider duck produces some of the best feathers and two collections can be made from a nesting female each season (Figure 8.14). However, archaeologically eider bones were not numerous and are largely confined to the Northern Isles, despite them being easy to take from the nest. The eider is so protective and loyal to her nest that she will not escape, even if in danger. The low bone representation may therefore indicate that eiders were being exploited for feathers and eggs, rather than just meat; the eider can be lifted off the nest and the down collected without fear that she might subsequently abandon the nest (Armour-Chelu 1985, 23; Bramwell 1994, 154; Groundwater 1974, 83-85).

However, medullary bone was identified in two eider duck ulnae from Neolithic Links of Noltland, suggesting that in this context the easy-to-catch females were occasionally taken for meat. This example indicates use of the resident breeding eider population during summer, rather than targeted capture during the moult or exploiting the influx of continental birds in winter (MacPherson 1897; 238; Stroud *et al.* 2001a, 154-156).

Figure 8.14: Eider duck nest with the downy feathers surrounding the eggs (WWW25)



Birds as tools: Bones, Guts and Skins

Bird skins may also be used in clothing and personal adornment. Although several skins would be needed to make any sizable garment, which is labour and resource intensive, they are light, waterproof and well insulated (Serjeantson 2009, 138). Scalping can help to remove a bird skin in such a way as to leave it usable and undamaged, and can sometimes be identified from cut marks on the skull and around the beak (Oakes and Stone 1990; Lefèvre pers. comm.; Serjeantson 2009, 204-205). One gannet from Iron Age Howe exhibited skull cuts. Bramwell (1994, 154) interprets that the bird could have been split in half and dried in the manner of the St Kildans, however it could also indicate skin removal.

Other uses invisible archaeologically may have included using bird stomachs as a vessel for storing oil and fat (Martin 1716, 185; Smith 1879, 83-101). In St Kilda the neck of a gannet was fashioned into shoes, which in particular were used to prevent sliding on slippery rocks when moving about the coastal and cliff areas (Martin 1753, 57). Bird excrement also makes excellent fertilizer. Ground nesters such as puffin fertilized the area, and domestic bird waste could be collected (Jones 2012, 8; Nicholson 2001, 281).

Worked avian bone is poorly recorded and underrepresented archaeologically. However the most common forms are tubes (which might be needle cases, beads etc.) or awl-like points. The latter may be used in leather/skin working, or also used as pins to hold clothing. Late Bronze Age Cladh Hallan is exceptional in the quantity of worked bone recovered, indicating a practical maximisation of avian resources and potentially a symbolic element to the use of these items as part of the wider avian-human relationship.

Falconry and Raptorial Use

A range of raptors are present in the archaeological record from the Mesolithic onwards. Whilst some such as the eagles are likely to have been killed for ritual reasons, products such as feathers, and to protect livestock; other species may have been kept for hunting. Archaeologically represented species such as goshawk, kestrel, peregrine falcon, and possibly merlin in Scotland, and Gyrfalcon in Iceland may have been tamed and used by the islanders to hunt birds and other game, and may be responsible for some of the waders and small waterfowl represented. Raptors may also have been captured for export.

8.5 Considering Birds: Beyond the Tangible

In addition to the avian role in mortuary contexts referred to in section 8.1, there are other elements of bird use which although archaeologically intangible, can be hypothesised.

Weather and Season

Birds can be used for weather prediction, which if planning movement around the seascape or cliff fowling, can prove exceedingly valuable. For instance, on St Kilda it was observed that if the fulmar came into land the west wind would not blow, but if they remained at sea then a western wind was likely (Maclean 1992, 106; Martin 1716, 283). When bad weather prevented visibility of key landmarks the movements of birds could be used to indicate certain directions, for example gannets returning to their nests at dusk to Boray, Stac Armin or Stac Lee (Maclean 1992, 106). The persistent archaeological focus on seabirds, including those that only visit land to breed, infers that movement of migrant birds may have provided longer-range predictions and marked the changing seasons (Martin 1753, 7 and 35). For example, if the oystercatcher came in early May a good summer was predicted (Martin 1953, 35)

Landnám: Reaching New Land

The economic use of birds in newly settled locations has been highlighted, but birds may also have been used in locating these new lands and navigation. The Norse Medieval Landnámabók, which details the settlement of Iceland, documents the account of Hrafna-Flóki (Raven-Floki) and the discovery of Iceland. According to the Landnámabók Floki Vilgerdardson left Shetland in search of Iceland, taking with him

three ravens. On releasing the first bird it promptly headed back to Shetland, whilst the second bird flew into the air and then settled back down on to the ship. However the third bird when set free flew straight off in front of the boat prow, indicating that it had sighted land in that direction. Floki followed it and reached Iceland. Interestingly on Floki's ship was a Hebridean named Faxi, perhaps indicating that such navigational aids were also familiar to the native Scottish Island populations, maybe even prior to the Norse settlement (Pálsson and Edwards 2006, 17-18).

Non-tamed species may also facilitate navigation. Many birds wintering in Britain, such as certain gulls and geese, are joined by populations from colder Scandinavian regions. This movement of wild birds could have been observed by seafarers and indicated which direction to travel in. Furthermore, if movements of birds between two known areas (i.e. Britain and Norway) were understood, then avian movements may also have indicated the presence of unexplored land in unknown locations, i.e. Iceland or even Greenland. For example, if birds were observed arriving in Britain from the direction in which Iceland lay, the explorers might have been incentivised to seek where they originated from.

Missing Species: Under-representation, Avoidance and Taboo

Culling of Raptors and the Treatment of Other Predatory Birds

The use of raptors in mortuary contexts, hunting and personal adornment has been mentioned. However eagles, and particularly the white-tailed eagle, can also be regarded as competitors for food, and a hazard to livestock. One account from Skye (recorded by Martin 1716, 299) indicates that occasionally they could carry off human infants; in this case the child's wails were heard by sheep-herders who rescued him. On

St Kilda for example, although the white-tailed eagle was a rare visitor, its nests were burned whenever it attempted to breed on the islands, to kill the young/eggs and discourage the adults from returning (Connell 1887, 125; Harman 1997, 221). The unfortunate man who had to perform this dangerous task (descending down the cliff face whilst under attack from these ferocious birds) was selected by lot (Connell 1887, 125). The white-tailed eagle could also be killed by hand (i.e. with a club) when it gorged heavily on prey and had difficulty getting off of the ground (Cowles 1978, 63).

The great black-backed gull may also have been culled, since they are capable of killing birds and even potentially small lambs (Serjeantson *et al.* 1993, 191-204). The St Kildan population tortured black-backed gulls (presumably the great black-backs) in a range of imaginative and (to the modern Western mindset – and many others) extremely cruel ways because they damaged their food resources by wrecking eggs and taking young chicks (Harman 1997, 221; MacAulay 1764, 158). MacAulay (1764, 158-159) records that the 18th century St Kildans hated these large gulls with such a passion that they would compete in torturing them to death by gouging out their eyes, sewing their wings together and then throwing them adrift at sea. Their hatred was such that although the eggs were some of the best and largest, taboo prevented their consumption, and instead they destroyed them (Lysaght 2005, 87-92, 106-7; MacAulay 1764, 158-159). However, since butchery marks indicative of pre-consumption processing were commonly identified on the Norse Bornais large gull remains (including lesser and great black-backed gull, and herring gull) it appears that this taboo on consumption was context specific, perhaps restricted to St Kilda. The large great black-backed gull may well have been disliked in other times and locations, but although potentially killed as a pest it would have probably then have been used as a food resource.

Skua

Skuas are poorly represented in the Scottish Island bone data, with only 15 bones from 7 sites being present. Skuas are notoriously aggressive birds (particularly the great skua) and ferociously defend their nest and territory by attacking creatures many times their size. Consequently, they would not be a logical species to target, and their aggression would make other birds more desirable by contrast. As seen, fowling can be dangerous even without avian attack from above. Great skua numbers have expanded in the 20th century, particularly on the Northern Isles (Figure 8.15 and 8.16). Linguistic and documentary evidence has been used to suggest that the great skua was not present in Northern Scotland, the Faroes or Iceland before the 16th century (Furness 1987, 67-61; Stroud *et al.* 2001a, 342). However, the archaeological material indicates presence in the Scottish Islands from the Neolithic (potentially in small numbers), and importantly a bone from a hearth deposit at Old Scatness provides evidence that it was occasionally taken for food despite its aggressive disposition (Nicholson 2010, 169). Low (1813, 120) writes that in the 19th century on Foula skuas were not killed as they drove off predatory eagles.

Tern

Terns are very poorly represented in the archaeological remains despite remaining around their breeding areas outside of the nesting period (only being absent in winter). Many populations including the Sandwich tern are swollen by passage birds in late July and August (Stroud *et al.* 2001a, 372), and a major proportion of the British common tern population breed on the Northern and Western Isles (Bourne and Harris 1979, 469; Stroud *et al.* 2001a, 377). Although morphologically similar to small gulls they are different enough to secure identification. They breed on the coast and near inland freshwater (Bourne and Harris 1979, 469), but are easily disturbed and prone to habitat

loss through coastal change and disturbance through increased activity in the area such as fishing (Stroud *et al.* 2001a, 378). Human activity around these landscape areas (as evidenced by the wealth of other species) may therefore explain their low representation.

Figure 8.15: Great skuas attack a hiker straying too near their nest, Orkney (WWW26)



Figure 8.16: Great skua attacking walker in Iceland. He is holding up an arm to protect his head, since skuas tend to attack the highest point (WWW27)



8.6: Closing Summary

This chapter has drawn together the results of the novel analyses and collated dataset in order to more fully understand avian resource use and avian-relations of the past. The research has demonstrated that much information can be attained through bird bone, stressing the need for good recovery and analysis. The dataset indicates that in all periods seabirds remained an important resource and were a targeted part of a diverse and flexible fowling economy. Across time and island group birds were being acquired locally and further afield, both during the summer and at other points of the year. Although many key species are consistently prominent, changed avian distributions are also evident, indicating that past populations were exploiting a flexible and adaptable avian resource base.

CHAPTER NINE

CONCLUSION



The work presented in this thesis has developed our understanding of avian resource use through time and space in the Scottish and wider North Atlantic Islands, and demonstrated that thorough, in-depth analysis of avian material (on a level more akin with mammals) provides a wealth of information for investigating access to resources, seasonality, processing, dietary contribution, habitat use, and movement around the landscape.

The research has revealed that birds played a continuing and potentially important role within diet, economy and life in a wide variety of periods and locations. Within this environment seabirds were the primary avian resource used, with key species such as the shag, cormorant, auks, gulls and gannet providing major inputs. Many of the avian assemblages display occasional use of a wide range of minor species in addition to the targeted capture of key seabirds. Avian resource use in the Scottish Islands was therefore flexible, opportunistic and made use of the diversity of bird life in the landscape. The results have also indicated that in capturing wild birds the human fowling were making use of a variety of habitats both locally and further afield. A range of fowling techniques would have been implemented, and in all periods the capture of cliff nesting birds indicates that a degree of risk was associated with their capture. This in turn suggests that avian resources were valued, and were considered worth an expense of labour and effort. The exploitation of these avian resources was part of a year-round fowling calendar, within which the breeding of seabirds in the summer constituted an important fowling episode. The nature of these insular environments means that at certain times of the year they can provide a glut of avian resources, with many seabirds nesting in large communal colonies which can be exploited for meat and

eggs. These birds would have provided a valuable source of dietary fat and oil, which could be stored (along with meat) for consumption at a later point of the year.

The temporal examination of species profiles has contributed to our understanding of past resource use by revealing both wide scale and localised variations in avian populations. These include a substantial decline of great auk, visible from the Late Iron Age onwards, and a contemporary increase in the exploitation of gannet, particularly in the Northern Isles. Wider breeding distributions of birds including puffin, fulmar, crane and skuas have also been inferred from the collated material. The work has furthermore contributed to our understanding of the introduction and adoption of domestic birds. The introduction of domestic fowl in the Middle and Late Iron Age was small in scale and limited in distribution, and their initial use appears focused on eggs, social display and potentially sport. An increase in their frequency and distribution in the Norse period, when combined with the eggshell analyses, indicated that chicken eggs were a valued food resource, but that the wild avian resources remained the main source of avian meat, fat, oil and feathers. In these locations domestic birds were entering a context which already had a plethora of wild birds under use. As such the role of domestic fowl, domestic geese and domestic ducks is determined by the island location.

This thesis has for the first time drawn the avian data into a usable, comparable and extendable form. Now that this groundwork has been conducted it may act as a basis for future development of this research, including potentially deeper statistical analysis, or more detailed use of avian data within the context of specific site types or cultural groups. Applications will now be made for funding to make the database accessible to the wider research community online. Previously unavailable and new data can be

easily incorporated into the assimilated dataset to continue expanding our understanding of avian resource use. The growing body of Mesolithic data currently being unearthed in the Scottish Islands would make an extremely valuable addition to the material considered in this thesis, at such a time when these avian assemblages become available for analysis or study.

Another valuable direction for future work includes increased eggshell analysis which integrates ZooMS technology with SEM analysis. Such a programme has the potential to radically enhance our understanding of landscape use and seasonal species exploitation in the Scottish Islands and further afield. Using SEM analysis to achieve greater species resolution for samples first identified by ZooMS will facilitate more detailed examination of the introduction and management of domesticates, including the possibility of hybridisation of wild and domestic goose or duck populations. Such work also has the potential to examine if there was a delay between domestication occurring and it becoming visible in the morphological characteristics used for SEM analysis. If such a delay was identified its length and form could aid understanding of this important development in avian-human relations.

Whilst birds may be liminal in terms of their movement between the realms of sea, sky and land, and their presence or absence in a specific location dependant on the time of year; their use in the Scottish Islands has been constant in presence and both repeated and varied in form. This presents a picture of resource use that is flexible and opportunistic but which incorporates specific, targeted fowling events that demonstrate a key understanding of the bird species with which people shared this island landscape. The often small representation of birds in terms of abundance via traditional

quantification techniques should not be taken to mean that their role was insignificant and masks the fact that birds provide a wide range of resources which can be accessed at multiple points of the year.

The historical accounts of Scottish, Faroese and Icelandic fowling provide a valuable resource which has enabled this work to investigate less tangible areas of bird use, including weather prediction, ritual and symbolic associations, personal identity and even the concept of taboo. A St Kildan elegy for a lost son reveals the importance and significance that birds could hold for the inhabitants of the Scottish Islands through time and space:

“My share of eggs I shall never receive; the strong and alive will have them, for thou my son art gone. My share of the fowls now fly in the air, up to the clouds they ascend; there they sport and flutter; but I am sad and forlorn” (Campbell 1799).

Such examples serve to remind us that past avian-human relations in these locations were complex and often extended beyond the provision of food, and illustrates that birds in a myriad of forms were a part of everyday life within the Scottish and other North Atlantic Islands from their earliest occupation right through to the present day.

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Internet Resources

In Text	Address	Access Checked
WWW 1	http://www.worldatlas.com/webimage/countrys/europe/outline/ukshetlandout.htm	06/06/2013
WWW 2	http://www.worldatlas.com/webimage/countrys/europe/outline/ukorkneyout.htm	06/06/2013
WWW 3	http://d-maps.com/carte.php?num_car=18245&lang=en	06/06/2013
WWW 4	http://www.cardiff.ac.uk/share/research/projectreports/southuistprojects/southuistgeography/south-uist-geography.html	30/05/2013
WWW 5	http://mykines.dk/bodou/bodou.420-20.jpg	10/09/2013
WWW 6	http://en.wikipedia.org/wiki/File:Saint_Kilda_archipelago_topographic_map-en.svg	22/05/2013
WWW 7	http://www.shorewatch.co.uk/html/accessarch.html	07/06/2013
WWW 8	http://www.shearwater.nl/index.php?file=kop18.php	18/09/2013
WWW 9	http://www.shearwater.nl/index.php?file=kop108.php	18/09/2013
WWW 10	https://www.cia.gov/library/publications/the-world-factbook/geos/zh.html	20/12/2012
WWW 11	http://upload.wikimedia.org/wikipedia/commons/4/47/Atlantic_Ocean_-_en.png	20/12/2012
WWW 12	http://www.grida.no/graphicslib/detail/arctic-map-political_1547	01/05/2013
WWW 13	http://s0.geograph.org.uk/photos/1774/177428_3c74b300.jpg	10/09/2013
WWW 14	http://cid3g.wikispaces.com/Group+4_Gelsea	18/09/2013
WWW 15	http://farm3.static.flickr.com/2309/1860676143_6c8e8ca50f.jpg	18/09/2013
WWW 16	http://www.rspb.org.uk/wildlife/birdguide/name/g/greatblackbackedgull/index.aspx	23/04/2013
WWW 17	http://www.rspb.org.uk/wildlife/birdguide/name/l/lesserblackbackedgull/index.aspx	23/04/2013
WWW 18	http://www.rspb.org.uk/wildlife/birdguide/name/h/herringgull/index.aspx	23/04/2013
WWW 19	http://www.rspb.org.uk/community/placestovisit/orkney/b/orkney-blog/archive/2012/06/28/on-the-up.aspx	01/08/2013
WWW 20	http://i.huffpost.com/gen/422451/EGGS.jpg	11/09/2013
WWW 21	http://s.wsj.net/media/frozenplanet4_J.jpg	11/09/2013
WWW 22	http://mykines.dk/oldpicts/dunga1050799.jpg	10/09/2013
WWW 23	http://mykines.dk/oldpicts/dunga1050806.jpg	10/09/2013
WWW 24	http://mykines.dk/oldpicts/fleyge11050804.jpg	10/09/2013
WWW 25	http://post.queensu.ca/~pearl/pics/Tern%20Island%20pics/Common%20eider%20eggs8.jpg	07/08/2013
WWW 26	http://davidlansing.com/midgies-and-bonxies/	16/04/2013
WWW 27	http://www.dpchallenge.com/image.php?IMAGE_ID=136459	16/04/2013

APPENDIX



1.1 List of bird species by common and Latin names

Arctic tern, *Sterna paradisaea*
Atlantic puffin / Puffin, *Fratercula arctica*
Barn owl, *Tyto alba*
Barnacle Goose, *Branta leucopsis*
Bean goose, *Anser fabalis*
Bewick's swan, *Cygnus columbianus bewickii*
Bittern / Eurasian bittern, *Botaurus stellaris*
Black grouse / Eurasian black grouse, *Lyrurus (Tetrao) tetrix*
Black guillemot, *Cephus grylle*
Blackbird / Eurasian blackbird, *Turdus merula*
Brent goose / Brant, *Branta bernicla*
Brunnich's guillemot / Thick-billed murre, *Uria lomvia*
Buzzard / Eurasian buzzard, *Buteo buteo*
Canada goose, *Branta canadensis*
Capercaillie / Western capercaillie, *Tetrao urogallus*
Carrion crow, *Corvus corone*
Collared dove, *Streptopelia decaocto*
Coot / Common coot, *Fulica atra*
Cormorant / Great cormorant, *Phalacrocorax carbo*
Crane / Common crane, *Grus grus*
Curlew / Eurasian curlew, *Numenius arquata*
Domestic duck, *Anas domesticus* and *Anas platyrhynchos domesticus*
Domestic Chicken, *Gallus (gallus) domesticus*
Domestic goose, *Anser anser domesticus*
Eagle Owl / Eurasian eagle-owl, *Bubo bubo*
Eider / Common eider, *Somateria mollissima*
Emu, *Dromaius novaehollandiae*
Fulmar / Northern fulmar, *Fulmarus glacialis*
Gannet / Northern gannet, *Morus bassanus*
Gadfly petrels, *Pterodroma* spp.
Garganey, *Anas querquedula*
Glaucous gull, *Larus hyperboreus*
Golden eagle, *Aquila chrysaetos*
Goldfinch / European goldfinch, *Carduelis carduelis*
Goosander, *Mergus merganser*
Goshawk / Northern goshawk, *Accipiter gentilis*
Great auk, *Pinguinus impennis*
Great black-backed gull, *Larus marinus*
Great bustard, *Otis tarda*
Great crested grebe, *Podiceps cristatus*
Great northern diver / Common loon or, *Gavia immer*
Great Shearwater, *Puffinus gravis*
Great skua, *Stercorarius (Catharacta) skua*
Great white egret, *Egretta alba*
Greater rhea, *Rhea americana*
Green peafowl, *Pavo muticus*
Grey heron, *Ardea cinerea*

Grey partridge, *Perdix perdix*
 Grey phalarope, *Phalaropus fulicarius*
 Greylag goose, *Anser anser*
 Griffon / Eurasian griffon / Griffon Vulture, *Gyps fulvus*
 Guillemot / Common murre, *Uria lomvia*
 Gyrfalcon, *Falco rusticolus*
 Heron / Grey heron, *Ardea cinerea*
 Herring gull, *Larus argentatus*
 Honey buzzard, *Pernis apivorus*
 Hooded Crow, *Corvus cornix*
 House martin, *Delichon urbica*
 House sparrow, *Passer domesticus*
 Iceland gull, *Larus glaucoideus*
 Indian peafowl / Peacock, *Pavo cristatus*
 Jackdaw / Eurasian jackdaw, *Corvus monedula*
 King cormorant, *Phalacrocorax albiventer*
 Kittiwake / Black-legged kittiwake, *Rissa tridactyla*
 Lanner falcon, *Falco biarmicus*
 Leach's petrel, *Oceanodroma leucorhoa*
 Lesser black-backed gull, *Larus fuscus*
 Lesser rhea, *Pterocnemia (Rhea) pennata*
 Little auk, *Alle alle*
 Little bustard, *Tetrax tetrax*
 Little grebe, *Tachybaptus ruficollis*
 Long-eared owl, *Asio otus*
 Long-tailed duck, *Clangula hyemalis*
 Magpie / Common magpie, *Pica pica*
 Mallard, *Anas platyrhynchos*
 Manx shearwater, *Puffinus puffinus*
 Muscovy duck, *Cairina moschata*
 Mute swan, *Cygnus olor*
 Pintail / Northern pintail, *Anas acuta*
 Osprey, *Pandion haliaetus*
 Ostrich, *Struthio camelus*
 Oystercatcher / Eurasian oystercatcher, *Haematopus ostralegus*
 Peregrine falcon, *Falco peregrinus*
 Pheasant / Common pheasant, *Phasianus colchicus*
 Pink-footed goose, *Anser brachyrhynchus*
 Pochard / Common pochard, *Aythya ferina*
 Ptarmigan / Rock ptarmigan, *Lagopus muta*
 Quail / Common quail, *Coturnix coturnix*
 Raven, *Corvus corax*
 Razorbill, *Alca torda*
 Red grouse / Willow grouse, *Lagopus lagopus*
 Red junglefowl, *Gallus gallus*
 Red kite, *Milvus milvus*
 Red-billed chough, *Pyrrhocorax pyrrhocorax*
 Red-breasted merganser, *Mergus serrator*
 Redshank / Common redshank, *Tringa totanus*
 Red-throated diver, *Cavia stellata*
 Reed bunting, *Emberiza schoeniclus*

Robin / European robin, *Erithacus rubecula*
Rock dove, *Columba Livia*
Rook, *Corvus frugilegus*
Saker falcon, *Falco cherrug*
Shag / European shag, *Phalacrocorax aristotelis*
Short-eared owl, *Asio flammeus*
Snipe / Common snipe, *Gallinago gallinago*
Snow goose, *Anser (Chen) caerulescens*
Song thrush, *Turdus philomelos*
Sooty shearwater, *Puffin us griseus*
Sooty tern, *Sterna fuscata*
Sparrowhawk / Eurasian sparrowhawk, *Accipiter nisus*
Starling - see European starling
Starling / European starling, *Sturnus vulgaris*
Stock dove, *Columba oenas*
Stone curlew / Eurasian stone curlew, *Burhinus oedicnemus*
Swift / Common swift, *Apus apus*
Tawny owl, *Strix aluco*
Teal / Common or green-winged teal, *Anas crecca*
Tufted puffin, *Fratercula cirrhata*
Turkey, *Meleagris gallopavo*
Turtle dove / European turtle dove, *Streptopelia turtur*
Twite, *Carduelis jlavirostris*
Velvet scoter / White-winged scoter, *Melanitta fusca*
White fronted goose / Greater white-fronted goose, *Anser albifrons*
White pelican, *Pelecanus onocrotalus*
White-tailed sea eagle, *Haliaeetus albicilla*
Whooper swan, *Cygnus cygnus*
Wigeon / Eurasian wigeon, *Anas penelope*
Willow grouse / Red grouse, *Lagopus lagopus*
Woodcock / Eurasian woodcock, *Scolopax rusticola*
Woodpigeon, *Columba palumbus*

APPENDIX TO CHAPTER THREE

METHODOLOGY FOR ANALYSED AND NOVEL ASSEMBLAGES

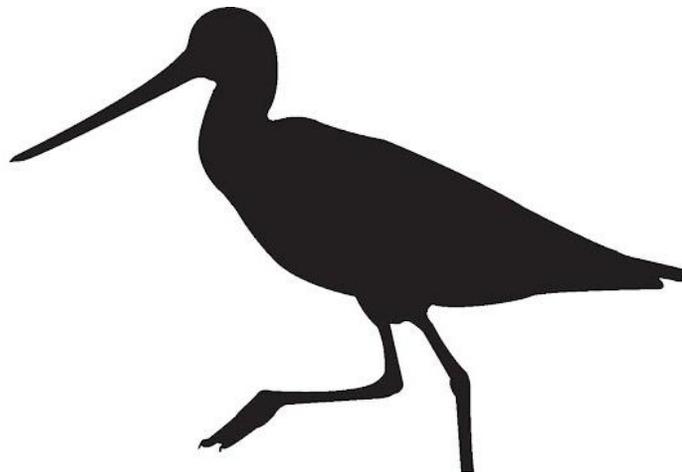


Table A3.1: Site data: Name used in thesis, Island, island Group, Grid Reference, Canmore ID and Site Number

SITE NAME	ISLAND	ISLAND GROUP	NGR	Canmore ID	Canmore Site No.
Machrins	Colonsay	IH	NR 3579 9330	37923	NR39SE 47
Dun Cul Bhuirg	Iona	IH	NM 2649 2462	21638	NM22SE 3
Iona Abby / Monastery	Iona	IH	NM 28683	21664	NM22SE 5
North of Reilig Odhrain	Iona	IH	NM 28605	21659	NM22SE 42
Ardnave	Islay	IH	NR 2899 7458	37488	NR27SE 22
Kilellan Farm	Islay	IH	NR 2863 7213	37496	NR27SE 3
Kings cave	Jura	IH	NR 5177 8246	38281	NR58SW 1
Caisteal nan Gillean	Oronsay	IH	NR 3582 8797	37820	NR38NE 8
Cnoc Coig	Oronsay	IH	NR 3606 8833	37817	NR38NE 5
Cnoc Sligeach	Oronsay	IH	NR 3727 8909	37801	NR38NE 12
Priory Midden	Oronsay	IH	NR 3468 8895	37823	NR38NW 2
Dun Ardtreck	Skye	IH	NG 3350 3581	11064	NG33NW 5
Sand	Inner Sound Applecross	IH	NG 6841 4934	157986	NG64NE 5
An Corran	Skye	IH	NG 4877 6840	158019	NG46NE 33
Dun Mor Vaul	Tiree	IH	NM 0423 4927	21524	NM04NW 3
Carding Mill Bay I	Mainland	ML	NM 8474 2935	70077	NM82NW 30
Carding Mill Bay II	Mainland	ML	NM 847 294	22947	NM82NW 20
Crosskirk Broch	Mainland	ML	ND 0248 7012	8019	ND07SW 4
Freswick Links	Mainland	ML	ND 3760 6762	9293	ND36NE 4
Robert's Haven	Mainland	ML	ND 3903 7353	9381	ND37SE 15
Room 5 Clifftop Settlement Brough of Calf of Eday	Brough of Birsay	OR	HY 23977	1796	HY22NW 1
Holm of Papa Westray	Holm of Papa Westray	OR	HY 5790 3864	3152	HY53NE 19
Beachview Burnside	Mainland	OR	HY 247 275	1807	HY22NW 19
Beachview Studio Site	Mainland	OR	HY 247 275	1807	HY22NW 19
Broch of Ayre	Mainland	OR	HY 4702 0136	2387	HY40SE 6
Brough of Deerness	Mainland	OR	HY 5955 0873	2927	HY50NE 14
Brough Road	Mainland	OR	HY 2467 2806	73552	HY22NW 61
Bu	Mainland	OR	HY 26967	1483	HY20NE 11
Buckquoy	Mainland	OR	HY 2436 2823	1802	HY22NW 14
Earl's Bu	Mainland	OR	HY 3346 0442	1970	HY30SW 2
Earl's Palace	Mainland	OR	HY 44978	2496	HY41SW 11
Gurness	Mainland	OR	HY 38179	2201	HY32NE 5
Howe	Mainland	OR	HY 2759 1092	1731	HY21SE 41
Kirkwall 57 Albert street	Mainland	OR	HY 449 110	110559	HY41SW 140
Kirkwall Gunn's Close	Mainland	OR	HY 447 106	110560	HY41SW 141
Kirkwall Mounthoolie lane	Mainland	OR	HY 449 110	110556	HY41SW 139
Mine Howe	Mainland	OR	HY 5105 0603	2998	HY50NW 38
Point of Buckquoy	Mainland	OR	HY 2428 2839	1800	HY22NW 12
Quanterness cairn	Mainland	OR	HY 4177 1292	2552	HY41SW 4
Saevar Howe	Mainland	OR	HY 2460 2700	1835	HY22NW 5
Skaill Deerness	Mainland	OR	HY 5881 0651	2932	HY50NE 19
Skara Brae	Mainland	OR	HY 23125	1663	HY21NW 12
Snusgar	Mainland	OR	HY 2361 1960	1674	HY21NW 21
St Magnus' Kirk Birsay	Mainland	OR	HY 24759	1838	HY22NW 8
Warebeth Broch	Mainland	OR	HY 2373 0818	1560	HY20NW 17
Barnhouse	Orkney Mainland	OR	HY 3076 1270	2151	HY31SW 61
Knap of Howar	Papa Westray	OR	HY 4830 5180	2848	HY45SE 1
St Boniface's Church	Papa Westray	OR	HY 4877 5271	2867	HY45SE 26
Bay of Moaness	Rousay	OR	HY 3775 2928	317857	HY32NE 92
Blackhammer	Rousay	OR	HY 4142 2761	2645	HY42NW 3
Knowe of Ramsay	Rousay	OR	HY 4004 2800	2637	HY42NW 22
Knowe of Yarso	Rousay	OR	HY 4048 2795	2623	HY42NW 1
Midhowe Broch	Rousay	OR	HY 37169	2286	HY33SE 2
Midhowe Cairn	Rousay	OR	HY 3722 3048	2274	HY33SE 1
Pool	Sanday	OR	HY 6194 3785	3422	HY63NW 17
Tofts Ness	Sanday	OR	HY 760 470	3574	HY74NE 3

Isbister	South Ronaldsay	OR	ND 4704 8449	9554	ND48SE 1
Newark Bay	Mainland	OR	Unknown	Unknown	Unknown
Sandwick North	Unst	SH	Unknown	Unknown	Unknown
Links of Noltland	Westray	OR	HY 428 493	2790	HY44NW 33
Pierowall Quarry	Westray	OR	HY 4389 4905	2789	HY44NW 32
Point of Cott	Westray	OR	HY 4654 4746	2756	HY44NE 3
Quoygrew	Westray	OR	HY 4433 5065	2919	HY45SW 4
Tuquoy	Westray	OR	HY 4546 4313	2822	HY44SE 5
Ceardach Ruadh Baile Sear	Baile Sear	OH	NF 7763 6157	10026	NF76SE 9
Sloc Sabhaid Baile Sear	Baile Sear	OH	7823 6085	10009	NF76SE 19
Bruach a Tuath	Benbecula	OH	NF 7870 5661	9957	NF75NE 1
Rosinish	Benbecula	OH	NF 8728 5380	10196	NF85SE 4
Northton	Harris	OH	NF 9753 9123	10502	NF99SE 2
St Kilda Black House G	Hirta St Kilda	OH	NF 10128	9689	NF19NW 21.07
St Kilda Black House 8	Hirta St Kilda	OH	NF 10107	9686	NF19NW 21.04
St Kilda Black House 6	Hirta St Kilda	OH	NF 10158	75828	NF19NW 21.25
Beirgh	Lewis	OH	NB 10348	4100	NB13NW 3
Bostadh	Lewis	OH	NB 1373 4010	4130	NB14SW 2
Cnip	Lewis	OH	NB 0980 3659	4009	NB03NE 17
Dun Bharabhat Cnip	Lewis	OH	NB 09886	4020	NB03NE 4
Mingulay	Mingulay	OH	NL 55540	21362	NL58SE 22
Bac Mhic Connain	North Uist	OH	NF 7694 7619	10054	NF77NE 5
Eilean Domhnuill Loch Olabhat	North Uist	OH	NF 74696	10069	NF77NW 3
Foshigarry	North Uist	OH	NF 7424 7638	10071	NF77NW 5
Sollas	North Uist	OH	NF 8011 7533	10337	NF87NW 5
Udal	North Uist	OH	NF 825 783	10330	NF87NW 2
Dunan Ruadh	Pabbay	OH	NL 6128 8760	21383	NL68NW 1
Sheader	Sandray	OH	NL 6312 9200	78851	NL69SW 7
HI15 House Island Sites	Shiant Isles	OH	NG 420 972	119716	NG49NW 11
RI41B Rough Island Sites	Shiant Isles	OH	NG 41 98	191490	NG49NW 14
A'Cheardach Bheag	South Uist	OH	NF 7577 4038	9947	NF74SE 7
A'Cheardach Mhor	South Uist	OH	NF 7570 4129	9949	NF74SE 9
Askernish	South Uist	OH	NF 73 23	139158	NF72SW 21
Bornais	South Uist	OH	NF 729 302	108290	NF73SW 8
Cill Donnain	South Uist	OH	NF 728 285	75832	NF72NW 26
Cille Pheadair	South Uist	OH	NF 7292 1979	139161	NF71NW 18
Cladh Hallan	South Uist	OH	NF 73138	108429	NF72SW 17
Dun Vulcan	South Uist	OH	NF 71407	9825	NF72NW 1
Frobost	South Uist	OH	c.NF 733 256	Unknown	Unknown
Hornish Point	South Uist	OH	NF 758 470	9913	NF74NE 18
Sligeanach	South Uist	OH	NF 726 289	140904	NF72NW 37
East Shore Broch	Mainland	SH	HU 4023 1125	918	HU41SW 4
Jarlshof	Mainland	SH	HU 39819	513	HU30NE 1
Old Scatness	Mainland	SH	HU 3898 1065	556	HU31SE 21
Scalloway	Mainland	SH	HU 406 399	995	HU43NW 32
Scalloway Castle	Mainland	SH	HU 40430	973	HU43NW 1
Scatness	Mainland	SH	HU 3889 0879	518	HU30NE 5
Scord of Brouster	Mainland	SH	HU 2560 5165	405	HU25SE 26
West Voe	Mainland	SH	HU 3920 1100	274115	HU31SE 102
The Biggings	Papa Stour	SH	HU 176 605	250	HU16SE 17
Milla Skerra Sandwick	Unst	SH	HP 6180 0250	274117	HP60SW 66
Site 22 Sands of Breckon	Yell	SH	HP 530 051	212674	HP50NW 11.01

Table A3.2: Abbreviation codes used in this thesis for each period and place

Period	Code	Island Group/Other	Code
Mesolithic	Mes	Inner Hebrides	IH
Neolithic	Neo	Outer Hebrides	OH
Early Neolithic	ENeo	Shetland	SH
Middle Neolithic	MNeo	Orkney	OR
Late Neolithic	LNeo	Present	P
Beaker	Beak	No Quantification	NQ
Bronze Age	BA	No Information	NI
Early Bronze Age	EBA	Unknown	UK
Middle Bronze Age	MBA	Unidentified	UNID
Late Bronze Age	LBA	Not Applicable	N/A
Iron Age	IA	Assesment Only	Ass
Early Iron Age	EIA	Individual	Indi
Middle Iron Age	MIA	Skeleton	*
Late Iron Age	LIA	In Analysis	In An
Pre-Norse/Pictish	PN/Pict	Red-breasted merganser	R-BM
Viking	Vik	Lesser black-backed gull	LBB Gull
Norse	N	Great black-backed gull	GBB Gull
Early Norse	EN	White fronted/pink footed goose	White Front/Pink Foot
Middle Norse	MN	Assesment Only	Ass
Late Norse	LN	At the Moment	atm
Medieval	Med		
Post Medieval	PMed		

Table A3.3: Terminology and developmental subdivisions for hatchling birds (Based on Serjeantson 2009, 11-12; data initially from Gaskell 2004, 231-240)

Classification	Stage at Hatching	Example birds
Superprecocial	Independent of parents.	Megapodidae i.e. Australian Brushturkey
Precocial	Can feed self from birth. Leave nest soon after hatched: when siblings have hatched and their down has dried.	Anatidae i.e. Greylag goose
Hypoprecocial	Substantial initial brooding and feeding but mobile.	Gaviidae i.e Red-breasted diver
Quasi-precocial	Able to walk but remain until at nest until body feather and wing coverts grown.	Razorbill, Guillemot
Semi-precocial	Able to walk but remains in nest until fledging.	Gulls
Lower or Semi altricial	Down covered, unable to walk.	Falcons, Manx Shearwater
Higher altricial	Eyes covered, little down, unable to walk.	Passerines e.g thrush. Gannet and Cormorant

Figure 3.1: Zoning definitions used for recording the novel assemblages (Cohen and Serjeantson 1996, 112)

HUMERUS (Fig. 8a)	3+4 proximal shaft	8 right ischium
1 proximal end, including head	5+6 distal shaft	
2 proximal end, including fossa	7 distal end, including ligamental prominence	SYNSACRUM (Fig. 9b)
3 proximal shaft, including deltoid crest	8 distal end, ventral	1+2 synsacral thoracic vertebrae
4 proximal end, ventral, including bicipital crest		3+4 synsacral lumbar vertebrae
5 distal shaft, dorsal	CARPO-METACARPUS (Fig. 8f)	5+6 synsacral sacral vertebrae
6 distal shaft, ventral	1 proximal end, including extensor process	7+8 synsacral caudal vertebrae
7 distal end, including dorsal epicondyle	2 proximal end including carpal trochlea	FEMUR (Fig. 9c)
8 distal end, including ventral epicondyle	3 major metacarpal, proximal shaft	1 femoral head
	4 minor metacarpal, proximal shaft	2 trochanter
CORACOID (Fig. 8b)	5 major metacarpal, distal shaft	3 shaft, proximal medial
1 articular facet	6 minor metacarpal, distal shaft	4 shaft, proximal lateral
2 acroracoid process	7 distal end, including facet for major digit	5 shaft, distal medial
3 proximal shaft, including scapular facet	8 distal end, including facet for minor digit	6 shaft, distal lateral
4 proximal shaft, including procoracoid process		7 distal end, medial condyle
5 distal shaft, dorsal	FURCULA (8g)	8 distal end, lateral condyle
6 distal shaft, ventral	1+2 interclavicle	TIBIO-TARSUS (Fig. 9d)
7 sterno-coracoidal process	3 body, proximal, left	1 cranial cnemial crest
8 sternal facet	4 body, proximal, right	2 proximal articular surface
	5 body, distal, left	3 shaft, proximal medial
SCAPULA (Fig. 8c)	6 body, distal, right	4 shaft, proximal including fibular crest
1 acromion	7 extremity, distal, left	5+6 shaft, distal
2 glenoid facet	8 extremity, distal, right	7 distal articular end, including internal condyle
3+4 blade, proximal		8 distal articular end, including external condyle
5+6 blade, distal	STERNUM (Fig. 8h)	TARSO-METATARSUS (Fig. 9e)
7+8 blade, distal	1 left coracoidal groove	1 proximal articular end, including medial cotyle
	2 right coracoidal groove	2 proximal articular end, including lateral cotyle
ULNA (Fig. 8d)	3 rostrum	3 proximal shaft, medial
1 proximal articular end, including dorsal cotyla	4 apex of keel	4 proximal shaft, lateral
2 proximal end, including prominence for anterior articular ligament	5 left rib facets	5 distal shaft, including facet for 1st metatarsal
3 proximal shaft, including depression for brachialis	6 right rib facets	6 distal shaft, lateral
4 proximal shaft, including quill knobs	7 pars hepatica, left	7 trochlea for MTII
5 distal shaft, dorsal	8 pars hepatica, right	8 trochlea for MTIV
6 distal shaft, ventral	PELVIS (Fig. 9a)	
7 distal end, including dorsal condyle	1 left ilium	
8 distal end, including ventral condyle	2 right ilium	
	3 left acetabular region	
RADIUS (Fig. 8e)	4 right acetabular region	
1+2 proximal articular end	5 left pubis	
	6 right pubis	
	7 left ischium	

Figure 3.2: Zone location diagrams used for recording the novel assemblages (based on Cohen and Serjeantson 1996, 110)

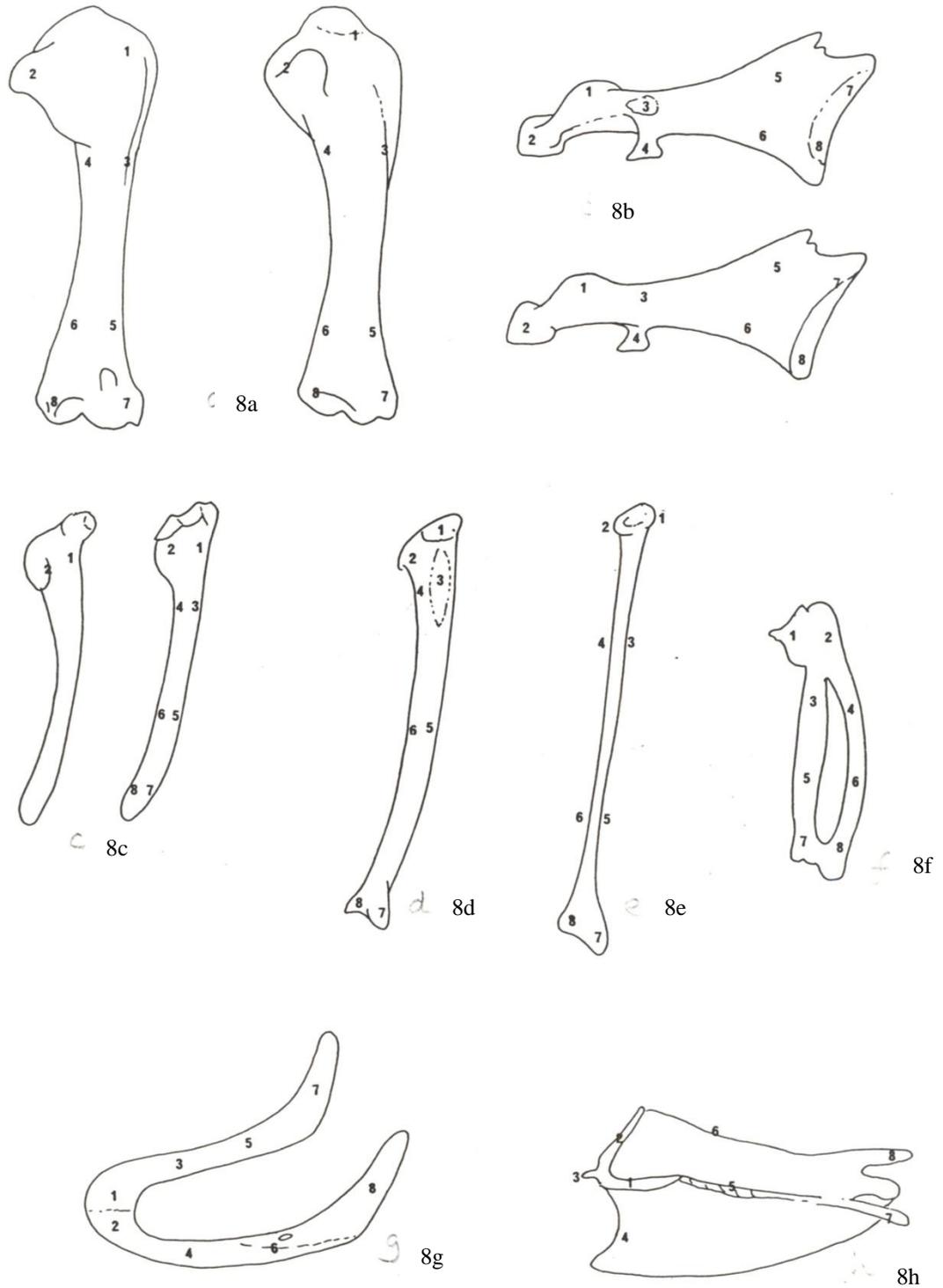


Figure 3.3: Zone location diagrams used for recording the novel assemblages (based on Cohen and Serjeantson 1996, 111).

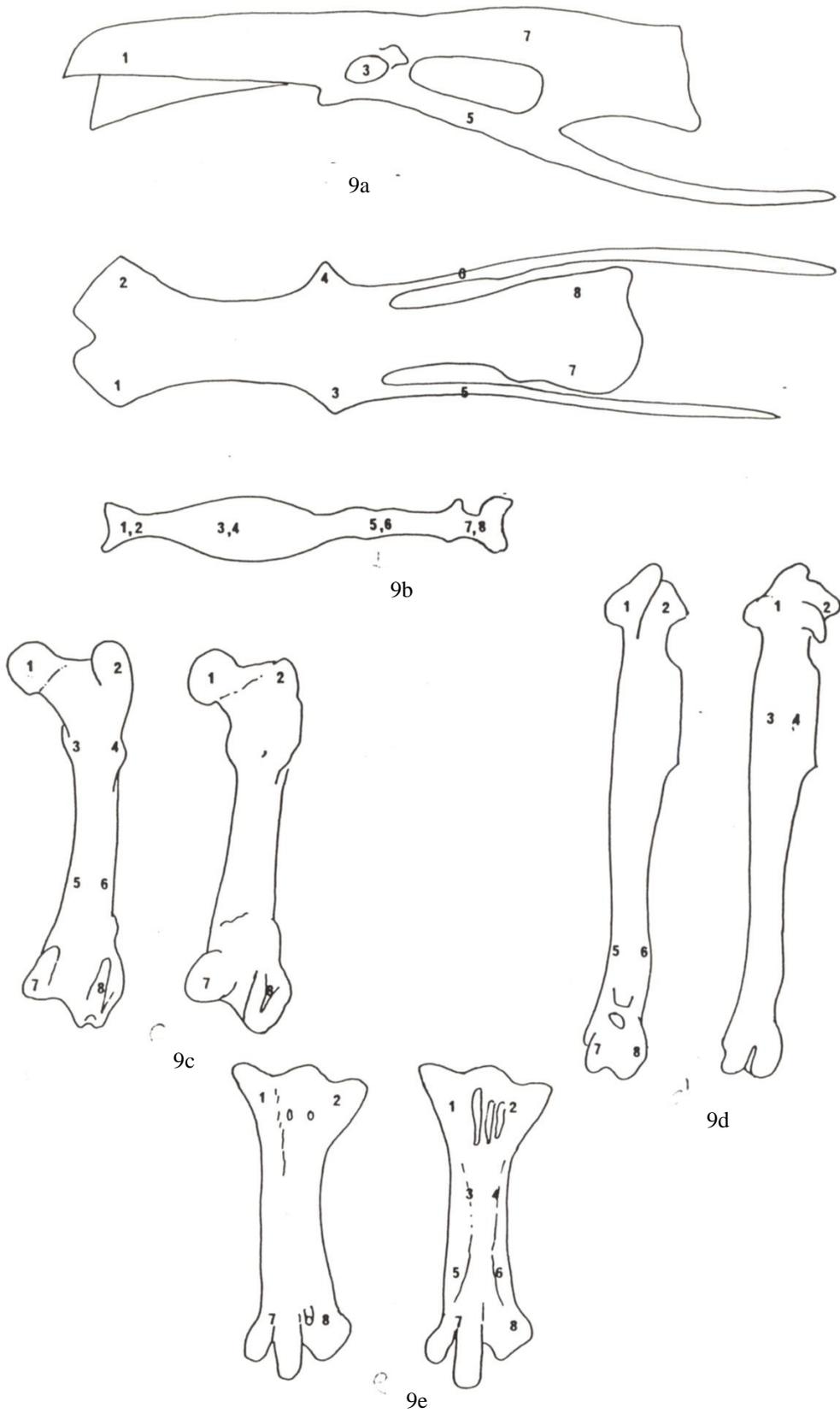


Figure 3.4: Description of measurement criteria used in recording the novel assemblages
(based on Cohen and Serjeantson 1996, 106)

CORACOID (Fig. 6a)

GL Greatest length
Lm Length of the medial side
Bb Basal breadth
Bf Breadth of the articular facet

SCAPULA (Fig. 6b)

GL Greatest length
Dic Greatest cranial diagonal

HUMERUS (Fig. 6c)

GL Greatest length
Bp Greatest breadth of proximal end
SC Smallest breadth of the corpus
Bd (Greatest) breadth of the distal end

ULNA (Fig. 6d)

GL Greatest length
Bp Breadth of the proximal end
Dip Diagonal of proximal end
SC Smallest breadth of corpus
Did Diagonal of distal end

RADIUS (Fig. 6e)

GL Greatest length
SC Smallest breadth of shaft
Bd Greatest breadth of distal end

CARPO-METACARPUS (Fig. 6f)

GL Greatest length
L Length of metacarpus II
Bp Greatest breadth of proximal end
Did Diagonal of distal end

SYNSACRUM & PELVIS (Fig. 7a)

GL Greatest length
LS Length of sternum
LV Length along the synsacral vertebrae
SB Smallest breadth of the Partes Glutea
BA Breadth in the middle

FEMUR (Fig. 7b)

GL Greatest length
Lm Medial length
Bp Greatest breadth of the proximal end
Dp Greatest depth of the proximal end
SC Smallest breadth of the corpus
Bd Greatest breadth of the distal end
Dd Greatest depth of distal end

TIBIO-TARSUS (Fig. 7c)

GL Greatest length
La Axial length
Dip Diagonal of proximal end
SC Smallest breadth of corpus
Dd Depth of the distal end

TARSO-METATARSUS (Fig. 7d)

GL Greatest length
Bp Greatest breadth of proximal end
SC Smallest breadth of corpus
Bd Greatest breadth of distal end
Spur Length of spur

Figure 3.5: Diagram of measurement criteria used in recording the novel assemblages (based on Cohen and Serjeantson 1996, 107)

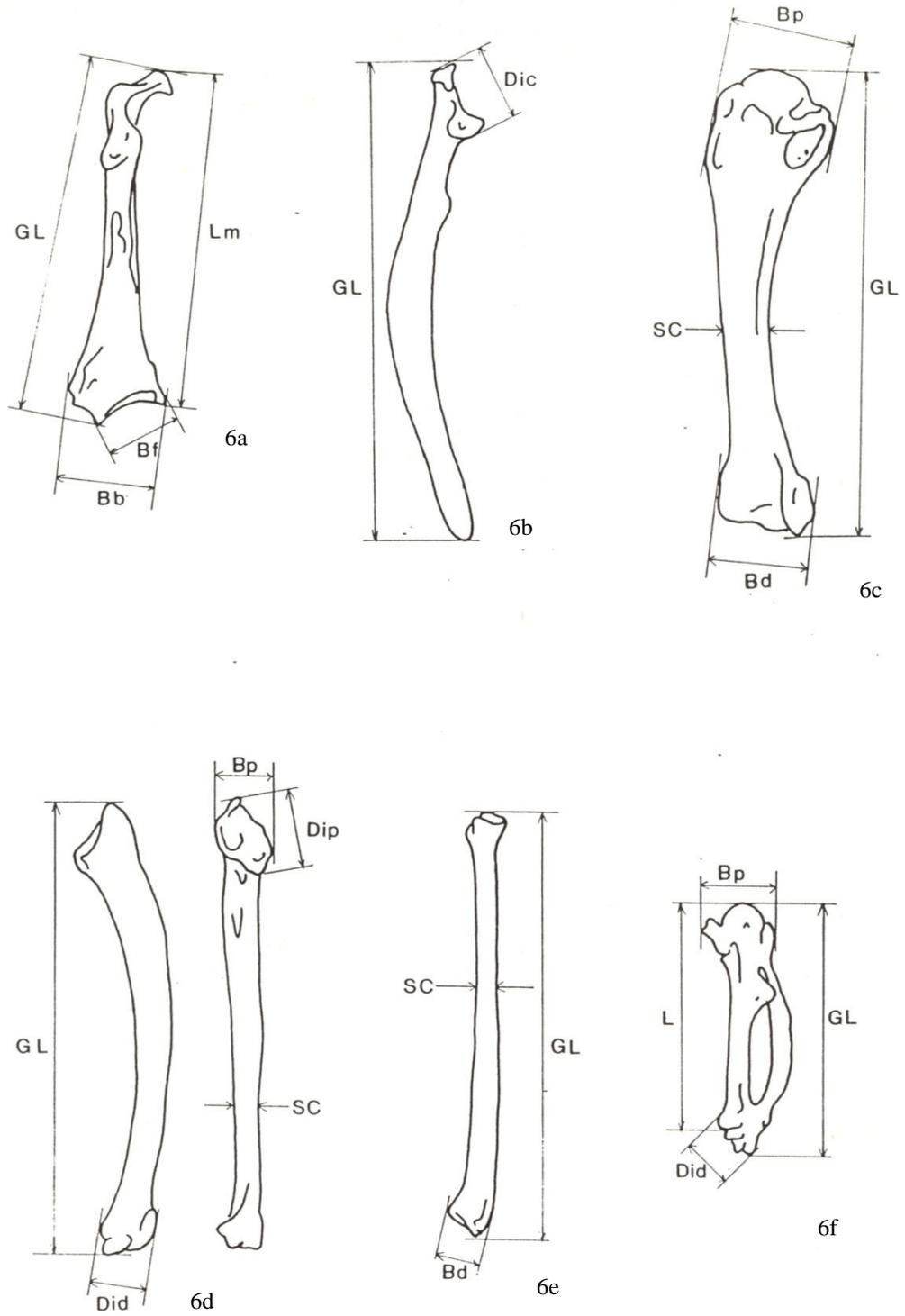
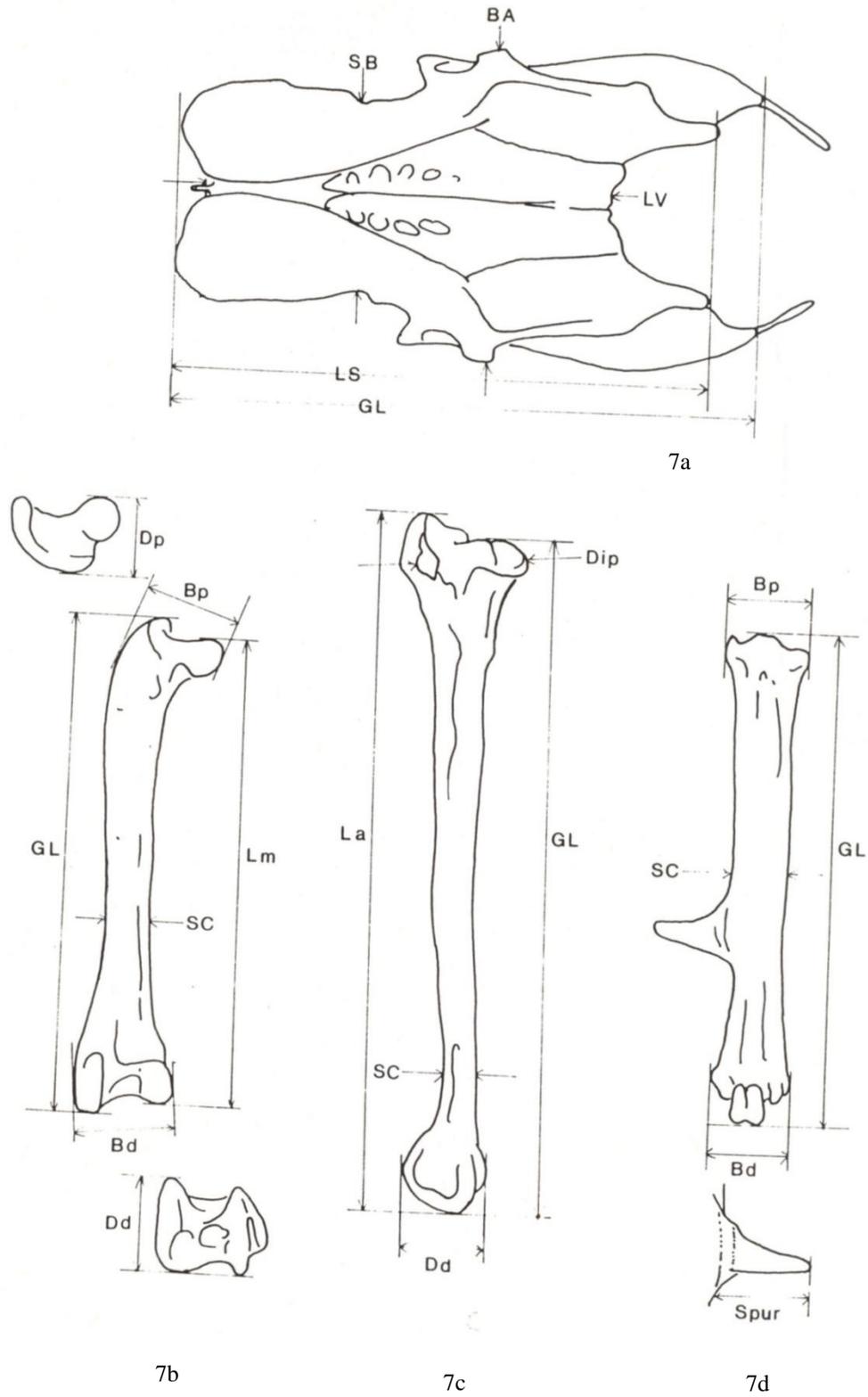


Figure 3.6: Diagram of measurement criteria used in recording the novel assemblages
 (based on Cohen and Serjeantson 1996, 108)



APPENDIX TO CHAPTER FOUR

RESULTS

The Avian Picture of South Uist: A case study



Figure A4.1 : South Uist birds and mammals NISPs by site (log scale)

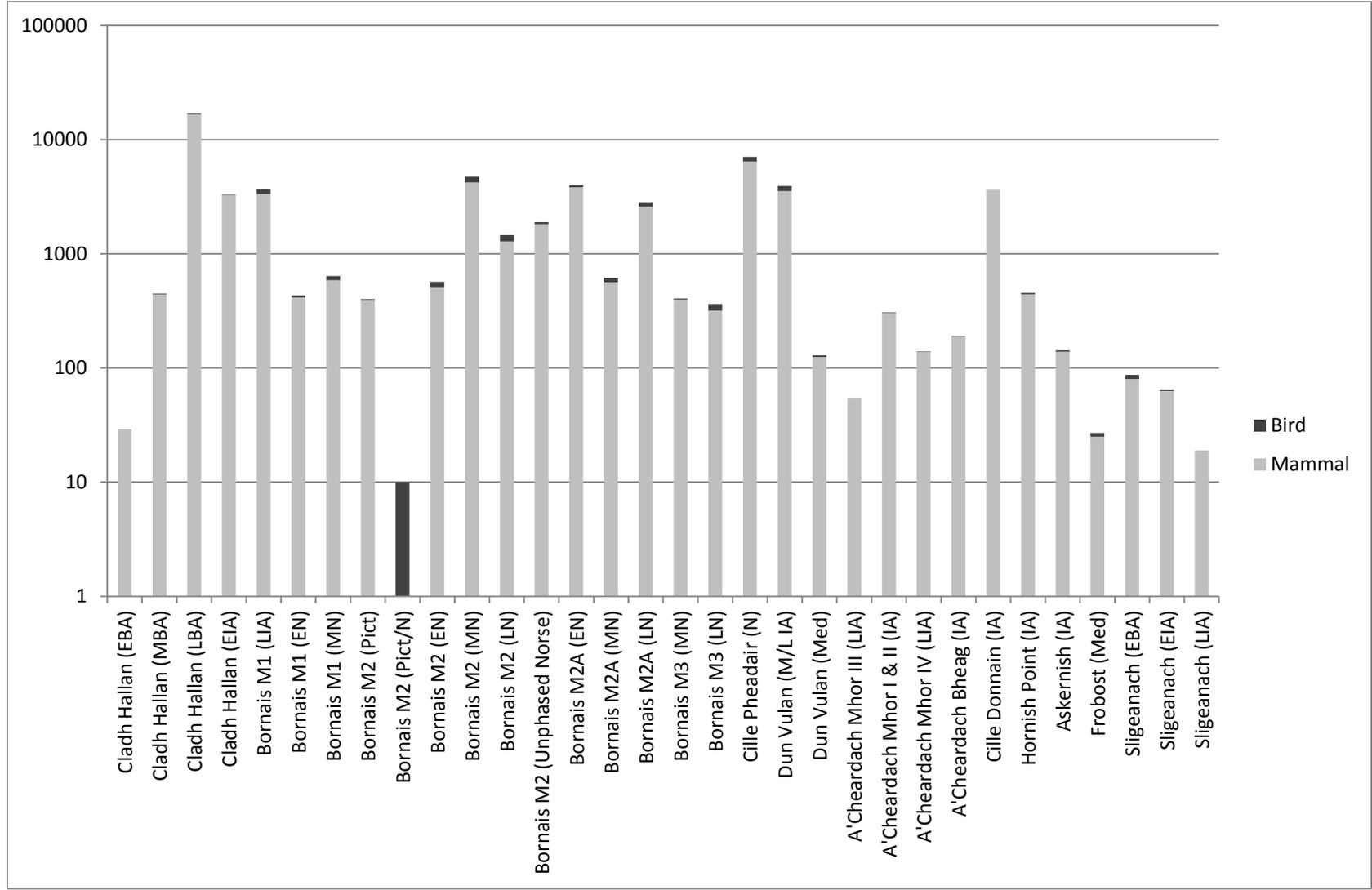


Figure A4.2 : South Uist birds and mammals NISPs by site

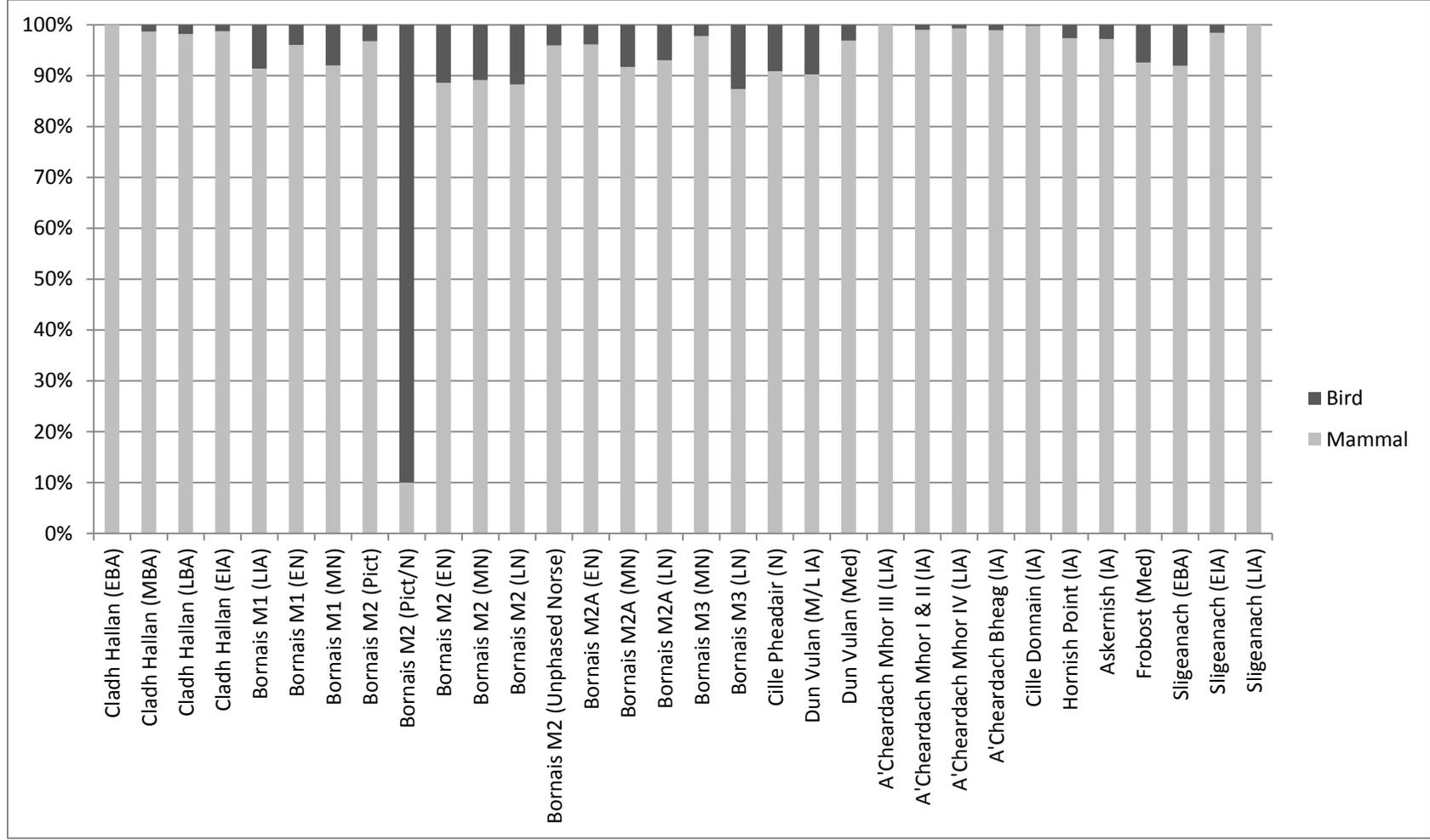


Figure A4.3 : South Uist birds, fish and mammals NISPs by site (% of combined NISP)

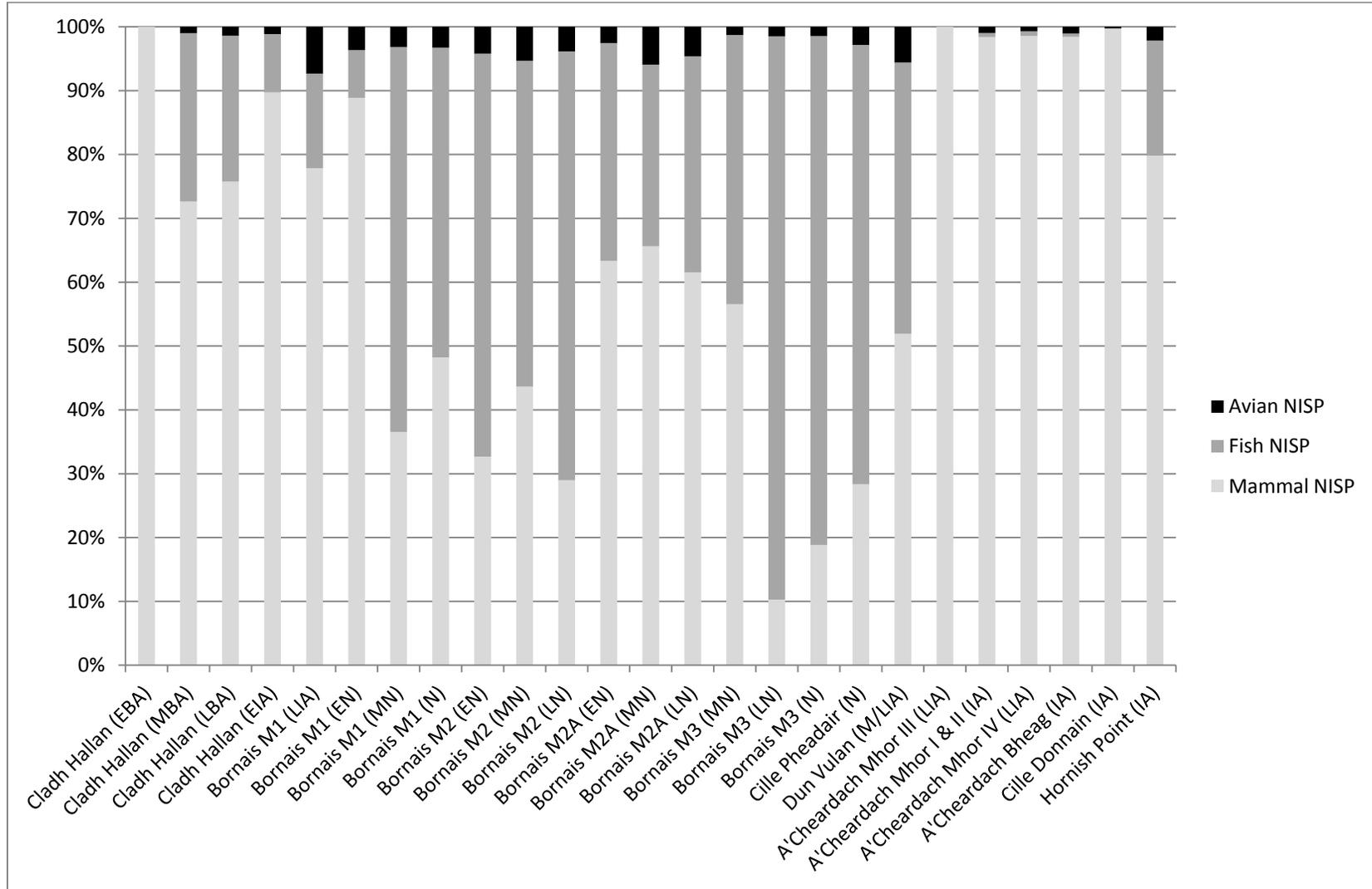


Figure A4.4 : South Uist birds, fish and mammals NISPs by site (NISP)

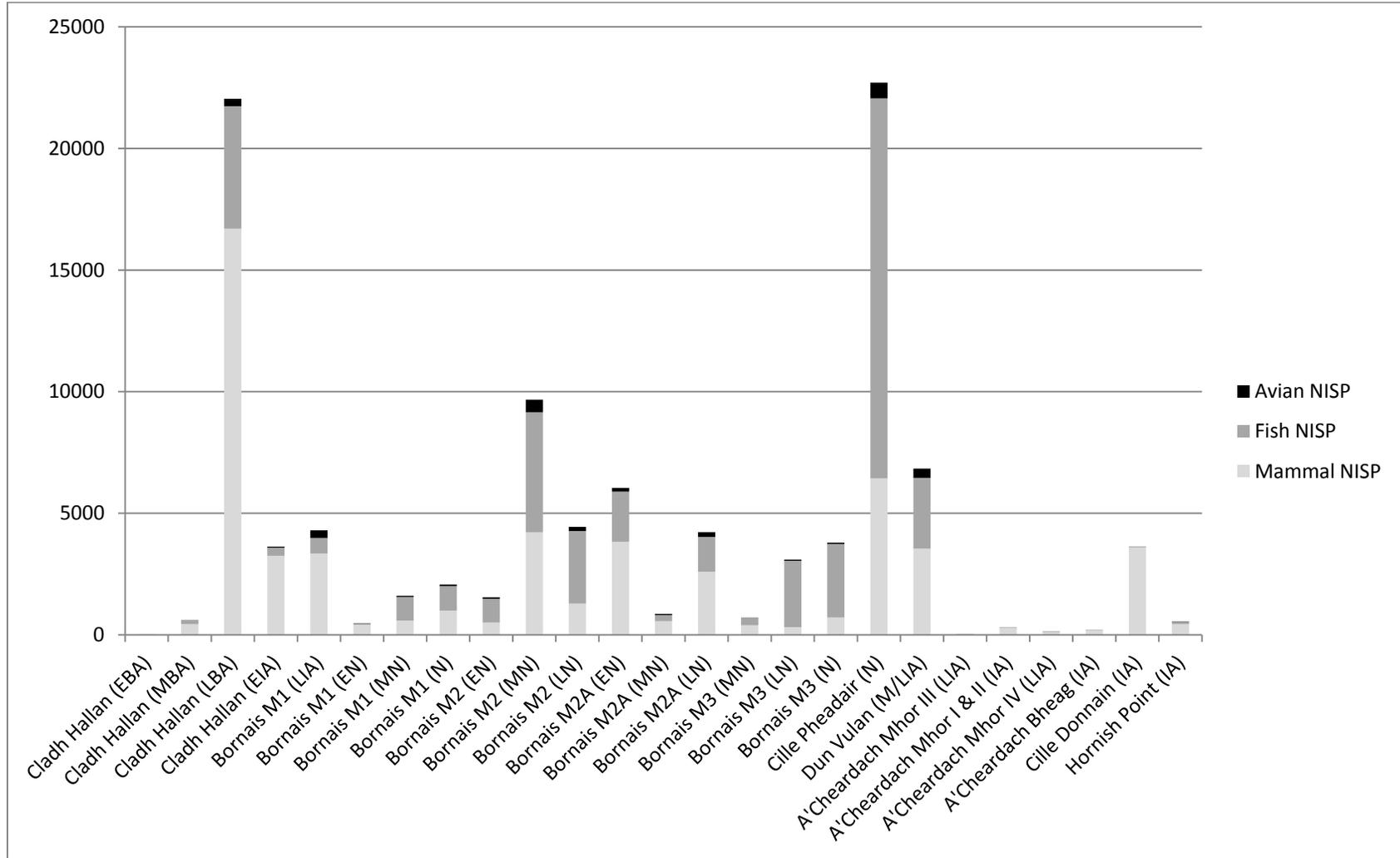


Figure A4.5: Birds as a percentage of the combined avian/mammal NISP for each internal phase of Norse Cille Pheadair

Cille Pheadair Phase	1	2	3	4	5	6	7	8	9
Mammal NISP	117	392	488	1270	1725	954	1161	221	110
Avian NISP	24	56	61	164	143	71	77	24	20
Birds as % of combined NISP	17.0	12.5	11.1	11.4	7.7	6.9	6.2	9.8	15.4

Figure A4.6: Temporal and Spatial variation: Mammal and Bird as Percentage Total NISP

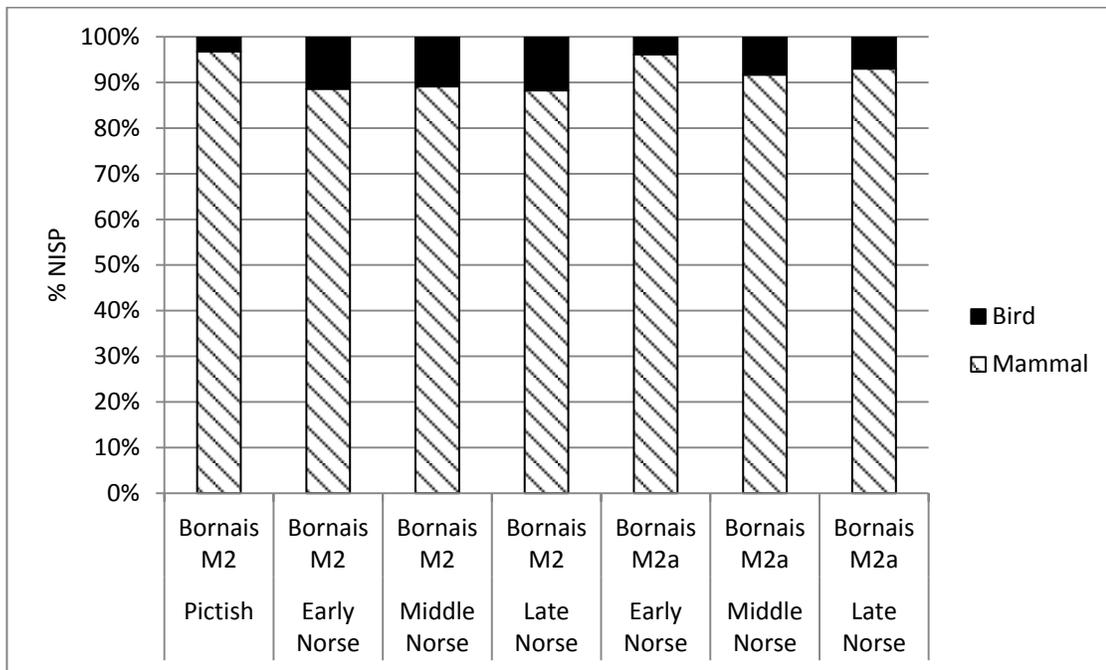


Figure A4.7 : Bornais bird categories/types show by phase division for each mound.

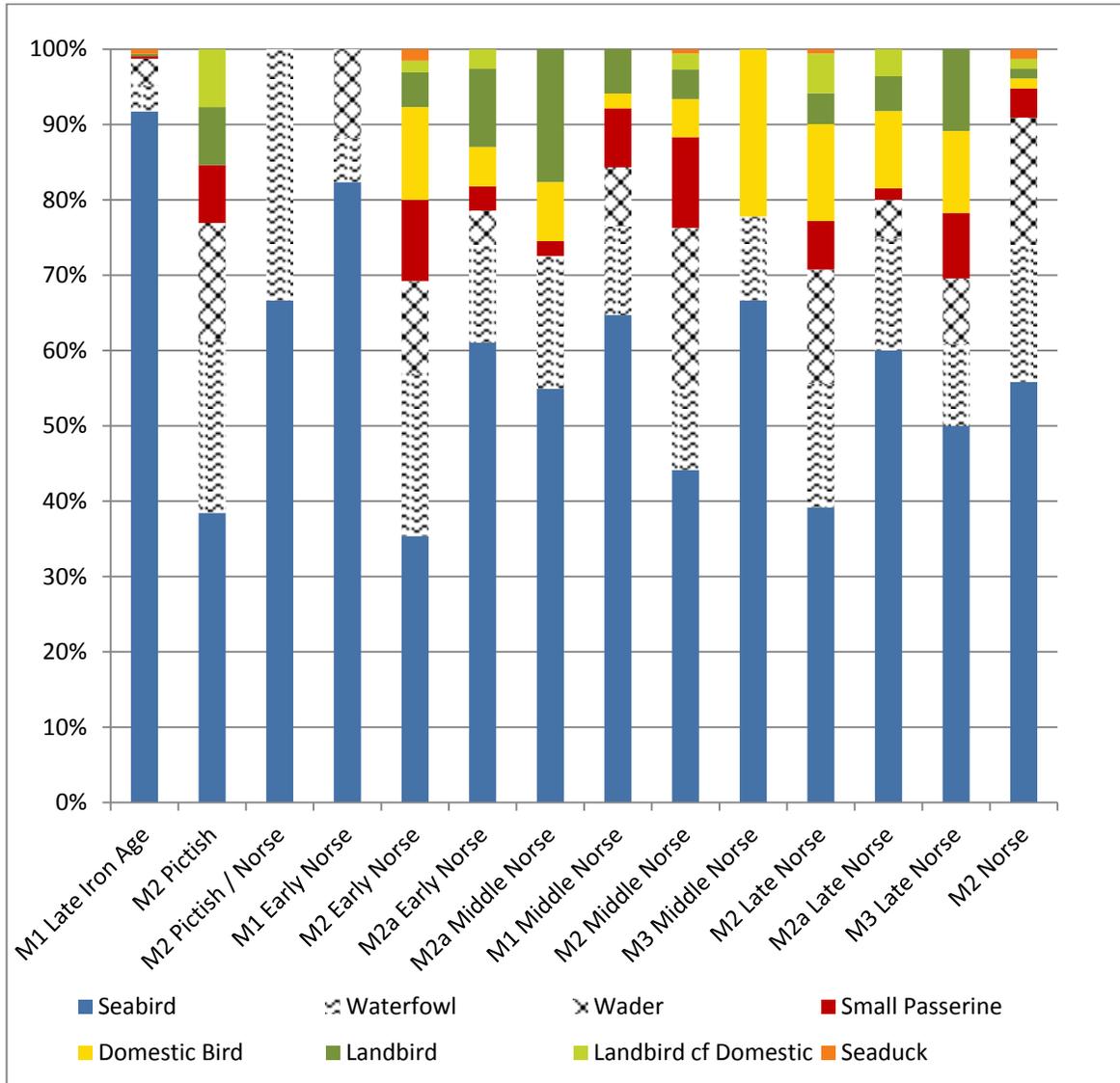


Table A4.1: All South Uist archaeological avian remains combined by NISP

Species	NISP	Species	NISP	Species	NISP
HERRING / LESSER BLACK BACKED	348	SMALL PASSERINE <i>CF.</i> THRUSH	10	WHOOPER SWAN	1
GANNET	221	DOMESTIC FOWL BANTAM SIZE	10	GOOSE / SWAN	1
CORMORANT	199	GREYLAG / DOMESTIC GOOSE	9	EIDER	1
GREAT BLACK BACKED GULL	174	CRANE	9	WHITE TAILED/GOLDEN EAGLE	1
SMALL WADER SP	150	WADER <i>CF.</i> OYSTERCATCHER	9	EAGLE <i>CF.</i> WHITE TAILED	1
DOMESTIC FOWL	124	SHELDUCK	8	PEREGRINE FALCON	1
SHAG	109	COMMON / HERRING GULL	8	SHORT EARED OWL	1
SMALL PASSERINE	94	LARGE GULL SP	8	RAPTOR	1
PUFFIN	90	GULL <i>CF.</i> HERRING / LBB	8	DOMESTIC FOWL BANTAM	1
GUILLEMOT	78	SNIPE	7	RED GROUSE / PTARMIGAN	1
GREAT AUK	68	PASSERINE	7	PLOVER	1
GOOSE SP	64	SHEARWATER <i>CF.</i> MANX	7	LAPWING / GODWIT	1
GULL SP	55	WADER <i>CF.</i> PLOVER	7	REDSHANK	1
LARGE GREY GOOSE <i>CF.</i> GREYLAG	55	WHIMBREL	7	CURLEW / HERRING GULL	1
MANX SHEARWATER	53	LARGE SHEARWATER SP	7	COMMON GULL	1
PLOVER <i>CF.</i> GOLDEN	50	SMALL GOOSE	6	HERRING GULL	1
STARLING	49	GULL / WADER	6	CORVID SP	1
RAZORBILL / GUILLEMOT	43	THRUSH SP	6	SONGTHRUSH	1
OYSTERCATCHER	42	DUCK <i>CF.</i> MALLARD / SHELDUCK	6	SKYLARK	1
WADER	37	COLUMBA SP <i>CF.</i> ROCK / STOCK	6	PIED WAGTAIL	1
GALLIFORM <i>CF.</i> DOMESTIC FOWL	37	GULL / SKUA <i>CF.</i> GBB GULL	6	LANDBIRD <i>CF.</i> CORNCRAKE	1
FULMAR	36	BRENT GOOSE	5		
LARGE GOOSE	34	GREY GOOSE SP	5		
DUCK SP	33	GULL <i>CF.</i> KITTIWAKE	5		
CURLEW	32	WADER <i>CF.</i> BAR-TAILED GODWIT	5		
RAVEN	32	MEDIUM WADER SP	5		
GREAT NORTHERN DIVER	30	WADER <i>CF.</i> JACKSNIPE	5		
GALLIFORM SP	29	SWAN <i>CF.</i> WHOOPER	4		
LARGE GREY GOOSE	27	DUCK <i>CF.</i> RED BREASTED MERGANSER	4		
CORMORANT/SHAG	26	LARGE WADER SP	4		
SWAN SP	26	KITTIWAKE	4		
LARGE DUCK SP	26	AUK SP	4		
SMALL GULL SP	24	COLUMBA SP	4		
GULL <i>CF.</i> COMMON	23	GALLIFORM <i>CF.</i> RED GROUSE	4		
GOLDEN PLOVER	22	GREY HERON	3		
PASSERINE FINCH SIZE	21	GOOSE <i>CF.</i> DOMESTIC	3		
RAZORBILL	20	SMALL GULL / SKUA	3		
DUCK <i>CF.</i> MALLARD	20	DUNLIN	3		
ROOK/CROW	19	TURNSTONE	3		
WADER <i>CF.</i> SNIPE	19	WATER RAIL	3		
ROCK / STOCK DOVE	17	DUCK <i>CF.</i> TEAL	3		
BRENT / BARNACLE GOOSE	15	WADER <i>CF.</i> WHIMBREL	3		
DUCK <i>CF.</i> SHELDUCK	15	PROCELLARIIDAE	3		
GULL / SKUA <i>CF.</i> HERRING / LBB	14	SHEARWATER SP	2		
GROUSE (RED/WILLOW)	13	RED BREASTED MERGANSER	2		
MALLARD	12	LAPWING	2		
GULL <i>CF.</i> GREAT BLACK BACKED	12	JACKSNIPE	2		
WADER <i>CF.</i> CURLEW	12	WOODCOCK	2		
WADER <i>CF.</i> GOLD / GREY PLOVER	12	PUFFIN / BLACK GUILLEMOT	2		
GREYLAG GOOSE	11	BLACK GUILLEMOT	2		
WHITE TAILED EAGLE	11	DUNNOCK	2		
SMALL PASSERINE <i>CF.</i> STARLING	11	DUCK <i>CF.</i> EIDER	2		
DUCK / GOOSE	10	SHEARWATER <i>CF.</i> GREAT	2		
TEAL	10	WADER <i>CF.</i> LAPWING	2		
LITTLE AUK	10	SOOTY SHEARWATER	1		

Table A4.2: Bird NISP in general categories by site in period order, from South Uist

	Sligeanach (EBA)	Cladh Hallan (MBA)	Cladh Hallan (LBA)	Cladh Hallan (EIA)	Sligeanach (EIA)	Dun Vulan (M-LIA)	A'Cheardach Mhor I & II (IA)	A'Cheardach Bheag (IA)	Cill Domain (IA)	Hornish Point (IA)	Askernish (IA)	A'Cheardach Mhor IV (LIA)	Bornais M1 (LIA)	Bornais M2 (PN/Pict)	Bornais M2 (PN/Pict/N)	Bornais M1 (EN)	Bornais M2 (EN)	Bornais M2A (EN)	Bornais M1 (MN)	Bornais M2 (MN)	Bornais M2A (MN)	Bornais M3 (MN)	Bornais M2A (LN)	Bornais M3 (LN)	Bornais M2 (LN)	Bornais M2 (N)	Cille Pheadair (N)	Dun Vulan (M)	Frobost (M)
Seabird	7	1	203	9	1	259	2		3	4	2	1	289	5	6	14	23	94	33	227	28	6	117	23	67	43	245	2	
Seaduck			1										2				1			3					1	1			
Wader		2	27	6		29							10	2		2	8	7	4	108			9	4	26	12	187		
Waterfowl		2	48	5		37	1	2		5	1		11	3	3	1	14	20	6	55	8	1	29	5	28	14	105		1
Land Wader																				1			1						
Crane / Rail / Heron			3	1		3							1							1	1					1	4		
Small Passerine			7	19		31				1			1	1			7	5	4	62	1		3	4	11	3	42	1	
Landbird			16	1		18				2	1						3	14	3	12	9		9	5	6	1	26	1	
Domestic Bird						6											8	8	1	26	4	2	20	5	22	1	32		
Landbird <i>cf.</i> Domestic														1			1	4		11			7		9	1	3		
Raptor			1			1							1	1				2		8					1	1			

Table A4.3: Bird NISP by period for taxonomic categories

	Bronze Age	Iron Age	Pre-Norse/Pictish	Norse
Seabird	212	570	5	920
Seaduck	1	2		6
Wader	29	45	2	367
Waterfowl	50	62	3	286
Land Wader				2
Crane / Rail /Heron	3	5		7
Small Passerine	7	52	1	142
Landbird	16	22		88
Domestic Bird		6		129
Landbird <i>cf.</i> Domestic			1	36
Raptor	1	2	1	12
TOTAL	319	766	13	1995

Figure A4.8: Avian assemblage sizes by site and period

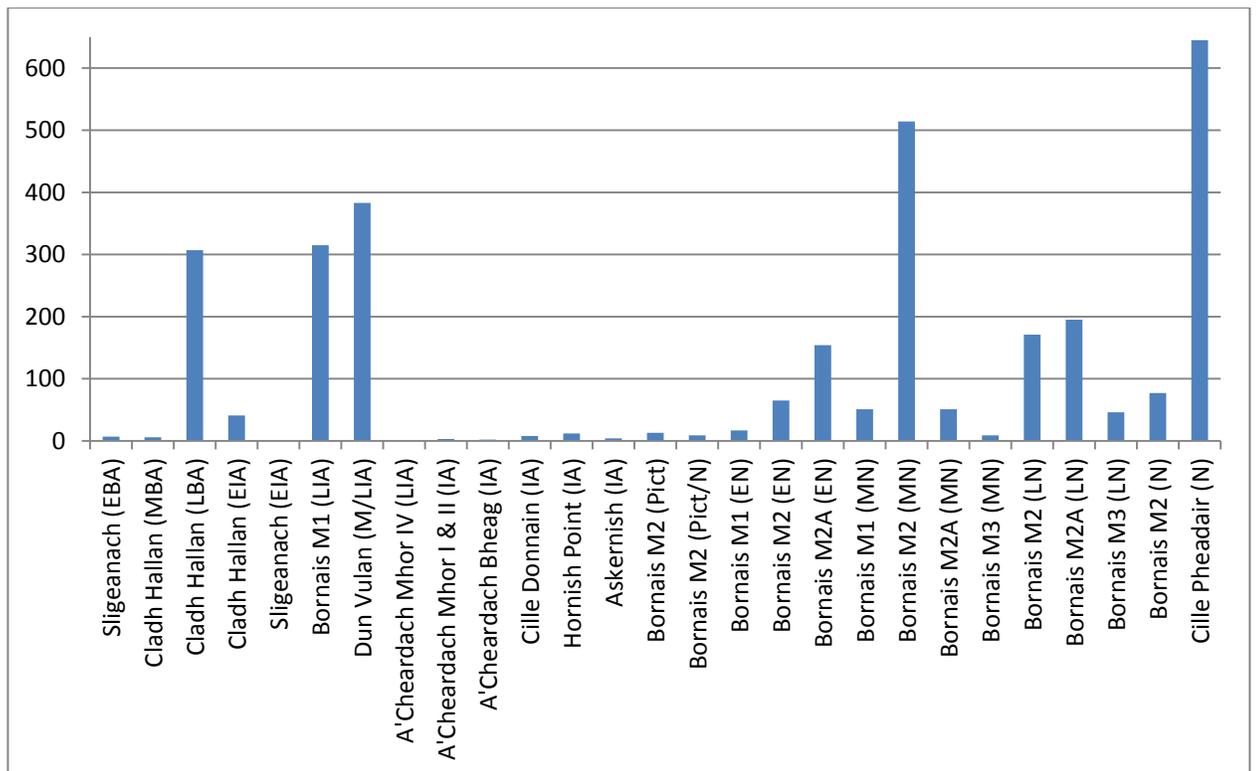


Figure A4.9: Graph of avian groupings by site in period order showing frequency by NISP

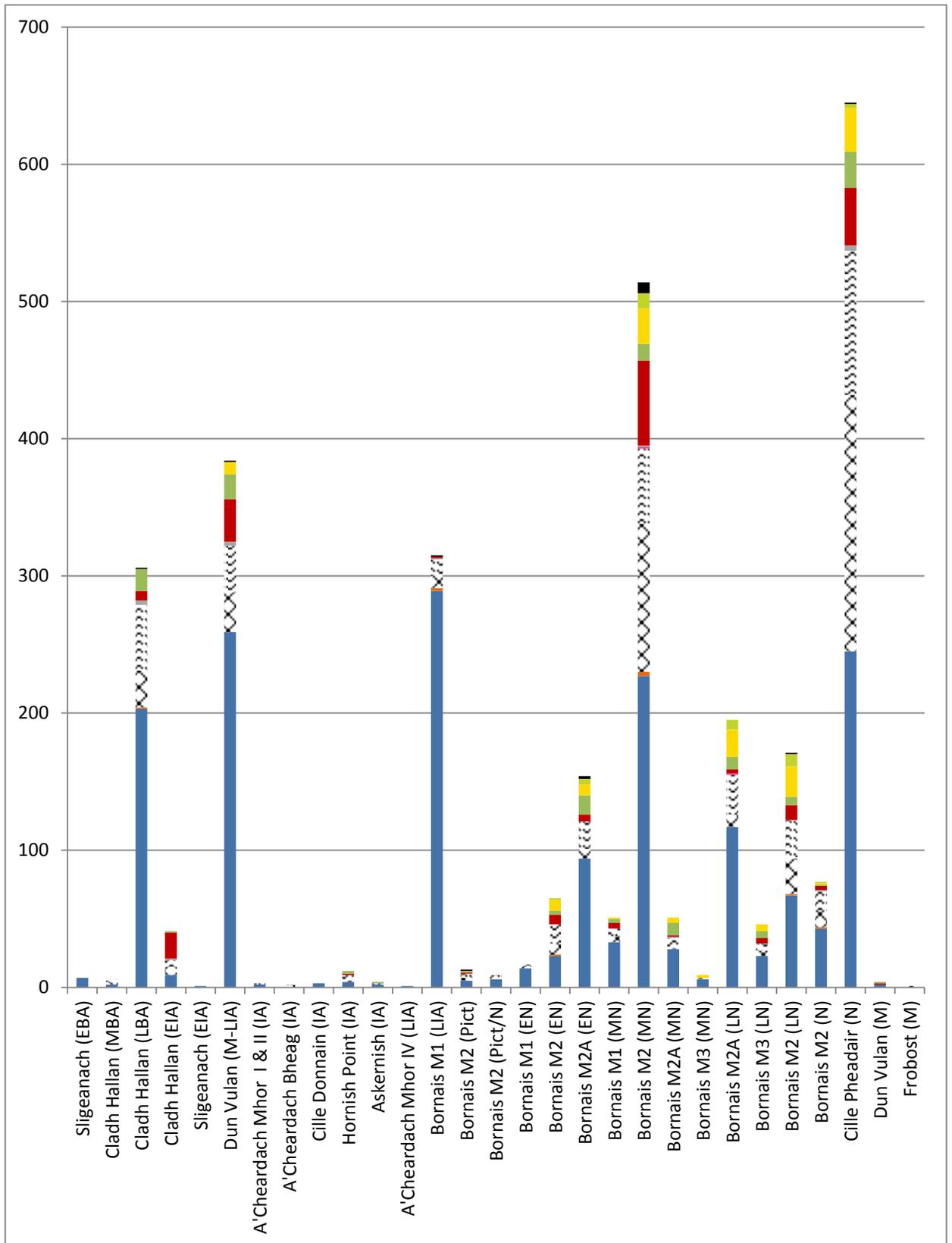


Table A4.4: Cille Pheadair NISP by Phase (Best and Cartledge In Press).

Species	Phase											Total
	0	1	2	3	4	5	6	7	8	9	U	
Small Wader	1	3	8	6	30	8	12	8	3	1		80
Herring / Lesser Black-Backed Gull		3	5	7	13	11	7	5	2	1		54
Great Black-Backed Gull			7	3	12	12	2	2				38
Gull <i>cf.</i> Great Black-Backed		1	1	2	2		2					8
Gull <i>cf.</i> Herring/Lesser Black-Backed					2	3	2					7
Great/Lesser Black-Backed Gull				1	1	1			1			4
Gull Sp.				1	1						1	3
Small Gull <i>cf.</i> Common						2	1					3
Common Gull / Kittiwake					1							1
Kittiwake			1									1
Small Gull <i>cf.</i> Kittiwake						1						1
Large Duck Sp.				2	3	4	3			3		15
Large Duck <i>cf.</i> Shelduck				2	2	3	1	3		2		13
Duck Sp.		1	2		3							6
Large Duck <i>cf.</i> Mallard					1	3	1		1			6
Teal		1			1	1						3
Duck <i>Anas</i> Sp. <i>cf.</i> Pintail					1							1
Shelduck				1			1		1	2		5
Large Duck <i>cf.</i> Mallard / Shelduck						1		2				3
Large Grey Goose <i>Anser</i> Sp.		2	3	2	4	8	2	1	1			23
Large Goose			1	1	6	5		3	1			17
Small Goose		1		1				2				4
<i>Anser Anser</i> Possibly Domestic					1	1						2
Goose Sp.			1		1							2
Black Goose Sp <i>cf. bernicula</i>									1			1
Plover <i>cf.</i> Golden			3	3	10	13	2	3				34
Small Passerine		1	1	3	8	5	2	10		1	2	33
Small Passerine <i>cf.</i> Starling				1		3	1		1			6
Gannet		2	5	4	6	7	1	6	1			32
Domestic Fowl		2	1		7	3	3	5	1			22
Domestic Fowl Bantam Size		1			1	3	1	4				10
Shag		1	2	1	6	6	2	3				21
Golden Plover			1		7	3	2	3		1		17
Fulmar			2	1	1	2	6	2	1			15
Cormorant		1	1	1	4	2	4	1		1		15
Galliform		1		1	5	4		1	1			13
Puffin		1		3	1		2	3	2			12
Wader <i>cf.</i> Golden or Grey Plover					1	2	5	2			1	11
Wader <i>cf.</i> Snipe						3	1	3	1			8
Carrion Crow/Rook				1	1	4						6
Whimbrel				1		1				4		6
Guillemot				1	3			1	1			6
Oystercatcher				1	1	4						6
Large Shearwater			1	3	2							6
Curlew				2	3							5
Razorbill/Guillemot			1			3	1					5
Common Crane					3	1						4
Manx Shearwater			1	2					1			4
Duck / Goose			1		2			1				4

Continued Table A4.4: Cille Pheadair NISP by Phase

Species Continued	Phase											Total
	0	1	2	3	4	5	6	7	8	9	U	
Medium Wader			2		1				1			
Starling						2	1					
Galliform <i>cf.</i> Red Grouse			2			1						
Galliform <i>cf.</i> Domestic Fowl		1			2							
Wader <i>cf.</i> Bar-Tailed Godwit								2	1			
Wader <i>cf.</i> Curlew				1						2		
Wader <i>cf.</i> Whimbrel		1								2		
Cormorant / Shag					1	1						
Razorbill							2					
Little Auk						1	1					
Large Shearwater <i>cf.</i> Great Shearwater			2									
Raven						1			1			
<i>Columba</i> Sp. <i>cf.</i> Rock / Stock Dove						2						
Wader					2							
White-Tailed Sea Eagle						1						
Great Northern Diver								1				
Plover <i>cf.</i> Grey				1								
Wader <i>cf.</i> Jacksnipe				1								
Wader <i>cf.</i> Oystercatcher			1									
Wader <i>cf.</i> Lapwing						1						
Large Wader					1							
Very Large Bird			3	13	5	6	1	1		2		
Small Bird	3		1	5	10		1			1	4	
Large Bird		1	3	1	4	3	1	4	2	1		
Medium Bird		5	1	1	4	7						
Bird		1	6			3					2	
Small/Medium Bird										10		
Tiny Bird			1		6							
Large / Very Large Bird				2	1		2			1		
Very Large Bird <i>cf.</i> Gannet			2		3				1			
Very Large Bird <i>cf.</i> Large Goose					2							
Large Bird <i>cf.</i> Gull					1			1				
Very Large Bird <i>cf.</i> Small Goose					1							
Large Bird <i>cf.</i> Large Duck Sp.					1							
Large Bird <i>cf.</i> Galliform		1										
Large Bird <i>cf.</i> Duck					1							
Large Bird <i>cf.</i> Goose			1									
Large Bird <i>cf.</i> Large Gull								1				
Large Bird <i>cf.</i> Large Shearwater				1								
Very Large Bird <i>cf.</i> Shag/Cormorant					1							
Large Bird <i>cf.</i> Raven						1						

Table A4.5: Summary table showing species by site and phase

	Bornais M1 (LIA)	Bornais M1 (EN)	Bornais M1 (MIN)	Bornais M2 (PN/Pict)	Bornais M2 (PN/Pict/N)	Bornais M2 (EN)	Bornais M2 (MIN)	Bornais M2 (LN)	Bornais M2 (N)	Bornais M2A (EN)	Bornais M2A (MIN)	Bornais M2A (LN)	Bornais M3 (LN)	Bornais M3 (MIN)	Cladh Hallan (MBA)	Cladh Hallan (LBA)	Cladh Hallan (EIA)	Dun Vulan (M-LIA)	Dun Vulan (Med)	A'Cheardach Mhor (IA)	A'Cheardach Mhor (LIA)	A'Cheardach Bheag (IA)	Cill Donnain (IA)	Cille Pheadair (N)	Hornish Point (IA)	Askernish (IA)	Frobost (Med)	Hornish Point (PMed)	Sligeanach (EBA)	Sligeanach (EIA)
FULMAR	1						10									5	1	3		1				15						
GANNET	5		7			1	3	9	4	6	2	21	3			102	1	24			1			32						
MANX SHEARWATER	12			1	1	2	6		2	8		1	1			1		11						4	2				1	
SOOTY SHEARWATER																														
SHEARWATER CF. MANX							1			5																			1	
LARGE SHEARWATER SP					1																			6						
SHEARWATER CF. GREAT																								2						
SHEARWATER SP									1							1														
CORMORANT	26		4			4	29	7	8	20	8	37	2	2		16	1	19					1	15						
SHAG	49	2					4		1	3		1	1			13	1	12						21		1				
CORMORANT/SHAG					1	2	5	3	4		2	3				3	1							2						
GREAT NORTHERN DIVER	1		1				2	13		3	2					2	1	3						1						
SMALL GULL / SKUA							2	1																						
GULL / WADER							2	3	1																					
CURLEW / HERRING GULL																1														
COMMON GULL								1																						
HERRING GULL													8																	1
COMMON / HERRING GULL																														
HERRING / LBB GULL	138	7	8		2	3	71	8	11	18	5	11				5	2	5						54						

Test 4.1

A (N=12) vs. B(N=12)	
Mean ranks:	3.958 8.542
T=Ub:	17
p(same):	0.001648
Monte Carlo p:	0.0008
Exact p:	0.0008498

Test 4.2

A (N=9) vs. B(N=11)	
Mean ranks:	3.4 7.1
T=Ub:	23
p(same):	0.04823
Monte Carlo p:	0.0467
Exact p:	0.04645

Table A4.6: South Uist Bronze Age sites in period order: NISP arranged by frequency

	Sligeanach (EBA)	Cladh Hallan (MBA)	Cladh Hallan (LBA)	TOTAL Bronze Age
GANNET		1	102	103
CORMORANT			16	16
SWAN SP			16	16
GREAT AUK			14	14
SHAG			13	13
GULL SP			10	10
PUFFIN	2		8	10
LARGE GREY GOOSE <i>CF.</i> GREYLAG			10	10
GREAT BLACK BACKED GULL			9	9
GROUSE (RED/WILLOW)			9	9
GOOSE SP			8	8
GUILLEMOT			7	7
CURLEW			7	7
FULMAR			5	5
HERRING / LESSER BLACK BACKED GULL	1		5	6
WADER <i>CF.</i> CURLEW		1	4	5
BRENT / BARNACLE GOOSE			5	5
SMALL PASSERINE			5	5
SNIBE			4	4
SWAN <i>CF.</i> WHOOPER			4	4
CORMORANT/SHAG			3	3
GREAT NORTHERN DIVER		1	2	3
ROCK / STOCK DOVE			3	3
MANX SHEARWATER	1		1	2
RAZORBILL			2	2
RAZORBILL / GUILLEMOT			2	2
LITTLE AUK	1		1	2
GOLDEN PLOVER			2	2
DUNLIN			2	2
JACKSNIBE			2	2
SMALL WADER SP			2	2
SHELDUCK			2	2
LARGE GREY GOOSE		2		2
CRANE			2	2
ROOK/CROW			2	2
STARLING			2	2
SHEARWATER <i>CF.</i> MANX	1			1
SHEARWATER SP			1	1
CURLEW / HERRING GULL			1	1
PUFFIN / BLACK GUILLEMOT	1			1
BLACK GUILLEMOT			1	1
OYSTERCATCHER			1	1
LAPWING			1	1
LAPWING / GODWIT			1	1
LARGE WADER SP			1	1
MEDIUM WADER SP		1		1
WATER RAIL			1	1
RED BREASTED MERGANSER			1	1
DUCK <i>CF.</i> MALLARD			1	1
TEAL			1	1
DUCK SP			1	1
RED GROUSE / PTARMIGAN			1	1
GALLIFORM SP			1	1
EAGLE <i>CF.</i> WHITE TAILED			1	1

Table A4.7: Cladh Hallan MNI by Period (including skeletons indicated by *) (Best and Mulville In Press)

Species	MNI LBA	MNI EIA
Gannet	5*	1
Cormorant	2	1
Goose Sp.	2	1
Large Grey Goose cf. Greylag	2	1
Brent / Barnacle Goose	1	
Gull Sp.	2	
Great Black-Backed Gull	1	
Herring / Lesser Black-Backed Gull	2	1
Swan Sp.	2	1
Swan cf. Whooper	1	
Great Auk	3	
Shag	2	1
Curlew	2	1
Small Passerine	2	2
Red Grouse	5	
Puffin	2	
Guillemot	2	
Fulmar	2	1
Snipe	1	
Shag / Cormorant	1	1
Large Wader cf. Curlew	1	
Starling	1	2*
Great Northern Diver	1	1
Carrion Crow / Rook	1	1
Dunlin	1	1
Rock / Stock Dove	1	
Small Wader	1	1
Razorbill / Guillemot	1	1
Golden Plover	1	
Oyster Catcher	1	1
Crane	1	
Jack Snipe	2	
Razorbill	1	
Shelduck	1	
Water Rail	1	1
Lapwing / Godwit	1	
Black Guillemot	1	
Curlew / Herring Gull	1	
Galliform Sp.	1	
Large Duck cf. Mallard	1	
Duck Sp.	1	
Lapwing	1	
Little Auk	1	
Manx Shearwater	1	
Raptor cf. Buzzard	1	
Eagle cf. White-Tailed	1	
Red Breasted Merganser	1	
Red Grouse / Ptarmigan	1	
Shearwater	1	
Teal	1	
Large Wader	1	

Table A4.8: South Uist Iron Age sites in period order: NISP arranged by frequency

	Cladh Hallan (EIA)	Sligeanach (EIA)	Dun Vulan (M-LIA)	A'Cheardach Bheag (IA)	Cill Donnain (IA)	Hornish Point (IA)	Askernish (IA)	A'Cheardach Mhor (IA)	A'Cheardach Mhor (LIA)	Bornais M1 (LIA)	TOTAL Iron Age
HERRING / LESSER BLACK BACKED GULL	2		5							138	145
SHAG	1		12				1			49	63
GREAT AUK			43			2				9	54
CORMORANT	1		19		1					26	47
STARLING	14		26								40
GULL SP			38								38
GREAT BLACK BACKED GULL			2				1			33	36
GUILLEMOT		1	31								32
PUFFIN			29		1			1		1	32
GANNET	1		24						1	5	31
MANX SHEARWATER			11			2				12	25
RAZORBILL / GUILLEMOT	1		18							2	21
RAVEN			17			1					18
WADER			17								17
DUCK SP			15								15
GULL CF. COMMON										12	12
GOOSE SP	3		6	2							11
RAZORBILL			9								9
CURLEW	3		1							5	9
MALLARD			3			5					8
OYSTERCATCHER	1		6								7
FULMAR	1		3					1		1	6
LITTLE AUK			6								6
DOMESTIC FOWL			6								6
GREAT NORTHERN DIVER	1		3							1	5
BRENT GOOSE			3							2	5
SMALL PASSERINE	5										5
DUCK CF. MALLARD							1			3	4
SWAN SP	1		2					1			4
KITTIWAKE			3								3
GOOSE CF. DOMESTIC			3								3
GREY GOOSE SP										3	3
GREY HERON			3								3
THRUSH SP			2			1					3
PASSERINE			2							1	3
TURNSTONE			2								2
WADER CF. BAR-TAILED GODWIT										2	2
WADER CF. OYSTERCATCHER										2	2
DUCK CF. EIDER										2	2
DUCK CF. SHELDUCK										2	2
TEAL			2								2
GREYLAG GOOSE			2								2
ROOK/CROW	1		1								2
SOOTY SHEARWATER			1								1
CORMORANT/SHAG	1										1
GULL CF. HERRING / LESSER BLACK BACKED					1						1
PUFFIN / BLACK GUILLEMOT			1								1
BLACK GUILLEMOT			1								1
GOLDEN PLOVER			1								1
LAPWING									1		1
DUNLIN	1										1
SNIPE			1								1
REDSHANK			1								1
SMALL WADER SP	1										1

Table A4.10: South Uist Norse Period sites in period order: NISP arranged by frequency

	Bornais M1 (EN)	Bornais M2 (EN)	Bornais M2A (EN)	Bornais M1 (MN)	Bornais M3 (MN)	Bornais M2 (MN)	Bornais M2A (MN)	Bornais M3 (LN)	Bornais M2 (LN)	Bornais M2A (LN)	Bornais M2 (N)	Cille Pheadair (N)	TOTAL Norse
HERRING / LESSER BLACK BACKED GULL	7	3	18	8		71	5		8	11	11	54	196
SMALL WADER SP		3	2			42	5		12	4	3	80	146
CORMORANT		4	20	4	2	29	8	2	7	37	8	15	136
GREAT BLACK BACKED GULL	3	2	12	7	1	44	7	4	4	3	4	38	129
DOMESTIC FOWL		8	8	1	2	26	4	4	22	20	1	22	118
GANNET		1	6	7		3	2	3	9	21	4	32	88
SMALL PASSERINE		2	5			33	1		8	1	1	33	84
PLOVER CF. GOLDEN				1		13			1		1	34	50
PUFFIN		2	12		1	10	1	1	2	3	2	12	46
GOOSE SP		3	5			9	2	4	7	7	5	2	44
LARGE GREY GOOSE CF. GREYLAG		3	7			15	4		2	9	2		42
GUILLEMOT		4	2			8		1	2	12	2	6	37
GALLIFORM CF. DOMESTIC FOWL		1	4			11			9	7	1	3	36
OYSTERCATCHER			2			20			1	3	2	6	34
SHAG	2		3			4		1		1	1	21	33
LARGE GOOSE		3				6			2	1	4	17	33
GALLIFORM SP		1	2			5			2	4		13	27
FULMAR						10						15	25
LARGE DUCK SP		1				3			3	3		15	25
LARGE GREY GOOSE			1			1						23	25
MANX SHEARWATER		2	8			6		1		1	2	4	24
SMALL GULL SP									5	17	1	1	24
GREAT NORTHERN DIVER			3	1		2	2		13			1	22
CORMORANT/SHAG		2				5	2		3	3	4	2	21
PASSERINE FINCH SIZE		5				12			2	1	1	21	21
WADER						12			4		2	2	20
RAZORBILL / GUILLEMOT	2			6	2	1		2	1			5	19
GOLDEN PLOVER								2				17	19
WADER CF. SNIPE		4	1			3			1		1	8	18
CURLEW				2		7		1	1			5	16
DUCK SP	1	2		1		2			1	1	1	7	16
DUCK CF. MALLARD			2			4			2		1	6	15
ROOK/CROW			1			3		1		4		6	15
GULL / SKUA CF. HERRING / LBB		1	1			8			2		2		14
ROCK / STOCK DOVE		2	4			2	1	4		1			14
DUCK CF. SHELDUCK												13	13
RAVEN			5	1			4				1	2	13
GULL CF. GREAT BLACK BACKED												12	12
WADER CF. GOLDEN OR GREY PLOVER												12	12
SMALL PASSERINE CF. STARLING						3			1	1		6	11
DUCK / GOOSE			2			2	1			1		4	10
DOMESTIC FOWL BANTAM SIZE								1				10	11
GULL CF. COMMON			1			3			1	1		3	9
RAZORBILL		1				2			2	2		2	9
GREYLAG GOOSE		2	1			3			2	1			9
BRENT / BARNACLE GOOSE						3	1		4			1	9
WHITE TAILED EAGLE			1			7						1	9
SMALL PASSERINE CF. THRUSH						8					1		9
COMMON / HERRING GULL								8					8
LARGE GULL SP			1			4			1	2			8
GREYLAG / DOMESTIC GOOSE				1	1				2	2		2	8
GULL SP			1			2			1			3	7
GULL CF. HERRING / LESSER BLACK BACKED												7	7
WHIMBREL			1									6	7
WADER CF. OYSTERCATCHER	1			1		3					1	1	7
WADER CF. CURLEW						2					2	3	7

WADER CF. PLOVER						6			1				7
TEAL			1			1		1				3	7
SHEARWATER CF. MANX			5			1							6
LARGE SHEARWATER SP												6	6
GULL / WADER						2			3			1	6
GULL / SKUA CF. GBB GULL			1			3	1		1				6
SHELDUCK											1	5	6
DUCK CF. MALLARD / SHELDUCK						1			1	1		3	6
SMALL GOOSE						2						4	6
SWAN SP						2			2	2			6
CRANE						1					1	4	6
COLUMBA SP CF. ROCK / STOCK			1				2		1			2	6
STARLING						3						3	6
GULL CF. KITTIWAKE						4						1	5
WADER CF. JACKSNIFE		1	1						1	1		1	5
AUK SP		1				2				1			4
MEDIUM WADER SP												4	4
DUCK CF. RED BREASTED MERGANSER						2			1		1		4
GROUSE (RED/WILLOW)						1	1		2				4
GALLIFORM CF. RED GROUSE									1			3	4
COLUMBA SP			1	2		1							4
PASSERINE				4									4
SMALL GULL / SKUA						2			1				3
WADER CF. BAR-TAILED GODWIT												3	3
WADER CF. WHIMBREL												3	3
LARGE WADER SP									2			1	3
PROCELLARIIDAE						1				2			3
THRUSH SP						3							3
SHEARWATER CF. GREAT												2	2
LITTLE AUK												2	2
SNIFE	1								1				2
WADER CF. LAPWING									1			1	2
WOODCOCK						1				1			2
DUCK CF. TEAL				2									2
GREY GOOSE SP				2									2
DUNNOCK								2					2
SHEARWATER SP											1		1
COMMON GULL									1				1
KITTIWAKE												1	1
PLOVER										1			1
TURNSTONE									1				1
WATER RAIL							1						1
EIDER						1							1
RED BREASTED MERGANSER		1											1
GOOSE / SWAN			1										1
WHOOPEE SWAN						1							1
LANDBIRD CF. CORNCRAKE							1						1
WHITE TAILED / GOLDEN EAGLE						1							1
SHORT EARED OWL									1				1
RAPTOR			1										1
SONGTHRUSH									1				1
SKYLARK									1				1

Table A4.11: Bronze Age Seasonal Distributions (for those identified species where season could be assigned)

Season	NISP	Percentage
Resident	67	24.91
Resident/Winter	20	7.43
Summer/Resident	12	4.46
Summer	145	53.90
Summer/Winter	13	4.83
Winter	12	4.46

Figure A4.11: Bronze Age Seasonal Distributions including *cf.* seasons – i.e. ‘*cf.* summer’

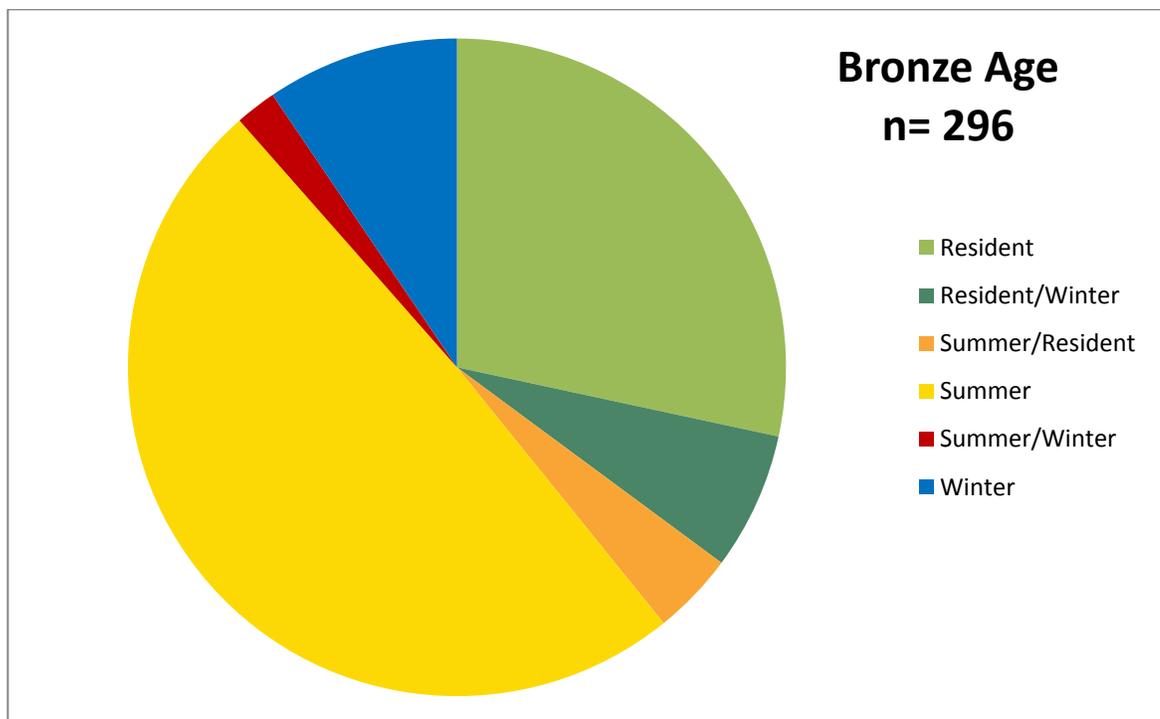


Table A4.12: Iron Age Seasonal Distributions (for those identified species where season could be assigned)

Season	NISP	Percentage
Resident	232	35.47
Resident/Winter	17	2.60
Summer/Resident	150	22.94
Summer	213	32.57
Summer/Winter	13	1.99
Winter	19	2.91
Passage	1	0.15
Domestic	9	1.38

Figure A4.12: Iron Age Seasonal Distributions including *cf.* seasons – i.e. ‘*cf.* summer’

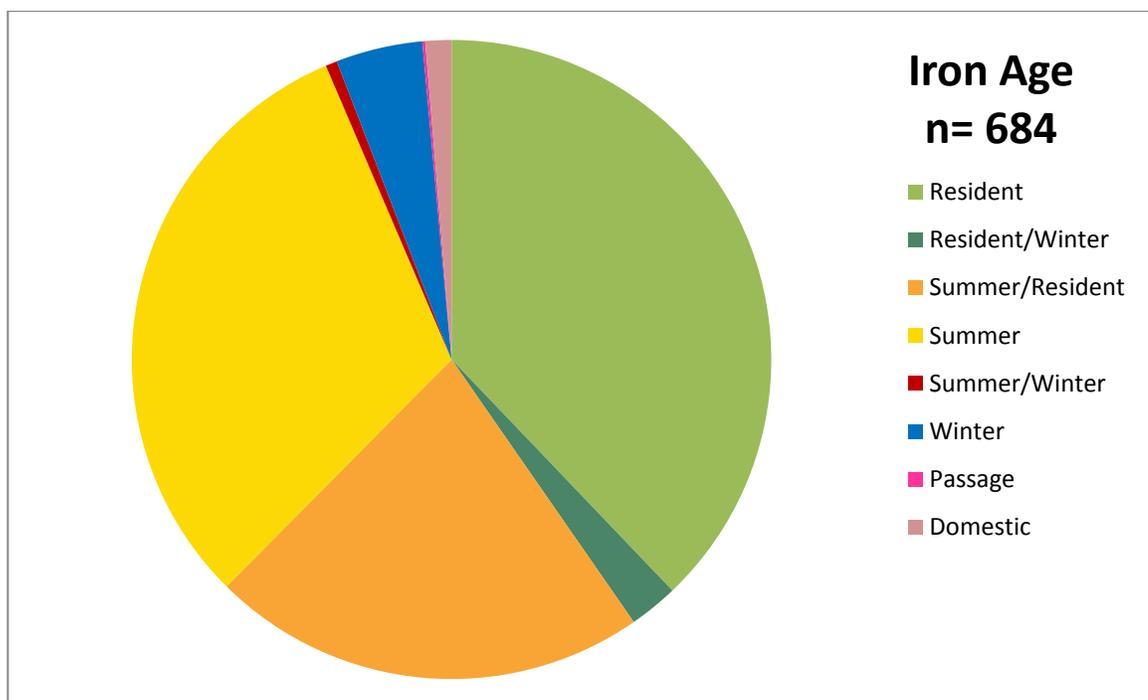


Table A4.13: Pre-Norse/Pictish Seasonal Distributions (for those identified species where season could be assigned)

Season	NISP	Percentage
Resident	1	16.67
Resident/Winter	2	33.33
Summer	3	50.00

Figure A4.13: Pre-Norse/Pictish Seasonal Distributions including *cf.* seasons – i.e. ‘*cf.* summer’

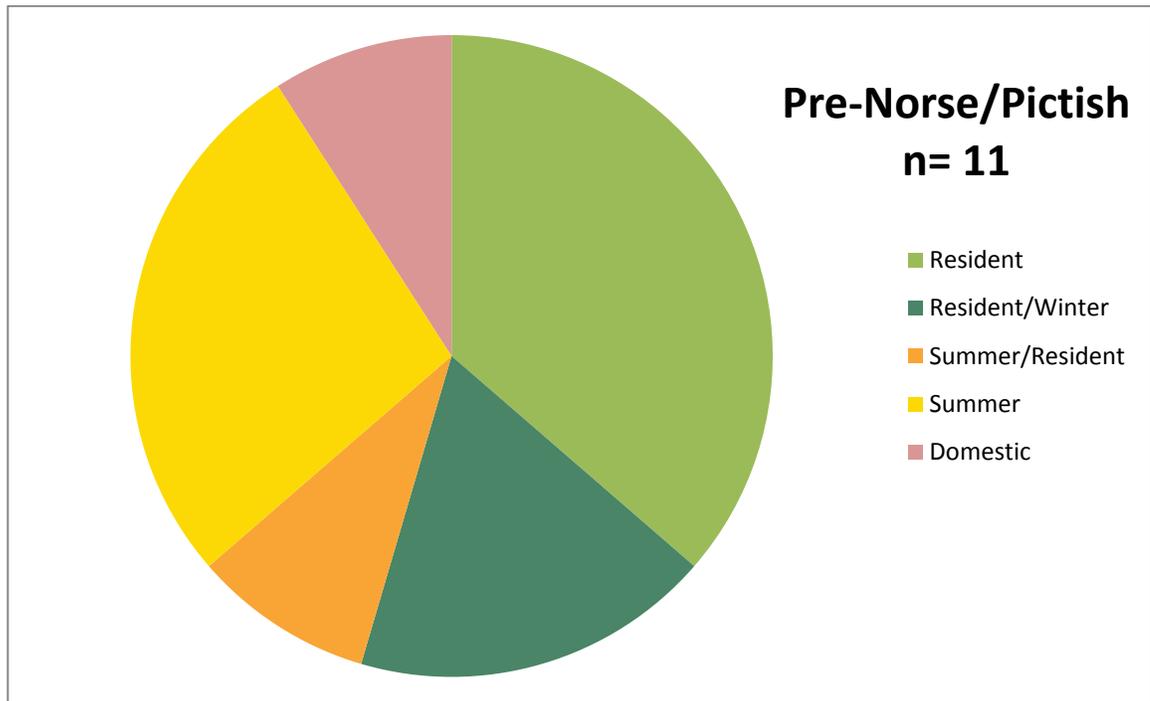


Table A4.14: Norse Seasonal Distributions (for those identified species where season could be assigned)

Season	NISP	Percentage
Resident	474	34.80
Resident/Winter	161	11.82
Summer	256	18.80
Summer/Resident	208	15.27
Summer/Winter	75	6.68
Winter	51	2.57
Passage	8	0.59
Domestic	129	9.47

Figure A4.14: Norse Seasonal Distributions including *cf.* seasons – i.e. ‘*cf.* summer’

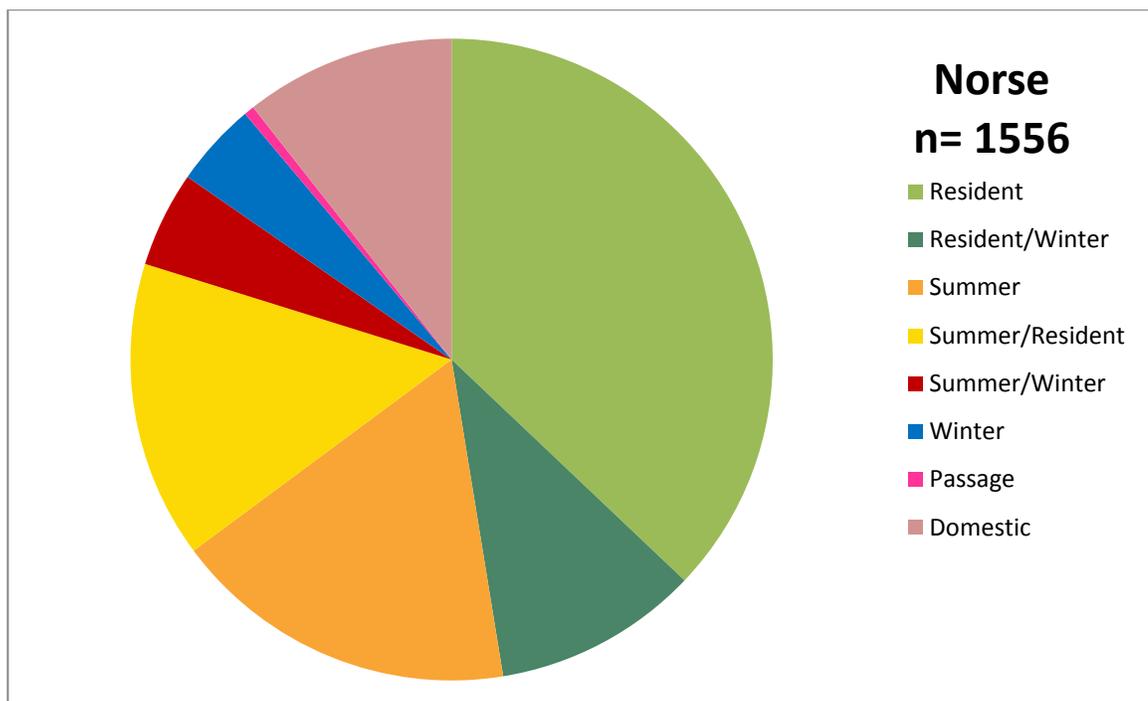


Table A4.15: Bronze Age NISP by seasonal category (*cf.* season data in grey at bottom)

SITE NAME	SEASON	Sligeanach (EBA)	Cladh Hallan (MBA)	Cladh Hallan (LBA)	TOTAL
CORMORANT	Resident			16	16
SHAG	Resident			13	13
CORMORANT/SHAG	Resident			3	3
SHELDUCK	Resident			2	2
RED BREASTED MERGANSER	Resident			1	1
EAGLE <i>CF.</i> WHITE TAILED	Resident			1	1
GROUSE (RED/WILLOW)	Resident			9	9
GALLIFORM SP	Resident			1	1
RED GROUSE / PTARMIGAN	Resident			1	1
OYSTERCATCHER	Resident			1	1
LAPWING	Resident			1	1
GREAT BLACK BACKED GULL	Resident			9	9
BLACK GUILLEMOT	Resident			1	1
WATER RAIL	Resident			1	1
ROCK / STOCK DOVE	Resident			3	3
ROOK/CROW	Resident			2	2
STARLING	Resident			2	2
GOOSE SP	Resident/Winter			8	8
LARGE GREY GOOSE	Resident/Winter		2		2
LARGE GREY GOOSE <i>CF.</i> GREYLAG	Resident/Winter			10	10
SNIPE	Summer/Resident			4	4
TEAL	Summer/Resident			1	1
HERRING / LESSER BLACK BACKED GULL	Summer/Resident	1		5	6
PUFFIN / BLACK GUILLEMOT	Summer/Resident	1			1
MANX SHEARWATER	Summer	1		1	2
FULMAR	Summer Visitor to Land			5	5
GANNET	Summer Visitor to Land		1	102	103
RAZORBILL	Summer Visitor to Land			2	2
GUILLEMOT	Summer Visitor to Land			7	7
RAZORBILL / GUILLEMOT	Summer Visitor to Land			2	2
PUFFIN	Summer Visitor to Land	2		8	10
GREAT AUK	Summer Visitor to Land			14	14
GOLDEN PLOVER	Summer/Winter			2	2
DUNLIN	Summer/Winter			2	2
CURLEW	Summer/Winter			7	7
CRANE	Summer/Winter Passage			2	2
BRENT / BARNACLE GOOSE	Winter			5	5
GREAT NORTHERN DIVER	Winter		1	2	3
JACKSNIFE	Winter			2	2
LITTLE AUK	Winter	1		1	2
SWAN SP	<i>cf.</i> Resident			16	16
DUCK <i>CF.</i> MALLARD	<i>cf.</i> Resident			1	1
SHEARWATER <i>CF</i> MANX	<i>cf.</i> Summer	1			1
SWAN <i>CF.</i> WHOOPER	<i>cf.</i> Winter			4	4
WADER <i>CF.</i> CURLEW	<i>cf.</i> Winter		1	4	5

Table A4.16: Iron Age NISP by seasonal category (*cf.* season data in grey at bottom)

	SEASON	Cladh Hallan (EIA)	Sligeanach (EIA)	Dun Vulan (M-LIA)	A'Cheardach Mhor (IA)	A'Cheardach Bheag (IA)	Cill Donnain (IA)	Hornish Point (IA)	Askernish (IA)	A'Cheardach Mhor (LIA)	Bornais M1 (LIA)	TOTAL
GOOSE <i>CF.</i> DOMESTIC	Domestic			3								3
DOMESTIC FOWL	Domestic			6								6
SOOTY SHEARWATER	Passage			1								1
CORMORANT	Resident	1		19			1				26	47
SHAG	Resident	1		12				1			49	63
CORMORANT/SHAG	Resident	1										1
GREY HERON	Resident			3								3
MALLARD	Resident			3				5				8
WHITE TAILED EAGLE	Resident			1								1
PEREGRINE FALCON	Resident										1	1
GALLIFORM SP	Resident							1				1
OYSTERCATCHER	Resident	1		6								7
LAPWING	Resident										1	1
GREAT BLACK BACKED GULL	Resident			2				1			33	36
BLACK GUILLEMOT	Resident			1								1
WATER RAIL	Resident	1										1
ROOK/CROW	Resident	1		1								2
RAVEN	Resident			17				1				18
CORVID SP	Resident							1				1
STARLING	Resident	14		26								40
GREYLAG GOOSE	Resident/Winter			2								2
GREY GOOSE SP	Resident/Winter										3	3
GOOSE SP	Resident/Winter	3		6		2						11
LARGE GREY GOOSE <i>CF.</i> GREYLAG	Resident/Winter	1										1
MANX SHEARWATER	Summer			11				2			12	25
FULMAR	Summer Visitor to Land	1		3	1						1	6
GANNET	Summer Visitor to Land	1		24					1		5	31
KITTIWAKE	Summer Visitor to Land			3								3
RAZORBILL	Summer Visitor to Land			9								9
GUILLEMOT	Summer Visitor to Land		1	31								32
RAZORBILL / GUILLEMOT	Summer Visitor to Land	1		18							2	21
PUFFIN	Summer Visitor to Land			29	1		1				1	32
GREAT AUK	Summer Visitor to Land			43				2			9	54
SNIPE	Summer/Resident			1								1
TEAL	Summer/Resident			2								2
HERRING / LBB GULL	Summer/Resident	2		5							138	145
PUFFIN / BLACK GUILLEMOT	Summer/Resident			1								1
PIED WAGTAIL	Summer/Resident			1								1
GOLDEN PLOVER	Summer/Winter			1								1
DUNLIN	Summer/Winter	1										1
REDSHANK	Summer/Winter			1								1
CURLEW	Summer/Winter	3		1							5	9
CRANE	Summer/Winter Passage										1	1
BRENT GOOSE	Winter			3							2	5
BRENT / BARNACLE GOOSE	Winter			1								1
GREAT NORTHERN DIVER	Winter	1		3							1	5
TURNSTONE	Winter			2								2
LITTLE AUK	Winter			6								6
SWAN SP	<i>cf.</i> Resident	1		2	1							4
DUCK <i>CF.</i> TEAL	<i>cf.</i> Resident										1	1
DUCK <i>CF.</i> MALLARD	<i>cf.</i> Resident							1			3	4
DUCK <i>CF.</i> SHELDUCK	<i>cf.</i> Resident										2	2
DUCK <i>CF.</i> EIDER	<i>cf.</i> Resident										2	2
GULL <i>CF.</i> COMMON	<i>cf.</i> Resident										12	12
WADER <i>CF.</i> OYSTERCATCHER	<i>cf.</i> Resident										2	2
GULL <i>CF.</i> HERRING / LBB	<i>cf.</i> Summer/Resident						1					1
WADER <i>CF.</i> BAR-TAILED GODWIT	<i>cf.</i> Winter										2	2

Table A4.17: Pre-Norse/Pictish NISP by seasonal category (*cf.* season data in grey at bottom)

SPECIES	SEASON	Bornais M2 (PN/Pict)
WHITE TAILED EAGLE	Resident	1
LARGE GREY GOOSE <i>CF.</i> GREYLAG	Resident/Winter	2
MANX SHEARWATER	Summer	1
GUILLEMOT	Summer Visitor to Land	1
PUFFIN	Summer Visitor to Land	1
GALLIFORM <i>CF.</i> DOMESTIC FOWL	<i>cf.</i> Domestic	1
GREYLAG / DOMESTIC GOOSE	<i>cf.</i> Resident	1
GULL <i>CF.</i> COMMON	<i>cf.</i> Resident	2
WADER <i>CF.</i> SNIPE	<i>cf.</i> Summer/Resident	1

Table A4.18: Norse NISP by seasonal category (*cf.* season data in grey at bottom)

	SEASON	Bornais M1 (EN)	Bornais M2 (EN)	Bornais M2A (EN)	Bornais M1 (MN)	Bornais M2 (MN)	Bornais M2A (MN)	Bornais M3 (MN)	Bornais M2A (LN)	Bornais M3 (LN)	Bornais M2 (LN)	Bornais M2 (N)	Cille Pheadair (N)	TOTAL
DOMESTIC FOWL	Domestic		8	8	1	26	4	2	20	4	22	1	22	118
DOMESTIC FOWL BANTAM SIZE	Domestic									1			10	11
SHEARWATER <i>CF.</i> GREAT	Passage												2	2
LARGE SHEARWATER SP	Passage												6	6
CORMORANT	Resident		4	20	4	29	8	2	37	2	7	8	15	136
SHAG	Resident	2		3		4			1	1		1	21	33
CORMORANT/SHAG	Resident		2			5	2		3		3	4	2	21
SHELDUCK	Resident											1	5	6
EIDER	Resident					1								1
RED BREASTED MERGANSER	Resident		1											1
WHITE TAILED EAGLE	Resident			1		7							1	9

SMALL GULL / SKUA	Summer/Resident					2				1			3	
HERRING / LBB Gull	Summer/Resident	7	3	18	8	71	5		11		8	11	54	196
GOLDEN PLOVER	Summer/Winter									2			17	19
PLOVER <i>CF.</i> GOLDEN	Summer/Winter				1	13					1	1	34	50
CURLEW	Summer/Winter				2	7				1	1		5	16
CRANE	Summer/Winter Passage					1						1	4	6
WHOOPEE SWAN	Winter					1								1
BRENT / BARNACLE GOOSE	Winter					3	1				4		1	9
GREAT NORTHERN DIVER	Winter			3	1	2	2				13		1	22
TURNSTONE	Winter									1				1
LITTLE AUK	Winter												2	2
GALLIFORM <i>CF.</i> DOMESTIC FOWL	<i>cf.</i> Domestic		1	4		11		7		9	1	3	36	
SWAN SP	<i>cf.</i> Resident					2		2		2			6	
GREYLAG / DOMESTIC GOOSE	<i>cf.</i> Resident				1		1	2		2		2	8	
COLUMBA SP	<i>cf.</i> Resident			1	2	1							4	
DUCK <i>CF.</i> TEAL	<i>cf.</i> Resident				2								2	
DUCK <i>CF.</i> MALLARD	<i>cf.</i> Resident			2		4				2	1	6	15	
DUCK <i>CF.</i> SHELDUCK	<i>cf.</i> Resident											13	13	
DUCK <i>CF.</i> R-BM	<i>cf.</i> Resident					2				1	1		4	
GULL <i>CF.</i> COMMON	<i>cf.</i> Resident			1		3		1		1		3	9	
WADER <i>CF.</i> OYSTERCATCHER	<i>cf.</i> Resident	1			1	3					1	1	7	
GULL <i>CF.</i> GREAT BLACK BACKED	<i>cf.</i> Resident											12	12	
SMALL PASSERINE <i>CF.</i> STARLING	<i>cf.</i> Resident					3		1		1		6	11	
GALLIFORM <i>CF.</i> RED GROUSE	<i>cf.</i> Resident									1		3	4	
DUCK <i>CF.</i> MALLARD / SHELDUCK	<i>cf.</i> Resident					1		1		1		3	6	
WADER <i>CF.</i> LAPWING	<i>cf.</i> Resident									1		1	2	
LANDBIRD <i>CF.</i> CORNCRAKE	<i>cf.</i> summer						1						1	
GULL <i>CF.</i> KITTIWAKE	<i>cf.</i> summer					4						1	5	
SHEARWATER <i>CF.</i> MANX	<i>cf.</i> Summer			5		1							6	
WADER <i>CF.</i> WHIMBREL	<i>cf.</i> Summer											3	3	
GULL <i>CF.</i> HERRING / LBB GULL	<i>cf.</i> Summer/Resident											7	7	
WADER <i>CF.</i> SNIPE	<i>cf.</i> Summer/Resident		4	1		3				1	1	8	18	
WADER <i>CF.</i> BAR-TAILED GODWIT	<i>cf.</i> Winter											3	3	
WADER <i>CF.</i> CURLEW	<i>cf.</i> Winter					2					2	3	7	
WADER <i>CF.</i> JACKSNIFE	<i>cf.</i> Winter		1	1				1		1		1	5	

Table A4.19: Cille Pheadair juvenile birds both by age stage (identifiable and unidentifiable)

Species	Very Young	Immature	Sub-adult	Possible Sub-adult	Total
Galliform		5			5
Fulmar			3		3
Small Wader		1	1	5	7
Duck Sp.		2		1	3
Galliform <i>cf.</i> Domestic Fowl	2				2
Gull <i>cf.</i> Great Black-Backed		2			2
Large Grey Goose <i>Anser</i> Sp.			2		2
Great Black-Backed Gull		1		3	4
Manx Shearwater		1		2	3
Herring / Lesser Black-Backed Gull		1		1	2
Large Duck Sp.		1		1	2
Wader <i>cf.</i> Golden or Grey Plover		1		1	2
Domestic Fowl Bantam Size		1			1
Golden Plover		1			1
Medium Wader			1		1
Plover <i>cf.</i> Golden		1			1
Razorbill			1		1
Cormorant				2	2
Guillemot				2	2
Gannet				1	1
Domestic Fowl				1	1
Large Shearwater Sp.				1	1
Oystercatcher				1	1
Small Goose				1	1
Small Passerine				1	1
Large Bird	1	4			5
Medium Bird		2			2
Bird	1	1			2
Large Bird <i>cf.</i> Galliform		1			1
Large Bird <i>cf.</i> Large Duck Sp.			1		1
Small Bird		1			1
Very Large Bird	1				1
Very Large Bird <i>cf.</i> Gannet				1	1
Tiny Bird				1	1
Total	5	27	9	26	67

Table A4.20: Juveniles by phase for Bornais Mound 2 and Mound 2A. Grey highlighting indicates possible subadults.

Phase	Species	Frequency	Phase	Species	Frequency
Pre-Norse/Pictish	Galliform <i>cf.</i> Domestic Fowl	1	Late Norse	Domestic Fowl	1
Pre-Norse/Pictish	Medium / Large Bird	1	Late Norse	Galliform <i>cf.</i> Domestic Fowl	4
Pre-Norse/Pictish	Very Large Bird	1	Late Norse	Galliform Sp.	1
PN/Pictish/Norse	Goose Sp.	1	Late Norse	Gannet	10
Early Norse	Anatidae <i>cf.</i> Black Goose	2	Late Norse	Gull / Wader	1
Early Norse	Bird	5	Late Norse	Gull <i>cf.</i> Small Gull	16
Early Norse	Carrion Crow / Rook	1	Late Norse	Gull Sp.	1
Early Norse	<i>Cf.</i> Galliform	1	Late Norse	Herring / LBB Gull	1
Early Norse	<i>Cf.</i> Gull	1	Late Norse	Large Bird	4
Early Norse	Herring / LBB Gull	1	Late Norse	Large Duck Sp.	1
Early Norse	Large Bird	1	Late Norse	Medium / Large Bird	3
Early Norse	Manx Shearwater	2	Late Norse	Medium + Bird	7
Early Norse	Medium + Bird	2	Late Norse	Medium Bird	9
Early Norse	Medium Bird	4	Late Norse	Plover Sp.	1
Early Norse	Shag	1	Late Norse	Puffin	1
Early Norse	Shearwater Sp. <i>cf.</i> Manx	3	Late Norse	Small / Medium Bird	4
Early Norse	Very Large Bird / Large Bird	5	Late Norse	Small Bird	1
Middle Norse	Bird	5	Late Norse	Very / Large Bird	1
Middle Norse	<i>Cf.</i> Large Wader	1	Late Norse	Very Large Bird	5
Middle Norse	<i>Cf.</i> Shearwater	1	Norse	<i>Cf.</i> Teal	1
Middle Norse	<i>Cf.</i> Small Wader	1	Norse	Duck <i>cf.</i> Goldeneye	1
Middle Norse	Common Crane	1	Norse	Galliform <i>cf.</i> Domestic Fowl	1
Middle Norse	Domestic Fowl	1	Norse	Gannet	1
Middle Norse	Eagle Sp. <i>cf.</i> White-Tailed Eagle	1	Norse	Large Bird	4
Middle Norse	Galliform <i>cf.</i> Domestic Fowl	5	Norse	Medium + Bird	3
Middle Norse	Great Black-Backed Gull	3	Norse	Merganser <i>cf.</i> Red-Breasted	1
Middle Norse	Gull <i>cf.</i> Kittiwake	1	Norse	Puffin	1
Middle Norse	Herring / LBB Gull	4	Norse	Very / Large Bird	2
Middle Norse	Large Bird	4	Early Norse	<i>Cf.</i> Gannet	1
Middle Norse	Large Grey Goose Sp.	1	Early Norse	Galliform <i>cf.</i> Domestic Fowl	1
Middle Norse	Manx Shearwater	3	Early Norse	Gannet	1
Middle Norse	Medium / Large Bird	1	Early Norse	Guillemot	1
Middle Norse	Medium + Bird	6	Early Norse	Manx Shearwater	2
Middle Norse	Medium Bird	10	Late Norse	Domestic Fowl	1
Middle Norse	Oystercatcher	1	Late Norse	Gannet	1
Middle Norse	Shearwater Sp. <i>cf.</i> Manx	1	Late Norse	Gannet	1
Middle Norse	Small / Medium Bird	2	Late Norse	Herring / LBB Gull	1
Middle Norse	Small Bird	11	Late Norse	Large Goose	1
Middle Norse	Small Passerine	1	Late Norse	Very / Large Bird	1
Middle Norse	Small Passerine <i>cf.</i> thrush	1	Middle Norse	<i>Cf.</i> Goose Sp.	2
Middle Norse	Small Passerine <i>cf.</i> thrush	1	Middle Norse	Cormorant	1
Middle Norse	Small Wader Sp.	4	Middle Norse	Gannet	1
Middle Norse	Very / Large Bird	14	Middle Norse	Great Black-Backed Gull	1
Middle Norse	Very Large Bird	2	Middle Norse	Guillemot	2
Middle Norse	Wader <i>cf.</i> Oystercatcher	1	Middle Norse	Herring / LBB Gull	3
Middle Norse	Wader <i>cf.</i> Plover	1	Middle Norse	Medium Bird	1
Late Norse	Bird	42	Middle Norse	Small Passerine	1
Late Norse	<i>Cf.</i> Auk / Gull	1	Middle Norse	Wader <i>cf.</i> Woodcock	1
Late Norse	<i>Cf.</i> Gannet	1	Norse	Gannet	1
Late Norse	Common Gull	1	Norse	Medium / Large Bird	1

Table A4.21: Full medullary bone data from all South Uist sites. Fill: + thin layer, ++ intermediate fill, +++ almost fills cortex of bone (Following Lentacker and Van Neer 1996, 488-496).

PERIOD	SITE	SPECIES	ELEMENT	SEX	FREQUENCY
Pre-Norse/Pictish	Bornais M2	Small Wader	Humerus	Female	1 (+)
Norse L10th/E11th - M/L13th	Cille Pheadair	Domestic Fowl	Femur	Female	2 (++)
Norse L10th/E11th - M/L13th	Cille Pheadair	Domestic Fowl Bantam Size	Ulna	Female	1 (+)
Norse L10th/E11th - M/L13th	Cille Pheadair	Duck / Goose	Femur	Female	1 (++)
Norse L10th/E11th - M/L13th	Cille Pheadair	Gannet	Tibiotarsus	Female	1 (++)
Norse L10th/E11th - M/L13th	Cille Pheadair	Herring / LBB Gull	Humerus	Female	1 (++)
Norse L10th/E11th - M/L13th	Cille Pheadair	Herring / LBB Gull	Tibiotarsus	Female	1 (++)
Norse L10th/E11th - M/L13th	Cille Pheadair	Large Duck Sp	Femur	Female	1 (+++)
Early Norse	Bornais M2A	<i>Cf.</i> Wader	Radius	Female	1 (++)
Early Norse	Bornais M2A	Domestic Fowl	Femur	Female	1 (++)
Early Norse	Bornais M2A	Domestic Fowl	Coracoid	Female	1 (++)
Early Norse	Bornais M2A	Galliform <i>cf.</i> Domestic Fowl	Femur	Female	1 (++)
Middle Norse	Bornais M2A	Domestic Fowl	Femur	Female	1 (++)
Late Norse	Bornais M2A	<i>Cf.</i> Galliform	Femur	Female	1 (++)
Late Norse	Bornais M2A	Domestic Fowl	Femur	Female	1 (++)
Late Norse	Bornais M2A	Domestic Fowl	Femur	Female	1 (++)
Late Norse	Bornais M2A	Domestic Fowl	Tibiotarsus	Female	1 (++)
Late Norse	Bornais M2A	Very / Large Bird	Long Bone Fragment	Possible Female	1 (P+)
Early Norse	Bornais M2	Medium + Bird	Long Bone Fragment	Female	1 (++)
Early Norse	Bornais M2	Puffin	Ulna	Possible Female	1 (P+)
Middle Norse	Bornais M2	Bird	Long Bone Fragment	Female	1 (++)
Middle Norse	Bornais M2	Domestic Fowl	Femur	Female	1 (++)
Middle Norse	Bornais M2	Domestic Fowl	Tibiotarsus	Female	1 (++)
Middle Norse	Bornais M2	Domestic Fowl	Ulna	Female	1 (+)
Middle Norse	Bornais M2	Domestic Fowl	Tarsometatarsus	Female	1 (P+)
Middle Norse	Bornais M2	Domestic Fowl	Tibiotarsus	Female	1 (++)
Middle Norse	Bornais M2	Duck <i>cf.</i> R-BM	Tibiotarsus	Female	1 (++)
Middle Norse	Bornais M2	Galliform <i>cf.</i> Domestic Fowl	Femur	Female	1 (++)
Middle Norse	Bornais M2	Galliform <i>cf.</i> Domestic Fowl	Tibiotarsus	Female	1 (++)
Middle Norse	Bornais M2	Very / Large Bird	Long Bone Fragment	Female	1 (++)
Late Norse	Bornais M2	Domestic Fowl	Tarsometatarsus	Possible Female	1 (++)
Late Norse	Bornais M2	Domestic Fowl	Tibiotarsus	Female	1 (++)
Late Norse	Bornais M2	Domestic Fowl	Tibiotarsus	Female	1 (++)
Late Norse	Bornais M2	Domestic Fowl	Femur	Female	1 (++)
Late Norse	Bornais M2	Galliform <i>cf.</i> Domestic Fowl	Tibiotarsus	Female	1 (++)
Unknown <i>cf.</i> Norse	Bornais M2	Puffin	Femur	Female	1 (++)

Table A4.22: Butchery data from Late Bronze Age Cladh Hallan (Best and Mulville in Press, 400)

Species	Knife Cut	Worked	Knife Cuts	
			& Separate Working	Possible Knife Cuts
Gannet	14	2		3
Cormorant	6	1		
Great Auk	4			
Swan Sp.	4	1	1	
Goose Sp.	2	2	1	
Great Black-Backed Gull	2	2		
Great Northern Diver	1			
Crane	1			
Curlew	1			
Gull Sp.	1			
Herring / Lesser Black-Backed Gull	1			
Lapwing / Godwit	1			
Puffin	1	1		
Red Grouse	1			
Rock / Stock Dove	1			
Shag	1	2	2	1
Large Duck <i>cf.</i> Mallard		1		
Black Guillemot				1
<i>cf.</i> Raptor				1
Fulmar		1		
Guillemot				1
Razorbill / Guillemot				1
Very / Large Bird	1			
Large Bird	2	1		
Bird	2	7		
Very Large Bird	5	3		

Table A4.23: Butchery data from Early Iron Age Cladh Hallan (Best and Mulville in Press, 400)

Species	Knife Cut	Possible Knife Cuts
Great Northern Diver	1	
Goose	1	
Crow / Rook	1	
Shag / Cormorant		1
Starling		2
Bird		1

Table A4.24: The partial Butchery from Bornais Mounds 1 and 3, Dun Vulcan and Hornish Point

SITE NAME	PERIOD	SPECIES	ELEMENT	TYPE	LOCATION	Freq.
Hornish Point	IA	Great Auk	Coracoid	Chop or heavy cut	Sternum articulation	1
Hornish Point	IA	Great Auk	Tibiotarsus	Knife Cuts	shaft	1
Dun Vulcan	M - L IA	Crane	Unknown	Worked	Tube lattice pattern	1
Bornais M1	LIA	Crane	Unknown	Unknown		1
Bornais M1	LIA	Great Auk	Unknown	Unknown		2
Bornais M1	LIA	Cormorant	Unknown	Unknown		1
Bornais M1	LIA/N	Shag	Unknown	Unknown		1
Bornais M1	LIA/N	Gull	Unknown	Unknown		1
Bornais M1	LIA/N	Razorbill / Guillemot	Unknown	Unknown		1
Bornais M1	LIA/N	Goose Sp.	Unknown	Unknown		1
Bornais M2	PN/Pict	Large Grey Goose <i>cf.</i> Greylag	Furcula	Knife Cut	Proximal	1
Bornais M2	PN/Pict/N	Goose Sp	Ulna	Knife Cut	Distal Shaft	1
Bornais M2	PN/Pict/N	Manx Shearwater	Tarsometatarsus	Knife Cut	Proximal Articulation	1
Bornais M3	N	Cormorant	Radius	Knife Cut		1
Hornish Point	PMed	Mallard	Humerus	Knife Cut	Proximal articulation	1

Table A4.25: Butchery from Bornais Mound 2A Norse Periods

Species	Knife Cut	Cut & Disarticulated	Possibly Knife Cut	Possibly Worked
Crow / Rook	1			
Seabird <i>cf.</i> Gannet	1			
Cormorant	6		1	
Domestic Fowl	5	1		
Duck / Goose	1			
Galliform Sp.	1			
Gannet	5			
Goose Sp.	1			
Great Black-Backed Gull	5		1	
Guillemot	1		1	
Herring / Lesser Black-Backed Gull	1			
Large Duck Sp.	2			
Large Grey Goose <i>cf.</i> Greylag	2		1	
Large Grey Goose Sp.	1			
Shag / Cormorant	1			
Shearwater Sp. <i>cf.</i> Manx	1			
White-Tailed Eagle	1			
Bird	1			
Very / Large Bird	2			
Very Large Bird	1		2	1

Table A4.26: Butchery from Bornais Mound 2 Norse Periods

Species	Chop	Knife Cut	Worked	Chop & Cut	Possibly Cut	Possibly Worked	Prob Cut & Pos Work
Herring / Lesser Black-Backed Gull	1	8			1		1
Cormorant		7			1		
Domestic Fowl		5		1			
Large Goose		5				1	
White-Tailed Eagle		4					
Goose Sp.		2			1		
Great Northern Diver	1	3			1		
Gannet		2	1				
Great Black-Backed Gull	1	2					
Greylag Goose		2			1		
Large Grey Goose <i>cf.</i> Greylag		1					
Shag / Cormorant		2					
Wader <i>cf.</i> Curlew		1					
Waterbird <i>cf.</i> Goose Sp.		1					
Common Crane		1					
Guillemot		1					
Large Gull / Skua		1					
Razorbill		1					
Shag		1					
Shearwater Sp.		1					
Shelduck		1					
Swan Sp.		1					
Wader Sp.		1					
Seabird <i>cf.</i> Gull					1		
Gull / Skua <i>cf.</i> Herring / LBB Gull					1		
Large Bird		2	2		1		
Medium / Large Bird						1	
Medium + Bird			1				
Very / Large Bird		2					
Very Large Bird		5				1	
Bird		4					

Table A4.27: Butchery from Norse Cille Pheadair (Best and Cartledge In Press)

Species	Knife Cut	Worked	Chop & Cut	Possible Cuts
Large Goose	8			
Large Grey Goose <i>Anser</i> Sp.	5		1	
Shag	5	1		1
Gannet	4			2
Herring / Lesser Black-Backed Gull	4			
Cormorant	3			1
Domestic Fowl	3			1
Galliform <i>cf.</i> Red Grouse	2			
Great Black-Backed Gull	2			
Plover <i>cf.</i> Golden	2			
Domestic Fowl Bantam Size	1			1
Duck / Goose	1			
Large Duck <i>cf.</i> Mallard	1			1
Large Duck <i>cf.</i> Mallard / Shelduck	1			
Shelduck	1			
Duck Sp.	1			
Fulmar	1			1
Galliform	1			
Golden Plover	1			
Guillemot	1			
Manx Shearwater	1			
Puffin	1			
Small Passerine	1			
Large Bird	1			
Gull Sp.				1
Large Duck Sp.				1
Small Goose				1
Small Passerine <i>cf.</i> Starling				1
Wader <i>cf.</i> Bar-Tailed Godwit				1
Very Large Bird	1			

Table A4.28 : Bornais Mound 2 and Mound 2A species frequency NISP (periods combined)

Species	Total NISP	Mound 2	Mound 2A
Herring / Lesser Black-Backed Gull	131	97	34
Cormorant	115	50	65
Domestic Fowl	90	57	33
Great Black-Backed Gull	77	55	22
Small Passerine	51	44	7
Gannet	47	17	30
Large Grey Goose <i>cf.</i> Greylag	45	25	20
Small Wader Sp.	40	39	1
Goose Sp.	39	25	14
Puffin	35	19	16
Galliform <i>cf.</i> Domestic Fowl	34	24	10
Guillemot	32	18	14
Oystercatcher	28	23	5
Small Wader	26	21	5
Manx Shearwater	21	12	9
Small Passerine Finch Size	21	20	1
Great Northern Diver	20	15	5
Gull <i>cf.</i> Small Gull	18		18
Shag / Cormorant	18	13	5
Large Goose	17	16	1
Wader Sp.	17	17	
Plover <i>cf.</i> Golden	15	15	
Galliform Sp.	14	8	6
Gull / Skua <i>cf.</i> Herring / Lesser Black-Backed Gull	11	10	1
Large Duck Sp.	11	8	3
Small Wader <i>cf.</i> Snipe	11	10	1
Columba Sp. Livia / Oenas	10	4	6
Fulmar	10	10	
Large Duck Sp. <i>cf.</i> Mallard	10	8	2
Raven	10	1	9
Small Passerine <i>cf.</i> thrush	10	10	
Greylag Goose	9	7	2
Large Gull Sp.	9	6	3
Shag	9	5	4
White-Tailed Eagle	9	8	1
Carrion Crow / Rook	8	3	5
Curlew	8	8	
Gull <i>cf.</i> Common	8	6	2
Small Gull Sp.	8	8	
Razorbill	7	5	2
Wader <i>cf.</i> Plover	7	7	
Gull / Skua <i>cf.</i> Great Black-Backed Gull	6	4	2
Gull / Wader	6	6	
Shearwater Sp. <i>cf.</i> Manx	6	1	5
Small Passerine <i>cf.</i> Starling	6	5	1
Swan Sp.	6	4	2
Anser Anser <i>cf.</i> Domestic	5	3	2
Black Goose Sp. <i>cf.</i> Brent	5	4	1
Columba Sp. <i>cf.</i> Livia / Oenas	4	1	3
Duck Sp.	4	4	
Gull <i>cf.</i> Kittiwake	4	4	
Large Gull / Skua	4	4	

Red Grouse	4	3	1
Wader <i>cf.</i> Curlew	4	4	
Wader <i>cf.</i> Oystercatcher	4	4	
Anatidae <i>cf.</i> Black Goose	3		3
Black Goose Sp.	3	3	
Duck <i>cf.</i> Red-Breasted Merganser	3	3	
Razorbill / Guillemot	3	2	1
Small Gull / Skua	3	3	
Small Wader <i>cf.</i> Jacksnipe	3	1	2
Starling	3	3	
Teal / Garganey	3	1	2
Thrush Sp.	3	3	
Anatidae <i>cf.</i> Duck	2	2	
Common Crane	2	2	
Goose <i>cf.</i> Branta Sp.	2	2	
Large Duck Sp. <i>cf.</i> Mallard / Shelduck	2	1	1
Large Grey Goose Sp.	2	1	1
Large Wader	2	2	
Phalacrocorax Sp.	2	2	
Procellariidae Sp.	2	1	1
Razorbill / Puffin	2	2	
Woodcock	2	1	1
Auk <i>cf.</i> Great Auk	1	1	
Columba <i>cf.</i> Palumbus	1	1	
Columba Sp.	1		1
Common Gull	1	1	
Duck / Goose	1		1
Duck <i>cf.</i> Goldeneye	2	2	
Eagle Sp. <i>cf.</i> White-Tailed Eagle	1	1	
Eider	1	1	
Galliform <i>cf.</i> Grouse	1	1	
Greylag Goose / Bewick's Swan	1		1
Gull Sp.	1	1	
Large Duck Sp. Anas or Sheld	1	1	
Large Sheawater Sp.	1	1	
Merganser <i>cf.</i> Red-Breasted	1	1	
Plover Sp.	1		1
Procellariidae Sp. <i>cf.</i> Shearwater	1		1
Rail <i>cf.</i> Corncrake	1		1
Red-Breasted Merganser	1	1	
Shearwater Sp.	1	1	
Shelduck	1	1	
Short-Eared Owl	1	1	
Small Auk	1		1
Small Duck Sp.	1		1
Small Passerine	1	1	
Small Wader <i>cf.</i> Dunlin	1	1	
Snipe	1	1	
Wader <i>cf.</i> Jacksnipe	1	1	
Wader <i>cf.</i> Lapwing	1	1	
Wader <i>cf.</i> Woodcock	1	1	
Water Rail	1		1
Whimbrel	1		1
Whooper Swan	1	1	

Table A4.29: Bornais Mound 2 and 2A unidentifiable bird count (periods combined)

Category	Total	Mound 2	Mound
Bird	741	546	195
Very / Large Bird	306	187	119
Very Large Bird	202	135	67
Large Bird	189	152	37
Medium Bird	172	138	33
Small Bird	162	149	13
Medium + Bird	42	38	4
Medium / Large Bird	37	31	6
Small / Medium Bird	35	27	6
Very Large Bird <i>cf.</i> Goose Sp.	12	8	4
Small / Medium Bird <i>cf.</i> Small Wader	11	10	1
Tiny Bird	11	10	1
Very Large Bird <i>cf.</i> Gannet	8	2	6
Large Bird <i>cf.</i> Gull	7	5	2
Large Bird <i>cf.</i> Galliform	5	2	3
Small / Medium <i>cf.</i> Wader	5	3	2
Very Large Bird <i>cf.</i> Swan	4	4	
Very Large <i>cf.</i> Cormorant	3	2	1
Large Bird <i>cf.</i> Large Gull	3	3	
Medium Bird <i>cf.</i> Shearwater	3	1	2
Large Bird <i>cf.</i> Duck	2	2	
Large Bird <i>cf.</i> Herring / Lesser Black-Backed	2	2	
Medium / Large Bird <i>cf.</i> Large Wader	2	2	
Very Large Bird <i>cf.</i> Shag / Cormorant	2	2	
Medium / Large Bird <i>cf.</i> Small Gull	2	2	
Tiny / Small Bird	2	2	
Large Bird <i>cf.</i> Auk / Gull	1	1	
Very / Large Bird <i>Cf.</i> Diver Sp.	1	1	
Large Bird <i>cf.</i> Domestic Fowl	1		1
Large Bird <i>cf.</i> Great Black-Backed Gull	1	1	
Small Bird <i>cf.</i> Passerine	1	1	
Medium Bird <i>cf.</i> Puffin	1		1
Large Bird <i>cf.</i> Razorbill / Guillemot	1		1
Very Large Bird <i>Cf.</i> Shag	1		1
Medium / Large Bird <i>Cf.</i> Small Gull / Wader	1	1	
Medium Bird <i>cf.</i> Teal	1	1	
Very Large Bird <i>cf.</i> White-Tailed Eagle	1		1
Bird <i>Cf.</i> Seabird / Wader	1	1	
<i>Cf.</i> Very Large Bird	2	2	
<i>Cf.</i> Tiny Bird	1	1	
<i>Cf.</i> Bird	46	34	12

Table A4.30: Bornais avian MNI by Mound, ordered in species groupings

Species	M2	M2A
Common Gull	1	0
Great Black-Backed Gull	5	5
Herring / Lesser Black-Backed Gull	6	4
Gull <i>cf.</i> Common	2	1
Gull <i>cf.</i> Kittiwake	1	0
Gull Sp.	2	2
Gull / Skua	2	1
Anser Anser <i>cf.</i> Domestic	1	2
Large Grey Goose <i>cf.</i> Greylag	4	3
Large Grey Goose Sp.	1	1
Black Goose Sp.	2	1
Goose Sp.	5	1
Anatidae <i>cf.</i> Black Goose	0	1
Greylag Goose / Bewick's Swan	0	1
Anatidae <i>cf.</i> Duck	1	0
Duck / Goose	0	1
Eider	1	0
Shelduck	1	0
Teal / Garganey	1	1
Merganser <i>cf.</i> Red-Breasted	2	0
Duck <i>cf.</i> Goldeneye	1	0
Large Duck Sp.	3	1
Duck Sp.	1	1
Swan Sp.	1	1
Whooper Swan	1	0
Columba <i>cf.</i> Palumbus	1	0
Columba <i>cf.</i> Livia / Oenas	1	2
Domestic Fowl	5	4
Galliform <i>cf.</i> Domestic Fowl	7	3
Galliform Sp.	2	1
Red Grouse	1	1
Gannet	2	3
Cormorant	4	4
Shag	1	1
Shag / Cormorant	1	1
Puffin	3	3
Razorbill	1	1
Guillemot	3	2
Auk Sp.	2	1
Carrion Crow / Rook	1	1
Raven	1	1
Common Crane	1	0
Fulmar	1	0
Great Northern Diver	1	1
Manx Shearwater	3	2
Shearwater Sp.	1	4
White-Tailed Eagle	1	1
Short-Eared Owl	1	0
Curlew	1	0
Oystercatcher	3	1
Plover <i>cf.</i> Golden	4	0
Plover Sp.	0	1
Rail <i>cf.</i> Corncrake	0	1
Snipe	1	0
Water Rail	0	1
Whimbrel	0	1
Woodcock	1	1
Small / Medium Wader	14	3
Large Wader	2	0
Small Passerine	10	1

Table A4.31: Bornais Avian MNI by Period

Species	Pre-Norse/Pictish	Early Norse	Middle Norse	Late Norse
Common Gull				1
Great Black-Backed Gull		5	3	1
Herring / Lesser Black-Backed Gull		3	5	3
Gull <i>cf.</i> Common	1	1	1	1
Gull <i>cf.</i> Kittiwake			1	
Gull Sp.		1	1	2
Gull / Skua		1	2	1
Anser <i>cf.</i> Domestic	1			2
Large Grey Goose <i>cf.</i> Greylag	1	2	4	2
Large Grey Goose Sp.		1	1	
Black Goose Sp.			1	2
Goose Sp.		1	2	2
Anatidae <i>cf.</i> Black Goose		1	1	
Greylag Goose / Bewick's Swan		1		
Anatidae <i>cf.</i> Duck			1	
Duck / Goose				1
Eider			1	
Teal / Garganey		1	1	1
Merganser <i>cf.</i> Red-Breasted		1		
Duck <i>cf.</i> Goldeneye		1		
Large Duck Sp.		2	2	1
Duck Sp.		1	1	1
Swan Sp.			1	1
Whooper Swan			1	
Columba <i>cf.</i> Palumbus			1	
Columba <i>cf.</i> Livia / Oenas		2	1	1
Domestic Fowl		2	4	5
Galliform <i>cf.</i> Domestic Fowl	1	1	2	7
Galliform Sp.		1	2	1
Red Grouse			1	1
Gannet		1	1	3
Cormorant		2	4	4
Shag		1	1	1
Shag / Cormorant		1	1	1
Puffin	1	3	2	2
Razorbill		1	1	1
Guillemot	1	2	1	2
Auk Sp.		1	2	1
Carrion Crow / Rook		1	1	1
Raven		1	1	
Common Crane			1	
Fulmar			1	
Great Northern Diver		1	1	1
Manx Shearwater	1	1	2	1
Shearwater sp.		4	1	1
White-Tailed Eagle	1	1	1	
Short-Eared Owl				1
Curlew			1	1
Oystercatcher		1	2	1
Plover <i>cf.</i> Golden			3	1
Plover Sp.				1
Rail <i>cf.</i> Corncrake			1	
Snipe				1
Water Rail			1	
Whimbrel		1		
Woodcock			1	1
Small / Medium Wader	1	3	9	4
Large Wader			1	1
Small Passerine	1	3	8	3

Table A4.32: Cille Pheadair NISP & MNI (grouped similar species, excluding size categories)

Species	NISP	% NISP	MNI
Gull	120	18.6	16
Small Wader	80	12.4	
Duck	52	8.1	7
Goose	49	7.6	7
Small Passerine	39	6.0	5
Plover <i>cf.</i> Golden	34	5.3	
Gannet	32	5.0	
Domestic Fowl	32	5.0	7
Shag	21	3.3	
Golden Plover	17	2.6	
Fulmar	15	2.3	
Cormorant	15	2.3	
Galliform	13	2.0	
Puffin	12	1.9	
Wader <i>cf.</i> Golden or Grey Plover	11	1.7	
Wader <i>cf.</i> Snipe	8	1.2	
Carrion Crow/Rook	6	0.9	
Whimbrel	6	0.9	
Guillemot	6	0.9	
Oystercatcher	6	0.9	
Large Shearwater	6	0.9	
Curlew	5	0.8	
Razorbill/Guillemot	5	0.8	
Common Crane	4	0.6	
Manx Shearwater	4	0.6	
Duck / Goose	4	0.6	
Medium Wader	4	0.6	
Starling	3	0.5	
Galliform <i>cf.</i> Red Grouse	3	0.5	
Galliform <i>cf.</i> Domestic Fowl	3	0.5	
Wader <i>cf.</i> Bar-Tailed Godwit	3	0.5	
Wader <i>cf.</i> Curlew	3	0.5	
Wader <i>cf.</i> Whimbrel	3	0.5	
Cormorant / Shag	2	0.3	
Razorbill	2	0.3	
Little Auk	2	0.3	
Large Shearwater <i>cf.</i> Great Shearwater	2	0.3	
Raven	2	0.3	
<i>Columba Sp. cf.</i> Rock / Stock Dove	2	0.3	
Wader	2	0.3	
White-Tailed Sea Eagle	1	0.2	
Great Northern Diver	1	0.2	
Plover <i>cf.</i> Grey	1	0.2	
Wader <i>cf.</i> Jacksnipe	1	0.2	
Wader <i>cf.</i> Oystercatcher	1	0.2	
Wader <i>cf.</i> Lapwing	1	0.2	
Large Wader	1	0.2	

Table A4.33: Cille Pheadair Avian NISP and MNI in order of frequency (Best and Cartledge In Press)

Species	NISP	MNI	Species Continued	NISP	MNI
Small Wader	80	13	Galliform <i>cf.</i> Domestic Fowl	3	1
Herring / Lesser Black-Backed Gull	54	10	Wader <i>cf.</i> Whimbrel	3	2
Great Black-Backed Gull	38	4	<i>Anser Anser</i> Possibly Domestic	2	2
Plover <i>cf.</i> Golden	34	9	Cormorant / Shag	2	1
Small Passerine	33	5	Large Shearwater <i>cf.</i> Great Shearwater	2	1
Gannet	32	3	Wader	2	1
Large Grey Goose <i>Anser Sp.</i>	23	3	Goose Sp.	2	1
Domestic Fowl	22	3	Little Auk	2	1
Shag	21	4	<i>Columba Sp. cf.</i> Rock / Stock Dove	2	1
Large Goose Sp.	17	5	Raven	2	1
Golden Plover	17	5	Razorbill	2	1
Fulmar	15	3	Wader <i>cf.</i> Jacksnipe	1	1
Large Duck Sp.	15	3	Small Gull <i>cf.</i> Kittiwake	1	1
Cormorant	15	2	Wader <i>cf.</i> Oystercatcher	1	1
Galliform	13	4	Duck <i>Anas Sp. cf.</i> Pintail	1	1
Large Duck <i>cf.</i> Shelduck	13	3	Kittiwake	1	1
Puffin	12	3	Large Wader	1	1
Wader <i>cf.</i> Golden or Grey Plover	11	4	Great Northern Diver	1	1
Domestic Fowl Bantam Size	10	4	Plover <i>cf.</i> Grey	1	1
Wader <i>cf.</i> Snipe	8	4	Wader <i>cf.</i> Lapwing	1	1
Gull <i>cf.</i> Great Black-Backed	8	2	Black Goose Sp. <i>cf. bernicula</i>	1	1
Gull <i>cf.</i> Herring/Lesser Black-Back	7	4	Common Gull / Kittiwake	1	1
Small Passerine <i>cf.</i> Starling	6	4	White-Tailed Sea Eagle	1	1
Carrion Crow/Rook	6	3			
Whimbrel	6	3			
Duck Sp.	6	2	Very Large Bird	31	
Guillemot	6	2	Small Bird	25	
Oystercatcher	6	1	Large Bird	20	
Large Shearwater	6	1	Medium Bird	18	
Large Duck <i>cf.</i> Mallard	6	2	Bird	12	
Shelduck	5	3	Small/Medium Bird	10	
Curlew	5	1	Tiny Bird	7	
Razorbill/Guillemot	5	1	Large / Very Large Bird	6	
Great/Lesser Black-Backed Gull	4	2	Very Large Bird <i>cf.</i> Gannet	6	
Common Crane	4	1	Very Large Bird <i>cf.</i> Large Goose	2	
Small Goose	4	1	Large Bird <i>cf.</i> Gull	2	
Manx Shearwater	4	1	Very Large Bird <i>cf.</i> Small Goose	1	
Duck / Goose	4	1	Large Bird <i>cf.</i> Large Duck Sp.	1	
Medium Wader	4	1	Large Bird <i>cf.</i> Galliform	1	
Wader <i>cf.</i> Bar-Tailed Godwit	3	1	Large Bird <i>cf.</i> Duck	1	
Starling	3	2	Large Bird <i>cf.</i> Goose	1	
Galliform <i>cf.</i> Red Grouse	3	2	Large Bird <i>cf.</i> Large Gull	1	
Large Duck <i>cf.</i> Mallard/Shelduck	3	3	Large Bird <i>cf.</i> Large Shearwater	1	
Teal	3	1	Very Large Bird <i>cf.</i> Shag/Cormorant	1	
Gull Sp.	3	1	Large Bird <i>cf.</i> Raven	1	
Wader <i>cf.</i> Curlew	3	1			
Small Gull <i>cf.</i> Common	3	2	Total	793	

Table A4.34: Cille Pheadair Dietary Input Values based on MNI

Species	MTWT kg	Protein g	Fat g	Energy kcal
Large Goose Sp.	20.2	3236	5866	64929
Combined Large Ducks	14.6	2330	4222	46738
Herring / Lesser Black-Backed Gull	8.5	1360	2465	27285
Gannet	6.3	1008	1827	20223
Shag	6.2	986	1786	19774
Small/Black Goose	4.8	774	1404	15536
Great Black-Backed Gull	3.4	544	986	10914
Gull <i>cf.</i> Herring/Lesser Black-Back	3.4	544	986	10914
Fulmar	3.4	538	974	10786
Cormorant	3.1	493	893	9887
Great Northern Diver	2.9	459	832	9213
<i>Anser Anser</i> Possibly Domestic	5.1	1416	303	8900
Common Crane	3.8	1058	227	6653
Domestic Fowl Bantam Size	3.6	1019	218	6406
White-Tailed Sea Eagle	3.5	980	210	6160
Gull <i>cf.</i> Great Black-Backed	1.7	272	493	5457
Great/Lesser Black-Backed Gull	1.7	272	493	5457
Cormorant / Shag	1.5	246	447	4943
Galliform	2.8	784	168	4928
Domestic Fowl	2.7	764	164	4805
Guillemot	1.3	202	365	4045
Puffin	1.1	168	305	3371
Whimbrel	0.8	134	244	2696
Wader <i>cf.</i> Snipe	0.8	124	224	2478
Galliform <i>cf.</i> Red Grouse	1.2	336	72	2112
Small Gull <i>cf.</i> Common	0.6	101	184	2035
Razorbill/Guillemot	0.6	96	174	1926
Wader <i>cf.</i> Whimbrel	0.6	90	162	1798
Large Shearwater	0.6	90	162	1798
Large Shearwater <i>cf.</i> Great Shearwater	0.6	90	162	1798
Small Wader	0.6	89	162	1794
Galliform <i>cf.</i> Domestic Fowl	0.9	255	55	1602
Razorbill	0.5	73	132	1461
Plover <i>cf.</i> Golden	0.4	62	112	1242
Oystercatcher	0.4	62	112	1236
Wader <i>cf.</i> Oystercatcher	0.4	62	112	1236
Manx Shearwater	0.4	56	102	1124
Teal	0.4	56	102	1124
Duck <i>Anas</i> Sp. <i>cf.</i> Pintail	0.4	56	102	1124
Gull Sp.	0.3	51	92	1018
Small Gull <i>cf.</i> Kittiwake	0.3	51	92	1018
Common Gull / Kittiwake	0.3	51	92	1018
Curlew	0.3	48	87	963
Wader <i>cf.</i> Curlew	0.3	48	87	963
Kittiwake	0.3	48	87	963
Large Wader	0.3	48	87	963
Wader <i>cf.</i> Bar-Tailed Godwit	0.3	45	81	899
Wader <i>cf.</i> Lapwing	0.3	45	81	899
Golden Plover	0.2	34	62	690
Wader <i>cf.</i> Golden or Grey Plover	0.2	28	50	552
Little Auk	0.1	18	32	360
Wader <i>cf.</i> Jacksnipe	0.0	7	12	138
Plover <i>cf.</i> Grey	0.0	7	12	138

Table A4.35: Bornais Mound 2 and Mound 2A Dietary Input Values based on MNI

Species	MTWT kg	Protein g	Fat g	Energy kcal
Large Grey Goose <i>cf.</i> Greylag	17.7	2832	5133	56813
Goose Sp.	14.5	2323	4211	46609
Cormorant	12.3	1971	3573	39547
Gannet	10.5	1680	3045	33705
Great Black-Backed Gull	8.5	1360	2465	27285
Herring / Lesser Black-Backed Gull	8.5	1360	2465	27285
Swan Sp.	14.0	3920	840	24640
Black Goose Sp.	7.3	1162	2105	23305
Great Northern Diver	5.7	918	1665	18425
Large Grey Goose Sp.	5.1	809	1466	16232
Galliform <i>cf.</i> Domestic Fowl	9.1	2548	546	16016
Domestic Fowl	8.2	2293	491	14414
Anser Anser <i>cf.</i> Domestic	7.6	2124	455	13350
White-Tailed Eagle	7.0	1960	420	12320
Large Duck Sp.	3.6	582	1056	11684
Whooper Swan	6.6	1848	396	11616
Guillemot	3.2	504	914	10112
Shag	3.1	493	893	9887
Shag / Cormorant	3.1	493	893	9887
Anatidae <i>cf.</i> Black Goose	2.4	387	702	7768
Puffin	2.1	336	609	6741
Common Crane	3.8	1058	227	6653
Merganser <i>cf.</i> Red-Breasted	1.8	291	528	5842
Manx Shearwater	1.8	280	508	5618
Shearwater Sp.	1.8	280	508	5618
Oystercatcher	1.5	246	447	4943
Greylag Goose / Bewick's Swan	2.5	708	152	4450
Gull Sp.	1.3	203	368	4070
Galliform Sp.	2.1	588	126	3696
Fulmar	1.1	179	325	3595
Gull <i>cf.</i> Common	1.0	152	276	3053
Gull / Skua	1.0	152	276	3053
Eider	0.9	146	264	2921
Shelduck	0.9	146	264	2921
Razorbill	0.9	146	264	2921
Small / Medium Wader	0.9	144	261	2892
Red Grouse	1.4	392	84	2464
Teal / Garganey	0.7	112	203	2247
Duck <i>cf.</i> Goldeneye	0.6	98	177	1958
Columba <i>cf.</i> Livia / Oenas	0.7	206	44	1294
Common Gull	0.3	51	92	1018
Gull <i>cf.</i> Kittiwake	0.3	51	92	1018
Curlew	0.3	48	87	963
Whimbrel	0.3	45	81	899
Woodcock	0.4	110	24	690
Snipe	0.2	31	56	620
Plover <i>cf.</i> Golden	0.2	28	50	552
Columba <i>cf.</i> Palumbus	0.2	69	15	431
Plover Sp.	0.04	7	12	138

APPENDIX TO CHAPTER FIVE

RESULTS

Crossing Time and Space: Temporal and Geographical

Analysis of the Avian Dataset



Table A5.1: Sites with class NISP shown by island group and period. Grey shading indicates assemblage size from assessment not NISP for six Shiant Isles sites in order for comparison with analysed sites.

SITE NAME	ISLAND	ISLAND GROUP	PERIOD	BIRD	MAMMAL	FISH	SHELLFISH
An Corran (Mes)	Skye	Inner Hebrides	Mesolithic	124	386	1985	
Ardnave (BA)	Islay	Inner Hebrides	Bronze age	3	261	0	5393
Caisteal nan Gilleann (Mes)	Oronsay	Inner Hebrides	Mesolithic	22	64		
Cnoc Coig (Mes)	Oronsay	Inner Hebrides	Mesolithic	400	580		
Cnoc Sligeach (Mes)	Oronsay	Inner Hebrides	Mesolithic	13	59	NQ	
Dun Ardtreck (M/LIA)	Skye	Inner Hebrides	Middle to Late Iron Age	NI	1242		
Dun Cul Bhuirg (MIA)	Iona	Inner Hebrides	Middle Iron Age 100 BC to 300 AD	2	190		
Dun Mor Vault (EIA)	Tiree	Inner Hebrides	Early Iron Age	0	80	Unknown	11+
Dun Mor Vault (IA/Later)	Tiree	Inner Hebrides	Iron Age / Later	22	c.39?	Unknown	33+
Dun Mor Vault (MIA)	Tiree	Inner Hebrides	Middle Iron age	29	1293	Unknown	704+
Iona Abby / Monastery (Emed)	Iona	Inner Hebrides	Medieval (Clarify date)	23	1876	92	
Kilellan Farm (EBA)	Islay	Inner Hebrides	Early Bronze Age	2	109	0	31753
Kilellan Farm (MIA)	Islay	Inner Hebrides	Middle Iron Age	6	622	0	5358
Kings cave (Mes/Med)	Jura	Inner Hebrides	Mesolithic - Middle Ages	28	587?		
Machrins (LIA)	Colonsay	Inner Hebrides	Late Iron Age 800 AD	0	99		
North of Reilig Odhrain (LIA)	Iona	Inner Hebrides	400-750AD	36	221		
Priory Midden (Mes)	Oronsay	Inner Hebrides	Mesolithic	0	17		
Sand (Mes)	Skye	Inner Hebrides	Mesolithic	1288	295	14954	
A'Cheardach Bheag (IA)	South Uist	Outer Hebrides	Iron Age	2	188	1	
A'Cheardach Mhor III (LIA)	South Uist	Outer Hebrides	Iron Age 5th - 7th C AD	0	54	0	
A'Cheardach Mhor IV (LIA)	South Uist	Outer Hebrides	Late Iron Age 7th - 8th C AD	1	139	1	
A'Cheardach Mhor Phase I & II (IA)	South Uist	Outer Hebrides	Iron Age	3	305	2	
Askernish (IA)	South Uist	Outer Hebrides	Iron Age	4	139	P	
Bac Mhic Connain (IA)	North Uist	Outer Hebrides	Iron Age	1	NQ		
Beirgh (M/LIA)	Lewis	Outer Hebrides	Middle - Late Iron Age 200-500 AD	3	1896	598	
Bornais M1 (EN)	South Uist	Outer Hebrides	Early Norse	17	415	35	
Bornais M1 (LIA)	South Uist	Outer Hebrides	Late Iron Age	315	3347	637	
Bornais M1 (MN)	South Uist	Outer Hebrides	Middle Norse	51	588	970	
Bornais M2 (EN)	South Uist	Outer Hebrides	Early Norse	65	505	975	
Bornais M2 (LN)	South Uist	Outer Hebrides	Late Norse	171	1287	2983	

Bornais M2 (MN)	South Uist	Outer Hebrides	Middle Norse	514	4219	4935	
Bornais M2 (N)	South Uist	Outer Hebrides	Norse	77	1821	N/A	
Bornais M2 (PN/Pict)	South Uist	Outer Hebrides	Pre-Norse/Pictish	13	389	0	
Bornais M2 (PN/Pict/N)	South Uist	Outer Hebrides	Pre-Norse/Pictish / Norse	9	1	N/A	
Bornais M2A (EN)	South Uist	Outer Hebrides	Early Norse	154	3827	2063	
Bornais M2A (LN)	South Uist	Outer Hebrides	Late Norse	195	2596	1429	
Bornais M2A (MN)	South Uist	Outer Hebrides	Middle Norse	51	565	245	
Bornais M3 (LN)	South Uist	Outer Hebrides	Late Norse	46	318	2728	
Bornais M3 (MN)	South Uist	Outer Hebrides	Middle Norse	9	397	296	
Bostadh (LIA)	Lewis	Outer Hebrides	Late Iron Age	61	1376	22208	34608
Bostadh (N)	Lewis	Outer Hebrides	Norse	8	518	2209	799
Bruach a Tuath (MIA)	Benbecula	Outer Hebrides	Middle Iron Age	3	94	0	
Ceardach Ruadh Baile Sear (M/LIA)	Baile Sear	Outer Hebrides	Middle-Late Iron Age	50	2047	124	
Cill Donnain (IA)	South Uist	Outer Hebrides	Iron Age	8	4694		
Cille Pheadair (N)	South Uist	Outer Hebrides	Norse L10th/E11th - M-L 13th	645	6436	15623	
Cladh Hallan	South Uist	Outer Hebrides	Early Bronze Age	0	29	0	0
Cladh Hallan (EIA)	South Uist	Outer Hebrides	Early Iron Age	41	3254	332	
Cladh Hallan (LBA)	South Uist	Outer Hebrides	Late Bronze Age	307	16702	5035	
Cladh Hallan (MBA)	South Uist	Outer Hebrides	Middle Bronze Age	6	443	161	
Cnip (MIA)	Lewis	Outer Hebrides	Middle Iron Age	36	1597	3962	184
Dun Bharabhat Cnip (E/MIA)	Lewis	Outer Hebrides	Iron Age second half of the 1st millenium BC	0	0	0	
Dun Vulcan (M/LIA)	South Uist	Outer Hebrides	Middle - Late Iron Age	384	3548	2905	
Dun Vulcan (Med)	South Uist	Outer Hebrides	Late Iron Age to High Medieval	4	125		
Dunan Ruadh (M/LIA)	Pabbay	Outer Hebrides	Iron Age 1st-9th AD	360	2426	1122	
Eilean Domhnuill Loch Olabhat (Neo)	North Uist	Outer Hebrides	Neolithic	2	NQ		
Foshigarry (M/LIA)	North Uist	Outer Hebrides	Middle-Late Iron Age	1	NQ		
Frobost (Med)	South Uist	Outer Hebrides	Medieval 13th - 14th Century	2	25	0	
Hornish Point (IA)	South Uist	Outer Hebrides	Iron Age	12	443	100	
Hornish Point (PMed)	South Uist	Outer Hebrides	Post Medieval	4	N/A	N/A	
Mingulay (IA)	Mingulay	Outer Hebrides	Iron Age	88	415	71	
Northton (Beak)	Harris	Outer Hebrides	Beaker VII	28	610	13	

Northton (Beak)	Harris	Outer Hebrides	Beaker V/VI	15	151	0	
Northton (IA)	Harris	Outer Hebrides	Iron Age (II)	1	279	6	
Northton (IA)	Harris	Outer Hebrides	Iron Age (I)	3	128	4	
Northton (LNeo)	Harris	Outer Hebrides	Late Neolithic	23	616	1	
Rosinish (Beak)	Benbecula	Outer Hebrides	Beaker	9	653	20	
Rosinish (MIA)	Benbecula	Outer Hebrides	Middle Iron Age AD 2nd - 3rd centuries AD	3	57	85	
Rosinish (Vik/N)	Benbecula	Outer Hebrides	Viking/Norse 9th - 10th centuries AD	0	24	1	
Rough Island 41B (LIA)	Shiant Isles	Outer Hebrides	Late Iron Age	244	28	Ass 1	
Rough Island 41B (N/EMed)	Shiant Isles	Outer Hebrides	Norse / Early Medieval	26	5	Ass 10	
Rough Island Sheiling 41B (PMed)	Shiant Isles	Outer Hebrides	18th Century	14	1	0	
Sheader (IA)	Sandray	Outer Hebrides	Iron Age	4	148	251	
Sligeanach (EBA)	South Uist	Outer Hebrides	Early Bronze Age	7	80	P	
Sligeanach (EIA)	South Uist	Outer Hebrides	Early Iron Age	1	63	P	
Sligeanach (LIA)	South Uist	Outer Hebrides	Late Iron Age	0	19	P	0
Sloc Sabhaid Baile Sear (MIA)	Baile Sear	Outer Hebrides	Middle Iron Age	30	2116		
Sollas Post-Wheelhouse B Refill (LIA)	North Uist	Outer Hebrides	late Iron Age	1	47	0	
Sollas wheel house B (IA)	North Uist	Outer Hebrides	Iron Age	31	NQ 88* Indi	21	
Sollas wheel house B Midden (IA)	North Uist	Outer Hebrides	Iron Age	5	364	0	
Sollas wheelhouse A (IA)	North Uist	Outer Hebrides	Iron Age	5	783	13	
St Kilda Black House 6 (PMed)	Hirta St Kilda	Outer Hebrides	Modern c. 1830-1930	52	38	4	0
St Kilda Black House 8 (Med)	Hirta St Kilda	Outer Hebrides	Pre blackhouse 10th-13th century onwards	207	33	0	4
St Kilda Black House 8 (PMed)	Hirta St Kilda	Outer Hebrides	Modern c. 1830-1930	5353	333	212	853
St Kilda Black House G (PMed)	Hirta St Kilda	Outer Hebrides	Modern c. 1830-1930	434	19	2	1
Udal (Beak)	North Uist	Outer Hebrides	Beaker	2	99	2	
Udal (EBA)	North Uist	Outer Hebrides	Early Bronze Age	16	281	112	
Udal (EIA)	North Uist	Outer Hebrides	Early Iron Age	40	784	22	
Udal (LBA)	North Uist	Outer Hebrides	Late Bronze Age	4	206	0	
Udal (MIA)	North Uist	Outer Hebrides	Middle Iron Age	141	2657	179	
Udal (Neo)	North Uist	Outer Hebrides	Neolithic	2	403	6	
Udal II VI (LMed/PMed)	North Uist	Outer Hebrides	1300 -1700 AD Late / Post Medieval	150	1806	25	
Udal Ixc X (Vik)	North Uist	Outer Hebrides	Viking	148	2532	48	

Udal VII IX (N)	North Uist	Outer Hebrides	800 - 1300 AD Norse	98	1268	10	
Udal XI XIII (M/LIA)	North Uist	Outer Hebrides	300 - 800 AD Late Iron Age	109	6840	19	
Barnhouse (Neo)	Orkney Mainland	Orkney	Neolithic	0	0		
Bay of Moaness (BA)	Rousay	Orkney	Bronze Age	3	113		
Beachview Burnside (LE/LN)	Mainland	Orkney	(Late)Early - Late Norse c 1020-1280/1320	132	722	7298	6838
Beachview Studio Site (E/LN)	Mainland	Orkney	Early - Late Norse 980-1300/1410	146	1728	4571	20007
Blackhammer (Neo)	Rousay	Orkney	Neolithic	4	NQ		
Broch of Ayre (MIA)	Mainland	Orkney	(Middle) Iron Age	14	NQ		
Brough of Deerness (LN/EMed)	Mainland	Orkney	Late Norse /Early Medieval/Recent	59	320	24	93
Brough Road (areas 1, 2 and 3) (LIA/N)	Mainland	Orkney	Late Iron Age / Norse 7th to 13th C	136	886	4986	25971
Brough Road Cairn Area 1 (IA/PN/Pict)	Mainland	Orkney	Roman Iron Age / Pre-Norse/Pictish	51	6	11	159
Bu (EIA)	Mainland	Orkney	Early Iron Age	270	c. 1389 id	125	913
Buckquoy (E/MN)	Mainland	Orkney	Norse (9th to 12th centuries AD)	142	2834	51	65024
Buckquoy (EN)	Mainland	Orkney	Early Norse (9th century)	9	2864	143	83193
Buckquoy (PN/Pict)	Mainland	Orkney	Pre-Norse/Pictish (200AD- 8th century)	79	2290	9	10710
Calf of Eday (IA)	Calf of Eday	Orkney	Iron Age	34	17+		
Earl's Bu (LN)	Mainland	Orkney	Late Norse 13th/14th century	71	1266	11979	
Earl's Palace (LMed)	Mainland	Orkney	Late medieval	11	174		
Gurness (IA)	Mainland	Orkney	Iron Age	9	308		
Holm of Papa Westray (Neo)	Holm of Papa Westray	Orkney	Neolithic	NI (2)	2673	4738	17920
Howe (EIA)	Mainland	Orkney	Early Iron Age	87	1994	54	721
Howe (IA/Pmed)	Mainland	Orkney	Iron Age / Recent Mixed	7	174	2	34
Howe (LIA)	Mainland	Orkney	Late Iron Age	490	10267	1147	7727
Howe (M/LIA)	Mainland	Orkney	Middle - Late Iron Age	84	1511	12	511
Howe (MIA)	Mainland	Orkney	Middle Iron Age	507	12088	1876	14267
Howe (Neo)	Mainland	Orkney	Neolithic	1	14	0	0
Howe (PMed)	Mainland	Orkney	Recent	218	No Info	No info	3229
Isbister (BA)	South Ronaldsay	Orkney	Bronze Age Reuse 2450-2050 cal BC	641	N/A	N/A	
Isbister (Neo)	South Ronaldsay	Orkney	Neolithic	84	756	2160	88
Kirkwall 57 Albert street (LMed)	Mainland	Orkney	15th - 16th C AD	3+	NQ 19 Indi		
Kirkwall Gunn's Close (LMed)	Mainland	Orkney	16th - 17th C AD	5+	NQ 14 Indi		

Kirkwall Mounthoolie lane (LMed/PMed)	Mainland	Orkney	17th C AD	5+	NQ 16 Indi			
Knap of Howar (Neo)	Papa Westray	Orkney	Neolithic	254	4841	13		
Knowe of Ramsay (Neo)	Rousay	Orkney	Neolithic	17	NQ			
Knowe of Yarso (Neo)	Rousay	Orkney	Neolithic 3350 to 2450 cal BC	0	NQ			
Links of Noltland (Neo)	Westray	Orkney	Neolithic	331	8686			
Midhowe Broch (MIA)	Rousay	Orkney	(Middle) Iron Age	7	NQ			
Midhowe Cairn (Neo)	Rousay	Orkney	Neolithic	8	NQ			
Mine Howe (IA)	Mainland	Orkney	Iron Age	NI P	10891			
Newark Bay (LM)	Mainland	Orkney	Late Medieval	96	440	47		
Newark Bay (N)	Mainland	Orkney	Norse	35	168			
Pierowall Quarry (EIA)	Westray	Orkney	Early Iron Age	7	224	9	4898	
Pierowall Quarry Cain (LNeo)	Westray	Orkney	Late Neolithic	14	669	2	869	
Pierowall Quarry Platform/Structure (LNeo)	Westray	Orkney	Late Neolithic	83	1179	4	^	
Point of Buckquoy (Area 6) (EBA)	Mainland	Orkney	Early Bronze Age 2285-1690 cal BC	23	112	152	2893	
Point of Buckquoy (Cuttings 5 and 6)	Mainland	Orkney	No Datable Material	2	?	?	?	
Point of Buckquoy (Cuttings 5 and 6) (MBA)	Mainland	Orkney	Middle Bronze Age c 1770-1370 cal BC	45	102	45	1383	
Point of Buckquoy (LNeo/EBA)	Mainland	Orkney	Late Neolithic/Early Bronze Age 2630-2180 BC	Present	41	248	81	
Point of Cott (Neo)	Westray	Orkney	Neolithic some mixed	242	648	0		
Pool (IA)	Sanday	Orkney	Iron Age Phase 5	8	633	9		
Pool (LIA)	Sanday	Orkney	Late Iron Age Phase 6	109	4588	767		
Pool (LIA/Vik)	Sanday	Orkney	Late Iron Age / Viking Interface Phase 7	368	9891	4633		
Pool (N)	Sanday	Orkney	Norse Phase 8	153	4221	4309		
Pool (Neo)	Sanday	Orkney	Neolithic Phases 1 and 2	10	2127	5		
Quanterness cairn (Neo)	Mainland	Orkney	Neolithic	128	243	24		
Quoygrew (Med/PMed)	Westray	Orkney	Late Medieval - Post Medieval	149	38	36		
Quoygrew Farm Midden ii (EN)	Westray	Orkney	Early Norse 779-981AD	48	1016	3622		
Quoygrew Farm Midden iii (M/LN)	Westray	Orkney	Middle-Late Norse 1035-1261AD	325	2318	3132		
Quoygrew Fish Midden 2 (M/LN)	Westray	Orkney	Middle-Late Norse 1066-1294AD	68	43	2501		
Room 5 Clifftop Brough of Birsay (N)	Brough of Birsay	Orkney	Norse	Present	2336			
Room 5 Clifftop Brough of Birsay (PN/Pict)	Brough of Birsay	Orkney	Pre-Norse/Pictish	Present	1485			
Saevar Howe (EN)	Mainland	Orkney	Early Norse	27	245	762	4608	

Saevar Howe (LIA/PN/Pict)	Mainland	Orkney	Late Iron Age / Pre-Norse/Pictish	7	161	115	922
Sandwick North (E/MN)	Unst	Shetland	Early / Middle Norse 11th-12th c	109	400	2376	
Sandwick North (LN)	Unst	Shetland	Late Norse 13th - 14th Century	3	41	812	
Sandwick North (M/LN)	Unst	Shetland	Middle/Late Norse 12th-13th c	40	375	807	
Skaill Deerness (IA)	Mainland	Orkney	Iron Age	442	12999		
Skaill Deerness (LBA)	Mainland	Orkney	Late Bronze Age	0	1243		
Skaill Deerness (Med)	Mainland	Orkney	Medieval	15	263		
Skaill Deerness (Vik)	Mainland	Orkney	Viking	240	5988	1696	
Skara Brae (Neo)	Mainland	Orkney	Neolithic	139	30169	601	
Snusgar (N)	Mainland	Orkney	Norse	100+	Unknown		
St Boniface's Church (IA)	Papa Westray	Orkney	Iron Age	33	19		
St Magnus' Kirk Birsay (N)	Mainland	Orkney	Norse possibly 12th C	52	126	68	64
Tofts Ness 1 & 2 (Neo)	Sanday	Orkney	Neolithic	211	9928	125	3
Tofts Ness 3 (EBA)	Sanday	Orkney	Early Bronze Age	118	2383	122	91
Tofts Ness 4 (LBA)	Sanday	Orkney	Later Bronze Age	186	1353	^	^
Tofts Ness Phases 5 & 6 (IA)	Sanday	Orkney	Iron Age	87	5112	68	1325
Tuquoy (LN/Med/PMed)	Westray	Orkney	Late Norse/Medieval - Post Medieval	136	Unknown		
Tuquoy (N)	Westray	Orkney	Norse	360	Unknown		
Warebeth Broch (MIA)	Mainland	Orkney	Middle Iron Age AD 210-420	0	2106	48	7
East Shore Broch (MIA)	Mainland	Shetland	(Middle) Iron Age	Present	NQ		
Jarlshof (LBA/EIA)	Mainland	Shetland	Late Bronze Age / Early Iron Age	19	NQ		
Jarlshof (M/LIA)	Mainland	Shetland	Middle to Late Iron Age	4	NQ		
Jarlshof (N)	Mainland	Shetland	Norse	30	NQ		
Jarlshof Tr 1 (LNeo/EBA)	Mainland	Shetland	Late Neolithic / Early Bronze Age	16	145	9761	
Milla Skerra Sandwick (IA)	Unst	Shetland	Iron Age	113	447		
Old Scatness (IA)	Mainland	Shetland	Iron Age	NI P	No Info atm	No Info	No Info
Old Scatness (LN)	Mainland	Shetland	Late Norse	36	159	4804	5921
Old Scatness (PN/Pict)	Mainland	Shetland	Pre-Norse/Pictish (/LIA?)	49	940	1911	338
Old Scatness (Vik/EN)	Mainland	Shetland	Viking / Early Norse	63	592	4021	976
Scalloway (IA)	Mainland	Shetland	Iron Age Block 7.1	177	4311	1135	96
Scalloway (LIA)	Mainland	Shetland	Later Iron Age Phase 3	32	^	^	^

Scalloway (MIA)	Mainland	Shetland	Middle Iron Age Phase 2	3	^	^	^
Scalloway Castle (LMed/PMed)	Mainland	Shetland	17th - Early 18th C	4	131		
Scatness (IA)	Mainland	Shetland	Iron Age	53	643		
Scord of Brouster (LNeo)	Mainland	Shetland	Late Neolithic 3050 to 2450 cal BC	0	15		
Site 22 Sands of Breckon (EIA)	Yell	Shetland	Early Iron Age	0	456		
The Biggings (EN)	Papa Stour	Shetland	Early Norse 11th Century	0	10	Unknown	
West Voe (Mes)	Mainland	Shetland	Mesolithic	In An 9	NQ atm		
Carding Mill Bay I (ENeo)	Mainland	Mainland	Early Neolithic	63	17	236	
Carding Mill Bay II (Mes/Neo)	Mainland	Mainland	Mesolithic / Neolithic	102	86	776	
Crosskirk Broch (IA)	Mainland	Mainland	Iron Age	122	1856	15	
Freswick Links (LIA/Med)	Mainland	Mainland	Late Iron Age / Medieval	180	580	1630	
Freswick Links (LIA/Vik)	Mainland	Mainland	Late Iron Age / Viking	38	455	289	
Freswick Links (N)	Mainland	Mainland	11th-14th C AD	105	245	1706	
Robert's Haven (E/ELN)	Mainland	Mainland	Early - (Early)Late Norse 11th-13th Century	36	47		
Robert's Haven (LN/Med)	Mainland	Mainland	Late Norse / Medieval	10	52		
HI15 A Blackhouse (IA)	Shiant Isles	Outer Hebrides	Iron Age	15	8	0	Unknown
HI15 A Blackhouse (Med/PMed)	Shiant Isles	Outer Hebrides	Medieval / Post Medieval	237	161	9	Unknown
HI15 C Winnowing Barn (PMed)	Shiant Isles	Outer Hebrides	Post Medieval	1194	117	20	Unknown
HI15 E and F Enclosure (PMed)	Shiant Isles	Outer Hebrides	Post Medieval	40	261	88	Unknown
HI15 G External Area (IA)	Shiant Isles	Outer Hebrides	Iron Age	19	112	5	Unknown
HI15B Midden (PMed)	Shiant Isles	Outer Hebrides	Post Medieval	5242	2319	2258	Unknown

Figure A5.1: Mammal and Avian NISP for the Inner Hebrides

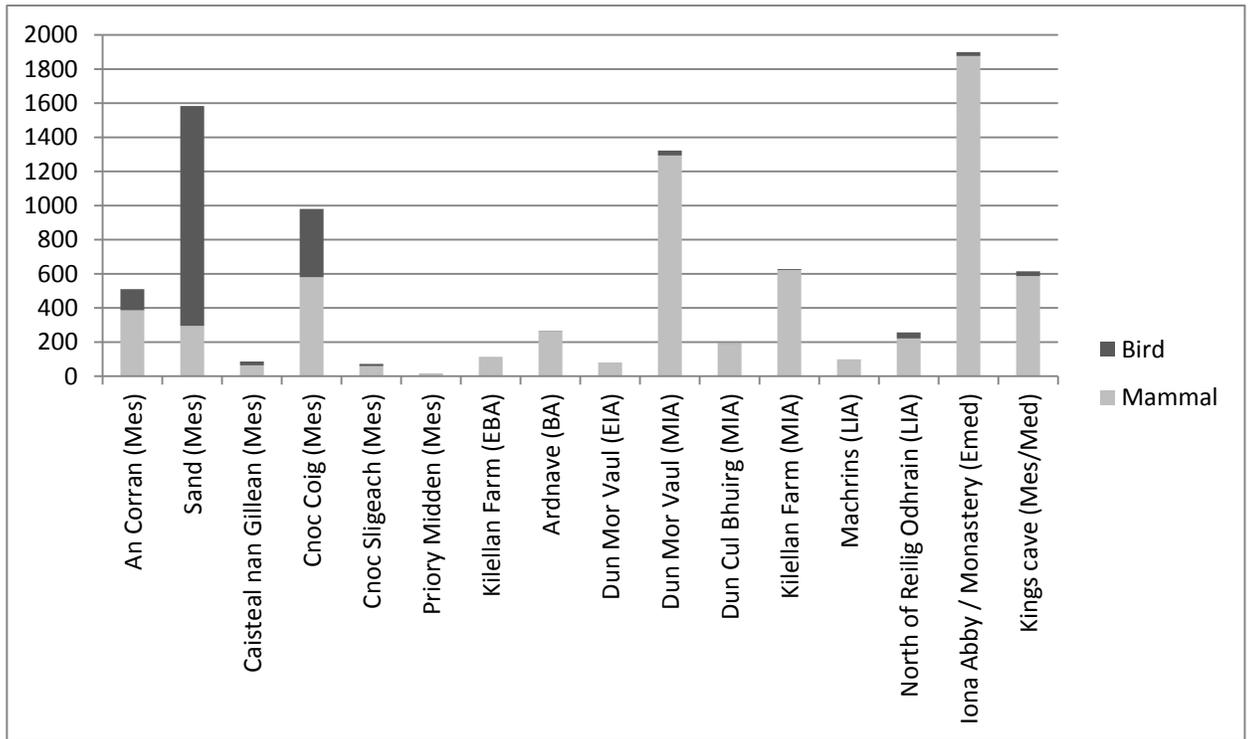


Figure A5.2: Mammal and Avian NISP for Shetland

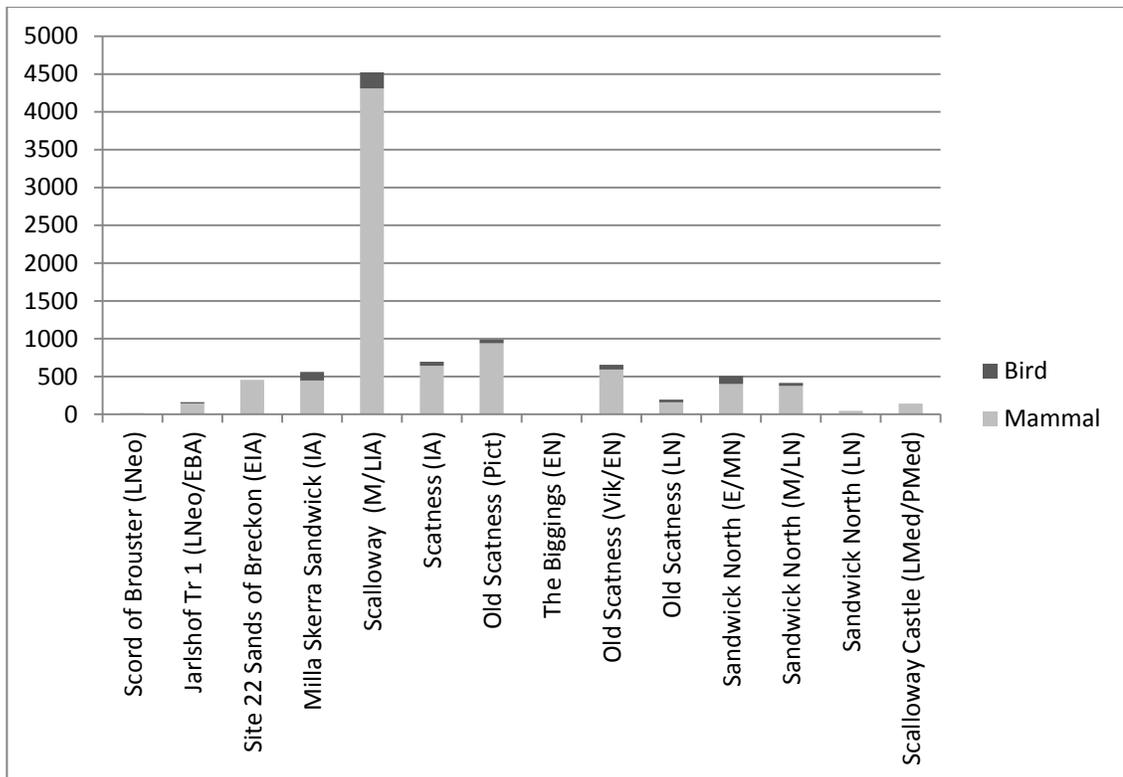


Figure A5.3: Mammal and Avian NISP for The Outer Hebrides

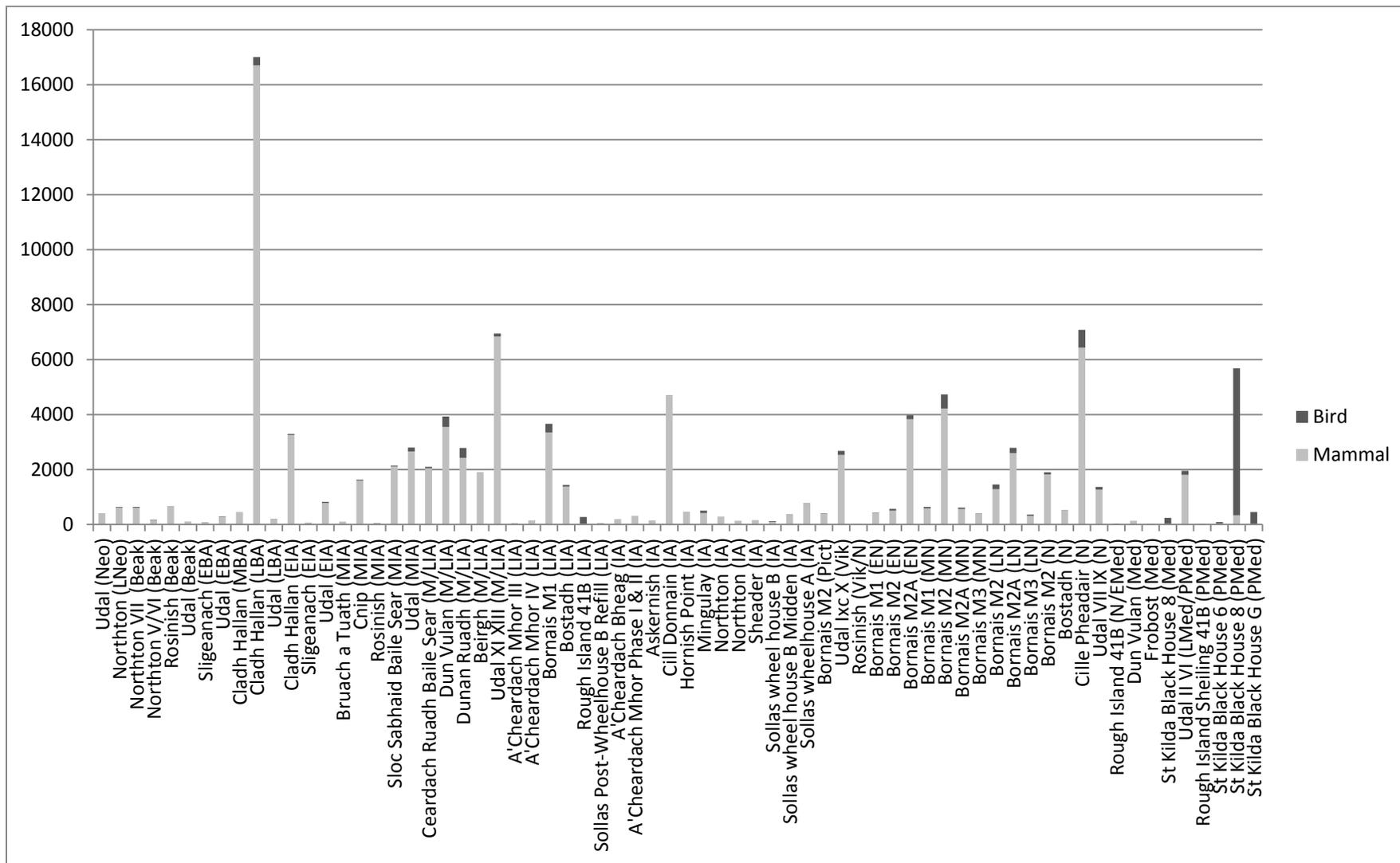
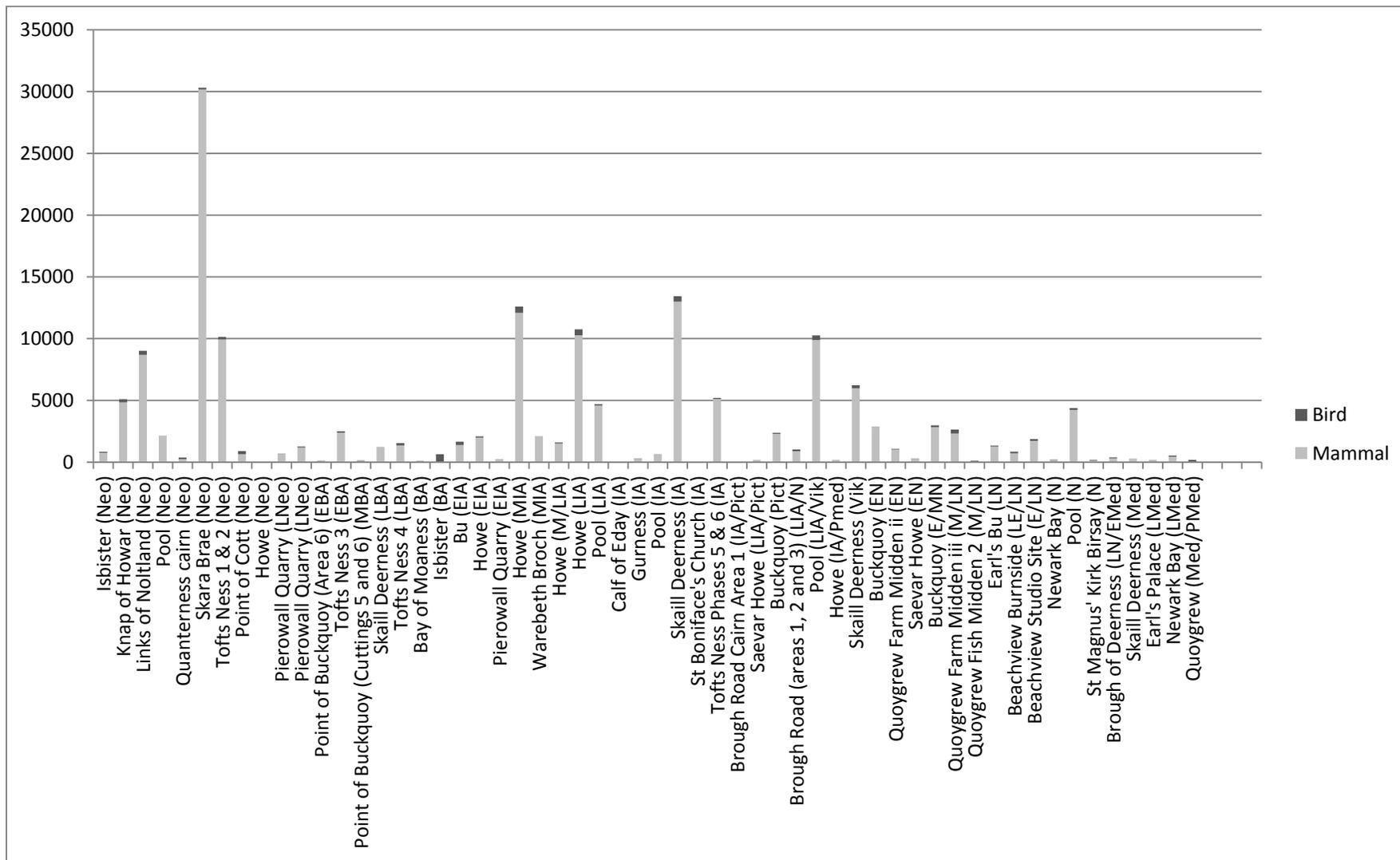


Figure A5.4: Mammal and Avian NISP for Orkney



Test 5.1

A (N=30) vs. B(N=17)
Mean ranks: 12.71 11.29
T=Ub: 132.5
p(same): 0.006909
Monte Carlo p: 0.0072

Test 5.2

A (N=14) vs. B(N=16)
Mean ranks: 5.667 9.833
T=Ub: 65
p(same): 0.05323
Monte Carlo p: 0.0533
Exact p: 0.05227

Figure A5.5: Mammal, Fish and Avian NISP for the Inner Hebrides

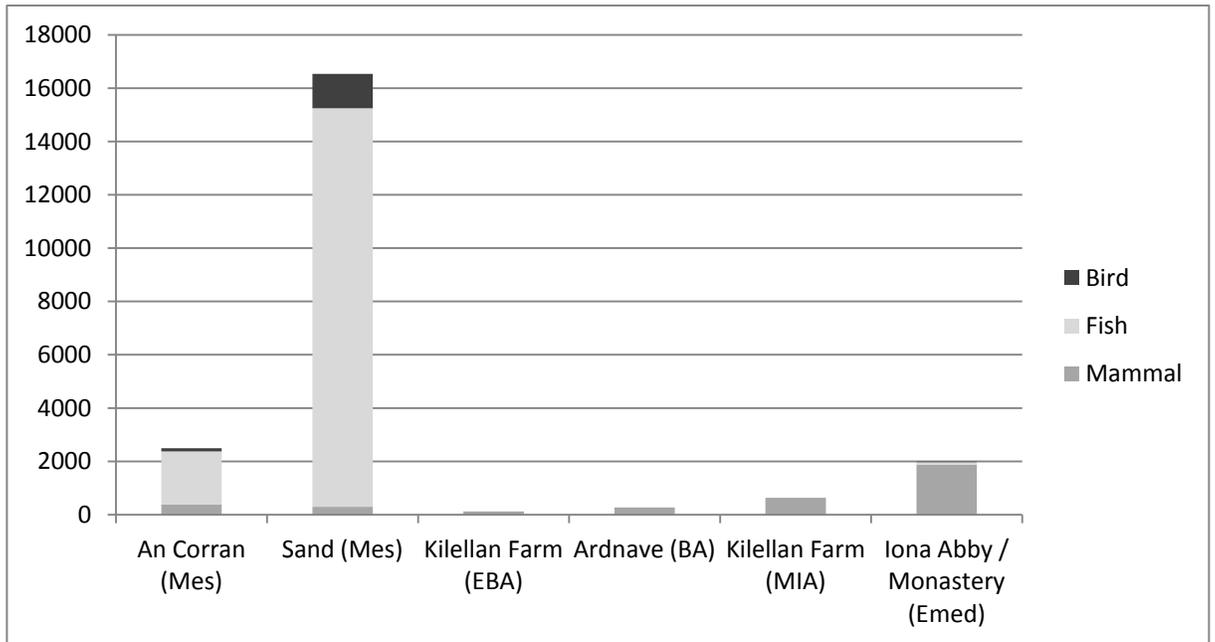


Figure A5.6: Mammal, Fish and Avian NISP for Shetland

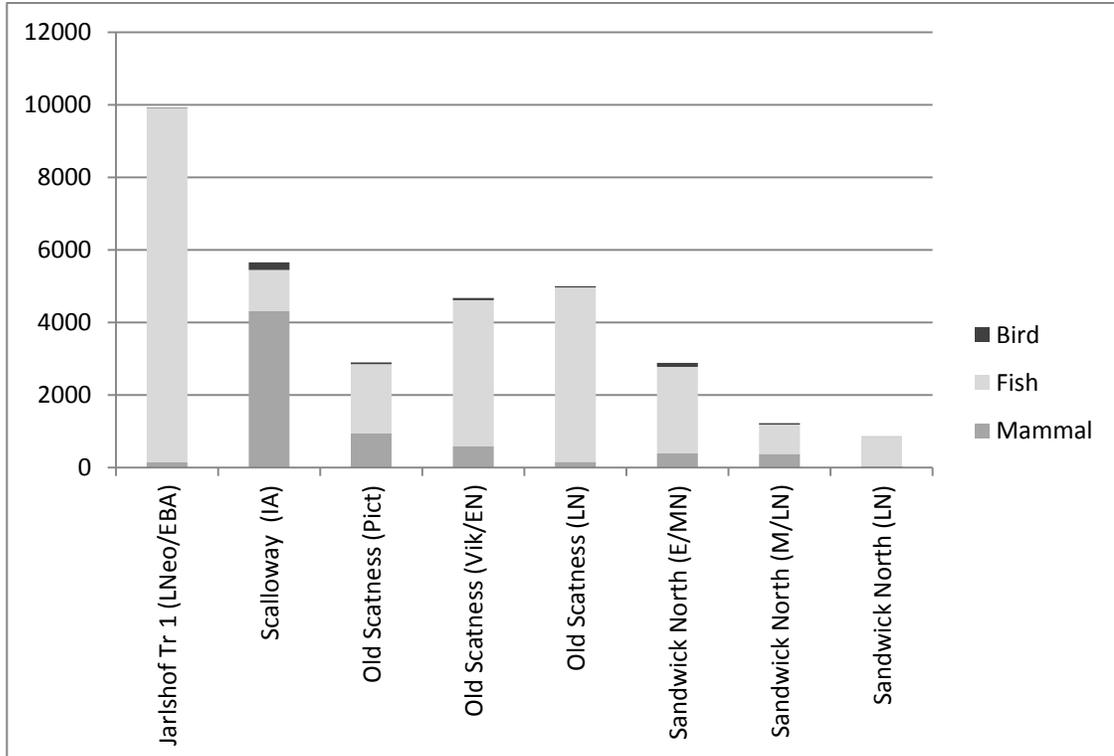


Figure A5.7: Mammal and Avian NISP for the Comparable Mainland Sites

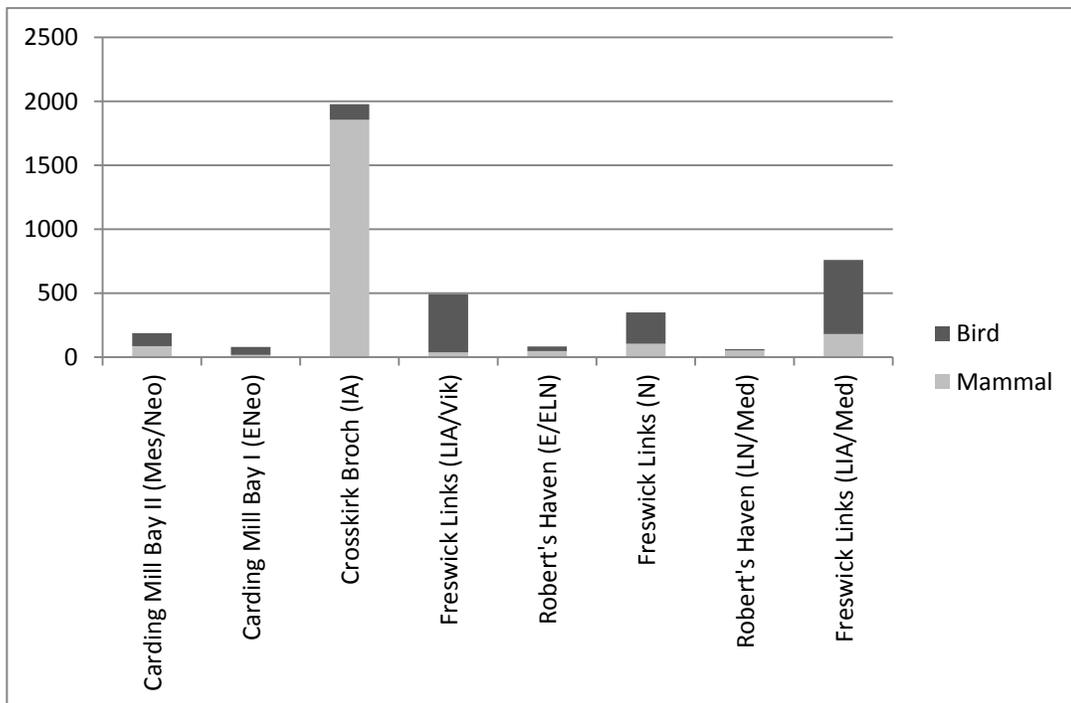


Figure A5.8: Mammal, Fish and Avian NISP for the Comparable Mainland Sites

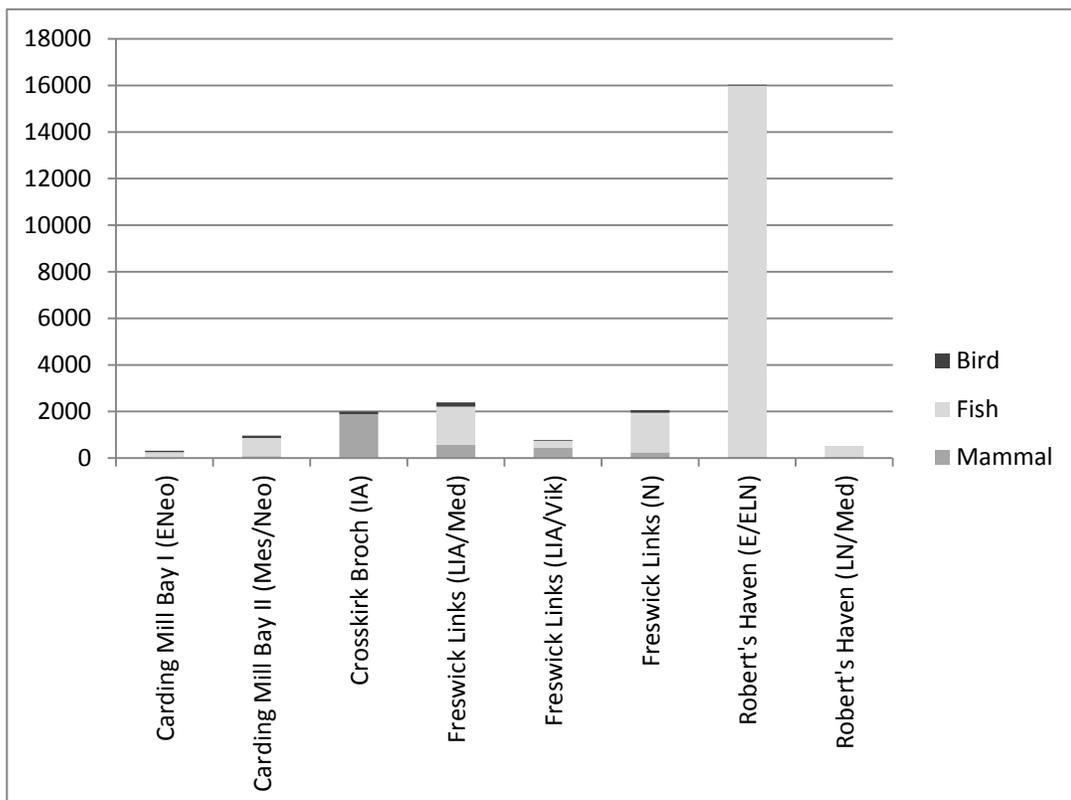


Figure A5.9: Mammal, Fish and Avian NISP for the Outer Hebrides

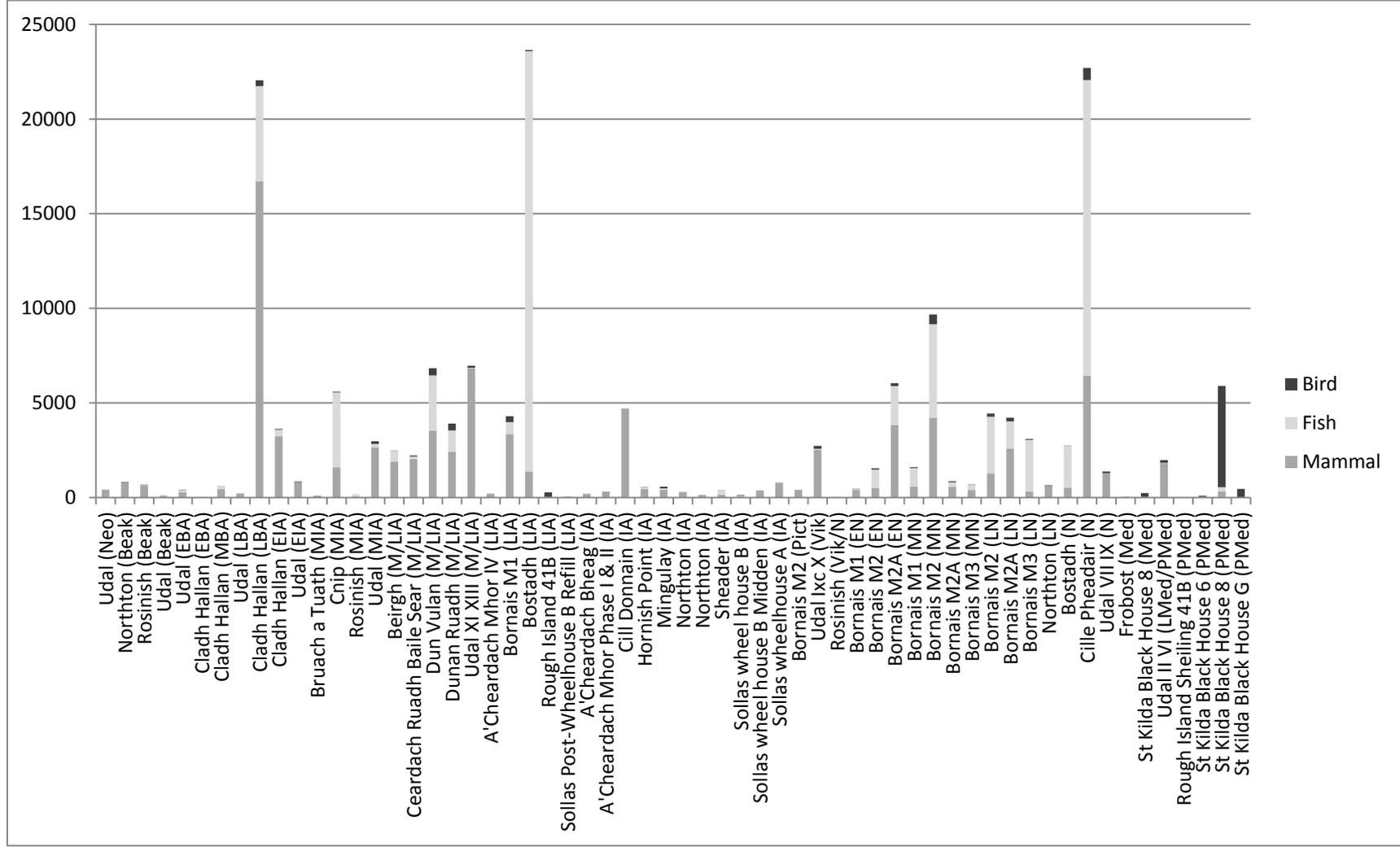


Figure A5.10: Mammal, Fish and Avian NISP for Orkney

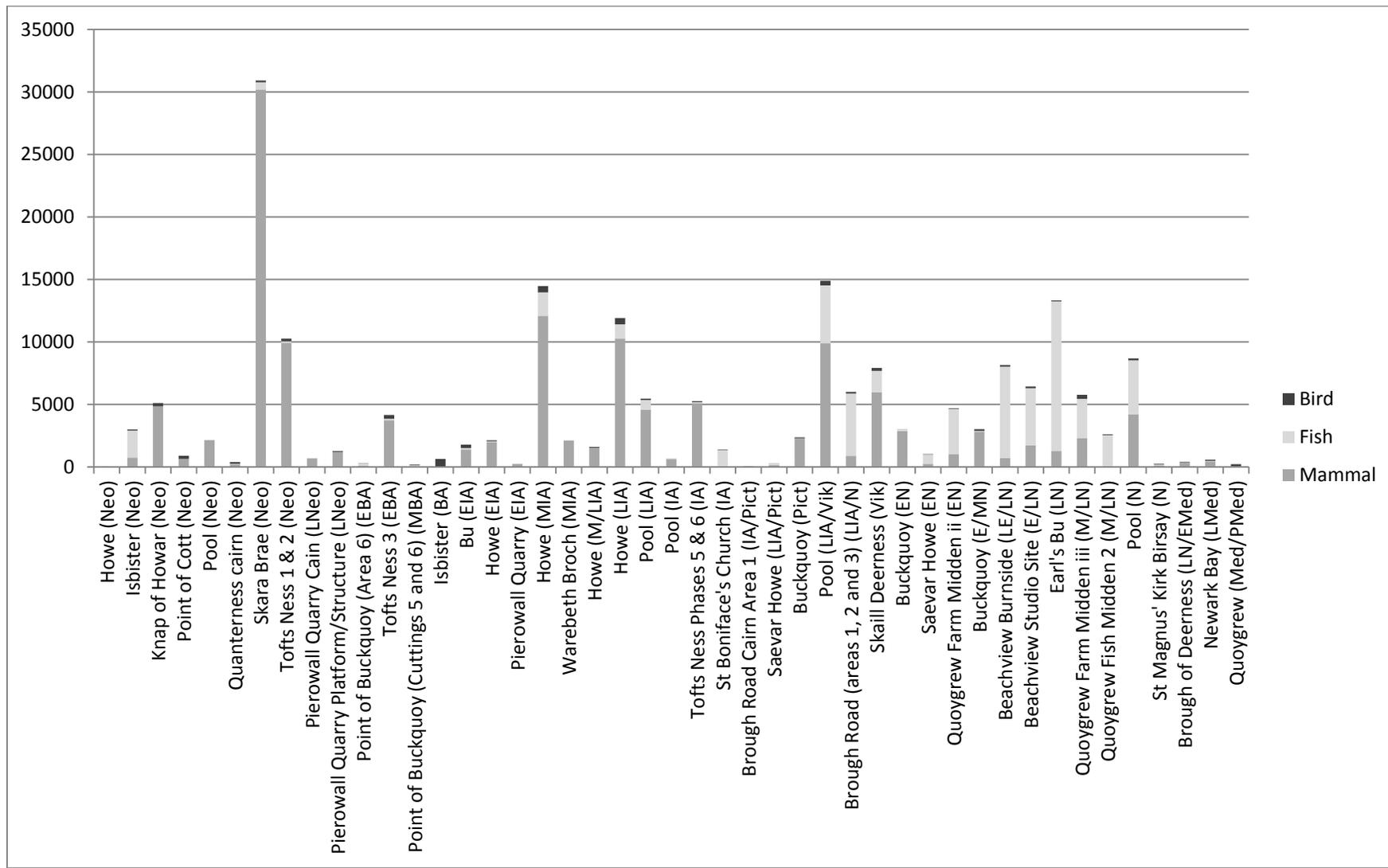


Figure A5.11: Combined Avian, Mammal, Fish NISP from assessed sites on Shiant Isles

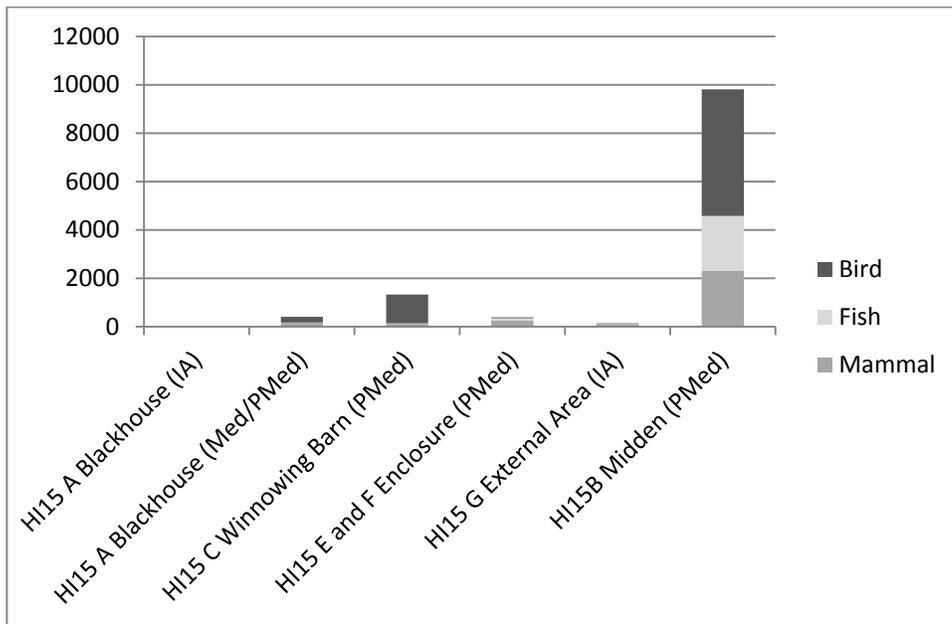


Figure A5.12: Avian groupings as a % NISP show by geographical island group

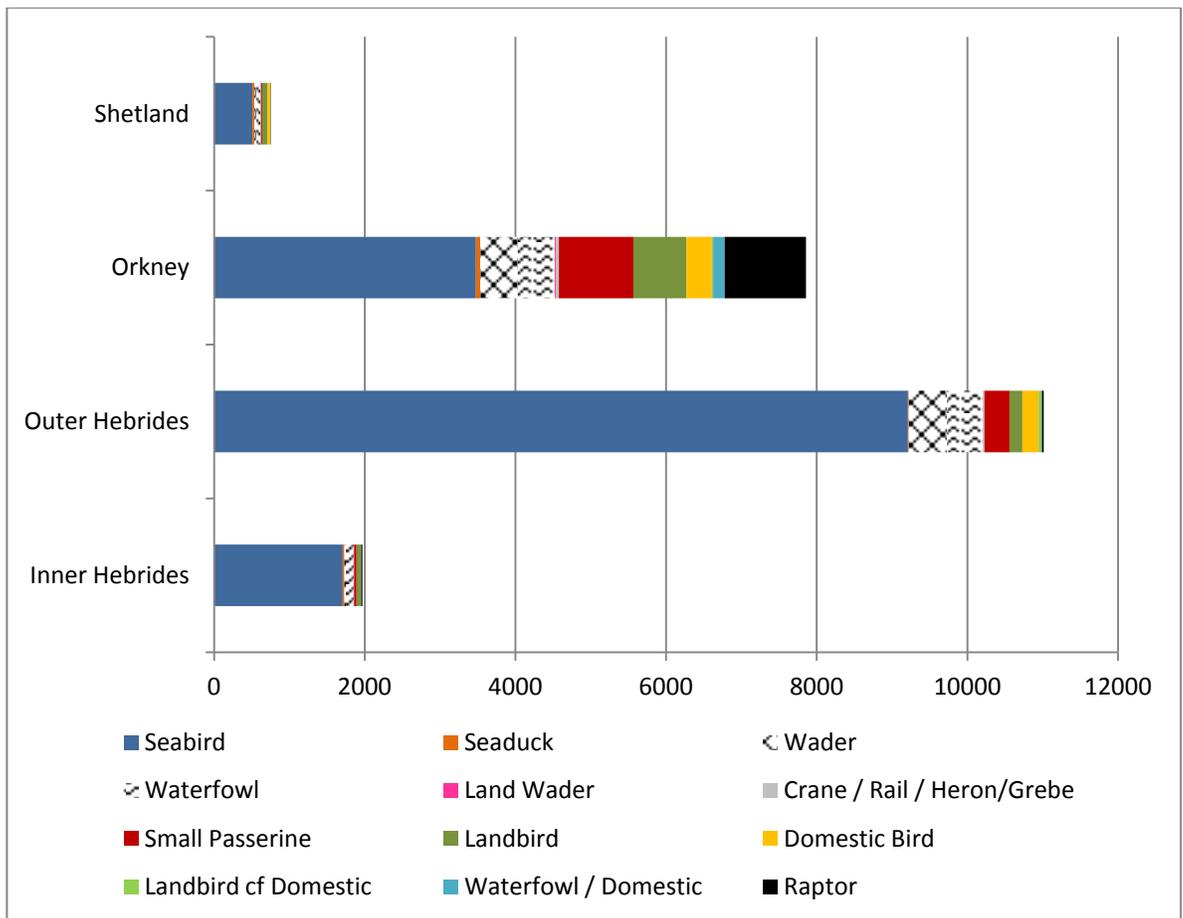


Table A5.2: Avian taxonomic category by NISP for each period - Hebrides

Inner and Outer Hebrides	Mesolithic	Neolithic	Bronze Age	Iron Age	PN/Pict	Norse	Med/Postmed
Seabird	1660	19	265	1636	5	1071	6261
Seaduck	23		1	3		6	
Wader	16	6	42	72	2	384	7
Waterfowl	88	1	54	105	3	300	23
Land Wader	4			1		2	
Crane / Rail / Heron/Grebe	3		4	7		9	1
Small Passerine	21		13	167	1	152	11
Landbird	19		16	70		115	7
Domestic Bird				11		174	32
Landbird <i>cf.</i> Domestic					1	36	
Waterfowl / Domestic				1		6	3
Raptor	13	1	2	8	1	14	3

Table A5.3: Avian taxonomic category by NISP for each period – Northern Isles

	Mesolithic	Neolithic	Late Neolithic / Early Bronze Age	Bronze Age	Late Bronze Age / Early Iron Age	Iron Age	Pre-Norse/Pictish	Late Iron Age / Norse Interface	Norse	Late Norse/Medieval - Post Medieval	Med/PostMed
Seabird	7	727	15	122	12	1147	108	349	1220	65	206
Seaduck	1	21		4		37	2	3	10		3
Wader		100		107	1	156	11	13	108	2	32
Waterfowl	1	125	1	28	2	168	3	66	109	11	25
Land Wader		5				7					1
Crane / Rail / Heron/Grebe		8		4	2	20	2	6	7		1
Small Passerine		185		58		524	6	6	96	4	78
Landbird		75		38		341		29	203	1	86
Domestic Bird						41	2	18	204	21	91
Landbird <i>cf.</i> Domestic									16	1	
Waterfowl / Domestic						25		4	91	29	5
Raptor		279		655	2	104	1	9	23	2	9

Table A5.4: Mesolithic Species in order of NISP

SITE NAME	An Corran	Cnoc Coig	Caisteal nan Gillean	Cnoc Sligeach	Sand	West Voe	Total
ISLAND GROUP	IH	IH	IH	IH	IH	SH	
RAZORBILL / GUILLEMOT		2			1024		1026
AUK SP		13			144		157
GUILLEMOT	1	39	1	1	79		121
GREAT AUK	17	58	18	1	11	1	106
PUFFIN	81	11				1	93
RAZORBILL		36	1	1	19		57
BEWICK'S SWAN		29					29
CORMORANT	5	20		1		1	27
GANNET	1	16		1		1	19
EIDER		16				1	17
TEAL		14					14
GOOSE SP		12		1			13
QUAIL		11					11
SHAG		8		1		2	11
BUZZARD		9					9
CORMORANT/SHAG	2				7		9
GREYLAG GOOSE		9					9
DUCK SP		9					9
PASSERINE	7	1					8
FULMAR		8					8
CURLEW		8					8
WHOOPER SWAN		6					6
BLACK GUILLEMOT		5					5
WOODCOCK		4					4
HERRING / LESSER BLACK BACKED GULL		4					4
SMALL PASSERINE		1			3		4
WILLOW TIT	3						3
SPOTTED CRAKE		3					3
RAVEN		3					3
MANX SHEARWATER		3					3
PELECANIFORME		3					3
GREAT BLACK BACKED GULL		3					3
GULL SP		2		1			3
COMMON SCOTER		3					3
BLACKBIRD / RING OUSEL		3					3
SNIPE		3					3
MALLARD		2				1	3
WATER RAIL		1		1			2
CORNCRAKE		2					2
WHITE TAILED EAGLE	2						2
SPARROW HAWK		2					2

LARGE GULL SP	2					2
SKUA <i>CF.</i> POMARINE	2					2
LITTLE AUK		1			1	2
LONG TAILED DUCK		2				2
THRUSH SP	1	1				2
SWAN SP			2			2
SHELDUCK		2				2
CRANE		1				1
GREAT NORTHERN DIVER		1				1
SANDWICH TERN		1				1
COMMON GULL		1				1
BLACK HEADED GULL		1				1
GULL <i>CF.</i> GREAT BLACK BACKED					1	1
COMMON TERN				1		1
VELVET SCOTER		1				1
RED BREASTED MERGANSER				1		1
REDWING		1				1
RINGED PLOVER				1		1
BLACKTAILED GODWIT		1				1
GREENSHANK		1				1
SANDPIPER SP		1				1
WADER <i>CF.</i> KNOT		1				1
ANATIDAE		1				1
DUCK <i>CF.</i> SHELDUCK				1		1

Table 5.5: Neolithic Species in order of NISP

SITE NAME	Point of Cott	Quanterness cairn	Pierowall Quarry	Pierowall Quarry	Howe	Knapp of Howar	Isbister	Links of Noltland	Tofts Ness 1 & 2	Skara Brae	Pool	Holm of Papa Westray	Midhowe Cairn	Blackhammer	Knowe of Ramsay	Udal	Eilean Domhnuill Loch Olabhat	Northton	Total
ISLAND GROUP	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OH	OH	OH	
White-Tailed Eagle	139							98				1			1				239
Gannet	2	7	1	10		24		27	11	20			1	2	7			2	114
Great Black-Backed Gull	1	1		3		17	26	16	37	1	1								103
Great Auk				1		35		6	23	5		1			1				72
Guillemot	6	5				39		12	3	1			1					4	71
Cormorant	1			2		9		31	8	1			2	1	4			1	60
Puffin	17			1		3	3	17	1	8								2	52
Starling	17	1		22	1	1		3		2									47
Herring / Lesser-Black Backed Gull						6		10	28									2	46
Rook/Crow			1	1			13	24					1						40
Shag	3			1		14	2	4	6	1								3	34
Fulmar	2					17		1		9									29
Thrush Sp	4	11	3	2		1		6											27
Razorbill	2					9		2	1	7								4	25
Skylark		14				2		2		7									25
Snipe	11	4				2	2	3		2									24
Cormorant/Shag				2				12	8										22
Blackbird		10		1				2		6									19
Oystercatcher	1	8				1	1		4	3						1			19
Greylag Goose						12		2		5									19
Gull cf. Great Black-Backed				1					15										16
Gull cf. Herring/Lesser Black-Backed				3			1		11										15
Grouse (Red/Willow)		12					1												13
Wader	11			1															12
Duck Sp	3			1		1		5							1			1	12
Gull Sp						3	1	4	3										11

Buzzard		2		2		1			2	3			1						11
Short Eared Owl							10	1											11
Songthrush		2	7	2															11
Redwing		5								5									10
Barnacle Sized Goose						10													10
Raven		1				1	6		1										9
Curlew						2	2		2	2					1				9
Swan Sp				1					7										8
Grey Goose Sp									3		5								8
Shelduck						1		7											8
Manx Shearwater						1		1	1	4									7
Common Gull						2	1	2	2										7
Kittiwake	3									4									7
Little Auk	2			1			3	1											7
Eider						3	1	2	1										7
Greylag/Bean Goose									4		3								7
Red-Breasted Merganser	4								2										6
Large Wader Sp						6													6
Whooper Swan						3		1		2									6
Goose cf. White Fronted/Pink Footed										4			1	1					6
Teal	1									5									6
Large Grey Goose cf. Greylag	1			2			3												6
Woodcock							3			2									5
Hooded Crow										5									5
Goshawk	2						3												5
Raptor cf. Buzzard	2			3															5
Great Skua						5													5
Black Guillemot						4				1									5
Velvet Scoter						1		4											5
Small Passerine cf. Wheatear		3						2											5
Turnstone						4									1				5
Small Wader Sp		1		3		1													5
Anatidae										5									5
Water Rail								4											4
Kestrel							1	2		1									4
Shearwater Sp	2					1											1		4
Great Northern Diver						1		2		1									4
Sandwich Tern						1				3									4
Herring Gull	1									3									4

Small Passerine <i>cf.</i> Warbler		2		1				1											4
Small Passerine <i>cf.</i> Blackbird			1	3															4
Golden Plover										4									4
Redshank						1		1		1					1				4
Swan <i>cf.</i> Whooper										3				1					4
Pochard										4									4
Goosander								4											4
Black-Throated Diver						3													3
Gull <i>cf.</i> Common										3									3
Small Passerine <i>cf.</i> Fieldfare			3																3
Blackbird/Ring Ousel			3																3
Small Passerine <i>cf.</i> Twite			2		1														3
Lapwing	2		1																3
Wader <i>cf.</i> Snipe																		3	3
Razorbill/Guillemot				1						1									2
Coot											2								2
Corvid Sp	1							1											2
Corvid <i>cf.</i> Magpie				2															2
Peregrine Falcon											1						1		2
Diver Sp	1			1															2
Black-Headed Gull		1						1											2
Skua Sp						1						1							2
Gull <i>cf.</i> Kittiwake										2									2
Little Auk/Common Tern				2															2
Duck <i>cf.</i> Eider				1						1									2
Passerine		2																	2
Wren		2																	2
Small Passerine <i>cf.</i> Tit		1		1															2
Small Passerine <i>cf.</i> Wagtail		2																	2
Small Passerine <i>cf.</i> Linnet		1						1											2
Brambling		2																	2
Goldcrest		2																	2
Small Passerine Finch Size				2															2
Grey Plover						1		1											2
Greenshank		2																	2
Goose Sp								2											2
Mallard							1			1									2
Tufted Duck																			2
Pintail																			2

Table A5.6: Bronze Age Species in order of NISP

SITE NAME	Rosinish	Cladh Hallan	Cladh Hallan	Udal	Udal	Udal	Ardnave	Killellan Farm	Northton	Northton	Sligeanach	Bay of Moaness	Point of Buckquoy (Area 6)	Point of Buckquoy (Cuttings 5 and 6)	Isbister	Tofts Ness 3	Tofts Ness 4	Total
ISLAND GROUP	OH	OH	OH	OH	OH	OH	IH	IH	OH	OH	OH	OR	OR	OR	OR	OR	OR	OR
White-Tailed Eagle															641		1	642
Gannet	1	1	102		1								1			9	2	117
Wader	1													12		1	44	58
Great Black-Backed Gull			9													24	3	36
Cormorant	2		16						6	4						6		34
Raven																1	31	32
Sandpiper Sp.													2	6			24	32
Great Auk			14	1	2	1				1						7		26
Herring / Lesser-Black Backed Gull			5						1		1					14	4	25
Shag			13					1	3	1		1				5		24
Passerine														9		1	13	23
Swan Sp			16													1	5	22
Guillemot			7		2				4	1			1			1	4	20
Puffin			8	1	2				6		2						1	20
Small Passerine			5										13					18
Gull Sp	1		10													5	1	17
Gull cf. Great Black-Backed																12		12
Goose Sp			8		3											1		12
Thrush Sp																	10	10
Curlew	1		7				1			1								10
Large Grey Goose cf. Greylag			10															10
Grouse (Red/Willow)			9															9
Gull cf. Herring/Lesser Black-Backed					1	1										6		8
Fulmar			5											1				7
Cormorant/Shag			3						1							2		6
Little Auk			1							1	1		1				2	6
Oystercatcher			1						1	3	1					1		6
Wader cf. Curlew	1	1	4															6
Wader cf. Snipe									1								5	6
Razorbill/Guillemot			2														3	5
Snipe			4										1					5
Swan cf. Whooper			4														1	5

Table A5.7: Transitional Bronze Age sites shown in order of NISP

	Jarlshof Tr 1	Jarlshof
	Late Neolithic / Early Bronze Age	Late Bronze Age / Early Iron Age
GANNET		4
GUILLEMOT	4	
GREAT BLACK BACKED GULL	3	
LARGE GULL SP	3	
CORMORANT		2
SHAG		2
HERRING / LESSER BLACK BACKED GULL	1	1
GREY HERON		1
STORK		1
WHITE TAILED / GOLDEN EAGLE		1
PEREGRINE FALCON		1
GREAT NORTHERN DIVER		1
GULL SP	1	
SKUA SP		1
RAZORBILL		1
PUFFIN / BLACK GUILLEMOT	1	
RAZORBILL / GUILLEMOT	1	
GREAT AUK	1	
LAPWING		1
SWAN SP		1
GOOSE SP		1
DUCK / GOOSE	1	

Table A5.8a: Iron Age Species in order of NISP: Hebrides (Part One)

SITE NAME	Dunan Ruadh (PY10)	Sheader (SY14)	Mingulay (MY384)	Bornais M1	Rough Island 41B	Dun Vulan	Sollas wheelhouse A	Sollas wheel house B Midden	Sollas wheel house B	Sollas Post-Wheelhouse B Refill	Udal	Udal	Udal XI XIII	A'Cheardach Mhor Phase I & II	A'Cheardach Mhor IV	A'Cheardach Bheag	Bostadh	Beirgh	Cnip	Cill Donnain	Hornish Point	Ceardach Ruadh Baile Sear	Sloc Sabhaid Baile Sear	Askernish	Foshigarry
ISLAND GROUP	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH
Shag	265	2	64	49	6	12			2				4						9					1	
Starling	4					26			3	1	7	17											1		
Puffin				1	224	29			1		2	5	7	1			36		5	1		2	1		
Gannet	3	1		5		24	1	1	2		2	7	33		1		1	1	2			2	4		
Great Auk	1			9		43	2		5		5	8	2						11		2	5	4		
Herring / LBB Gull				138		5							7				1								
Cormorant	5		2	26		19							4				5	1		1		1			
Grouse (Red/Willow)													4												
Guillemot					1	31			1		2	38	6				8		1			3			
Raven	5					17															1				
Manx Shearwater	18		20	12		11			1			3	7				1				2	1			
Gull Sp	18					38																			1
Fulmar				1		3			1		6		2	1								24			
Thrush Sp	3					2															1				
Great Black-Backed Gull				1	33	2							2											1	
Razorbill					5	9			1				5												
Domestic Fowl						6							2												
Golden Plover	2					1																			
Razorbill/Guillemot	5	1		2	6	18																			
Little Auk	4					6							1												
Glaucous/GBB Gull																									
Goose Sp	1					6			1			1				2			3						
Large Gull Sp																									
Rook/Crow						1																			
Songthrush												18													
Passerine				1		2																			
Snipe	4					1																			
Curlew				5		1							1												
Duck Sp	1		1			15																			

Table A5.8c: Iron Age Species in order of NISP: Shetland

SITE NAME	Scatness	Scalloway	Milla Skerra Sandwick	Scalloway	Scalloway	Jarlshof
ISLAND GROUP	SH	SH	SH	SH	SH	SH
Puffin	1			4	49	
Gannet			21	5	14	
Shag	12		19		3	1
Great Auk		2	28			2
Domestic Fowl				1	23	
Cormorant	2	1	1	4	14	1
Rook/Crow				3	20	
Guillemot	2		12	2	4	
Snipe	2				14	
Eider	10		6			
Cormorant/Shag			13			
Herring Gull	4			1	6	
Mallard				1	8	
Little Auk	5		2			
Kittiwake	3				4	
Mute Swan				6		
Raven					5	
Large Grey Goose <i>cf.</i> Greylag				1	4	
Curlew	1				3	
Teal					4	
Starling	3					
Passerine			3			
Red-Throated Diver				3		
Bar-Tailed Godwit	1				2	
Hooded Crow	3					
Razorbill			2			
Wader			2			
Shoveler	2					
Manx Shearwater	1					
Goose Sp			1			
Duck Sp			1			
Black Guillemot			1			
White-Tailed Eagle			1			
Grey Heron				1		
Duck <i>cf.</i> Pochard	1					

Table A5.9: Norse Species in order of NISP (Bornais Mounds and Norse phases combined; for detailed division see Chapter Four)

SITE NAME	Rough Island 41B	Udal Ixc-X	Udal VII-IX	Bostadh	Cille Pheadair	Bornais (Combined)	Buckquoy (E/MIN)	Newark Bay	Tuquoy	Buckquoy (EN)	Pool	Saevar Howe	Earl's Bu	Skaill Deerness	Quoygrew Farm Midden ii	Quoygrew Farm Midden iii	Quoygrew Fish Midden 2	Jarlshof	Old Scatness (V/EN)	Old Scatness (LN)	Sandwick North (E/MIN)	Sandwick North (M/LN)	Sandwick North (LN)	St Magnus' Kirk Birsay	Beachview Burnside	Beachview Studio Site	
ISLAND GROUP	OH	OH	OH	OH	OH	OH	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	SH	SH	SH	SH	SH	SH	OR	OR	OR	
Gannet		23	23		32	56	47		24	1	57	9		20	1	15	14	1	4	2	34	1		3	33	42	
Domestic Fowl		19	26		22	96	10	2	89	1	4	2	22	14	1	14	1	1	4	1	7	3		4	9	14	
Herring / LBB Gull		3	3	2	54	142	3		5		8			32	3	40	8	1			2				2	3	
Shag	1	3	1		21	12	7	1	40		19			38	8	46	2	1	17	3					5	3	
Cormorant		2		1	15	121	1	1	8	1	16	1	1	10	1	18	1	1		1	8	2			3	3	
GBB Gull		5	1		38	91		1			4	1			3	28	2	1	19	2							
Small Wader Sp					80	66	1	2	2															25	3	1	
Guillemot		10	6	3	6	31	6		8		7			8				1	1	2	24	10	1	2	8	3	
Puffin	22	8			12	34	2	1	4	1	1		1		5	27	5	1		1	1				2	5	
Small Passerine					33	51			10																8	4	
Greylag/Domestic Goose					2	4	12		42				7	20				1			1			1			
Razorbill/Guillemot					5	14					2	1		4	4	38	9				2	4			4	1	
Raven					2	11			8	1	1		1	6	7			1	1	10	11	9		1		4	
Manx Shearwater		3	13		4	20	10		2	1		2		2	1	4	1				2		1			6	
Plover cf. Golden		11	3		34	16																					
Goose Sp					2	42			10		1					3									2	2	
Rook/Crow		22	1		6	9	8	2			1		4	8												1	
Large Goose					17	16																				10	
Cormorant/Shag					2	19			1		7			14		4			1		4		1		3		
Passerine						4					1				8	25	14			1				2			
Galliform cf. Domestic Fowl					3	33			15		1																
Columba Sp						4			11				2	31											1		
Large Grey Goose cf. Greylag						42														2						1	
Rock / Stock Dove						14	3	2						3											13	6	
Fulmar		4	3		15	10	3										1			1	2	1					
Razorbill	3	2			2	7	2		9		4			7							1						
Oystercatcher					6	28								1				1									
Great Northern Diver					1	21	4			1		2		1										1		3	
Small Gull Sp					1	23		1		1	1				1	1					1	2					
Galliform Sp					13	14							1												1		

Golden Plover				17	2		4					3								3		
Gull Sp				3	4		1						2	17	1							
Wader				2	18			3				1			2						2	
Duck Sp				7	8	2		1		1		1	3					1				3
Gull cf. Great Black-Backed				12				13														
Large Grey Goose				23	2																	
Large Duck Sp				15	10																	
Glaucous/Great Black-Backed Gull						2			1			10				4		3				4
Curlew		1		5	11		1					2				1					2	
Grouse (Red/Willow)					4		1					14										3
Greylag Goose	2	9			9		2															
Kittiwake		1		1						1			2	12	3	1						
Small Passerine Finch Size					21																	
Large Gull Sp					8			1				1					9					1
Wader cf. Snipe				8	10																1	
Plover					1							1		16								
Starling				3	3	2	2														2	3
Duck cf. Mallard				6	9																	2
Small Passerine cf. Starling				6	5																1	2
Gull / Skua cf. Herring / LBB					14																	
White-Tailed Eagle	2			1	8			1				1										
Gull cf. Kittiwake				1	4			8														
Greylag/Bean Goose									8									2	3			
Duck cf. Shelduck				13																		
Wader cf. Golden or Grey Plover				12																		
Duck/Goose				4	6			1										1				
Gull cf. Common				3	6			1		1												
Wader cf. Plover					7			3														
Shelduck				5	1	4															1	
Herring Gull										6			2	2			1					
Domestic Fowl Bantam Size				10																		
Gull cf. Black-Headed								10														
Eider					1																	
Thrush Sp					3	1				3		1	4			1	1			2		2
Brent/Barnacle Goose				1	8																1	
Grey Goose Sp	6				2								1							1		
Columba Sp cf. Rock/Stock				2	4																	3
Auk Sp			2		4															1		1
Small Passerine cf. Thrush					9																	
Small Goose				4	2			1														2
Teal				3	4		2															
Buzzard								4				4										

Table A5.11: Transitional period species

SITE NAME	Brough Road (areas 1, 2 and 3)	Pool	Tuquov
ISLAND GROUP	OR	OR	OR
PERIOD	LIA/N	LIA/Vik	LN/Med-PMed
SHAG	8	71	19
CORMORANT	3	59	7
GANNET	18	40	8
GREYLAG / BEAN GOOSE		38	
DOMESTIC FOWL	4	8	21
HERRING / LESSER BLACK BACKED GULL	3	20	2
RAVEN		23	
MANX SHEARWATER	22	1	
RAZORBILL	3	14	6
GREAT BLACK BACKED GULL	2	17	
KITTIWAKE		17	
GREYLAG / DOMESTIC GOOSE	4		13
MALLARD / DOMESTIC DUCK			16
MALLARD	11	3	
CORMORANT/SHAG	3	6	4
PUFFIN	9	2	2
GUILLEMOT	4	2	6
DUCK / GOOSE	1		7
DOMESTIC GOOSE	6		
CRANE	5		
LARGE GULL SP	1	3	1
SMALL PASSERINE	1		4
OYSTERCATCHER	2	3	
PLOVER	3	2	
ANATIDAE		5	
DUCK SP	1	1	3
MERLIN		4	
GULL SP	3		1
LITTLE AUK	2	1	1
ROOK/CROW	2	1	
KESTREL		3	
FULMAR		2	1
RAZORBILL / GUILLEMOT		3	
GULL CF. GREAT BLACK BACKED		2	1
PASSERINE	2	1	
CURLEW	1	2	
GREY GOOSE SP		3	
ROCK / STOCK DOVE	1	1	
COLUMBA SP	1		1
BUZZARD			2
DIVER SP	1		1
SMALL GULL SP			2
GREAT AUK	1	1	
GULL CF. COMMON		1	1
EIDER	2		
WADER			2
GREY HERON	1		
GALLIFORM CF. DOMESTIC FOWL			1
WHITE TAILED EAGLE		1	
CF. MERLIN		1	
LESSER BLACK BACKED GULL	1		
GLAUCOUS / GREAT BLACK BACKED GULL	1		
BLACK GUILLEMOT		1	
AUK SP	1		
AUK CF. GUILLEMOT			1
SHEARWATER CF. MANX			1
RED BREASTED MERGANSER		1	
THRUSH SP		1	
STARLING	1		
SWAN SP		1	
TEAL		1	
DUCK CF. TEAL			1
DUCK CF. POCHARD		1	

Table A5.12: Fulmar NISP by site, period and location

SITE NAME	ISLAND GROUP	PERIOD	FULMAR
Cnoc Coig	Inner Hebrides	Mesolithic	8
Knap of Howar	Orkney	Neolithic	17
Skara Brae	Orkney	Neolithic	9
Links of Noltland	Orkney	Neolithic	1
Point of Cott	Orkney	Neolithic some mixed	2
Bay of Moaness	Orkney	Bronze Age	1
Point of Buckquoy (Cuttings 5 and 6)	Orkney	Middle Bronze Age c 1770-1370 cal BC	1
Cladh Hallan	Outer Hebrides	Late Bronze Age	5
Cladh Hallan	Outer Hebrides	Early Iron Age	1
Udal	Outer Hebrides	Early Iron Age	6
Howe	Orkney	Middle Iron Age	3
Dun Cul Bhuirg	Inner Hebrides	Middle Iron Age 100 BC to 300 AD	1
Dun Vulcan	Outer Hebrides	Middle - Late Iron Age	3
Ceardach Ruadh Baile Sear	Outer Hebrides	Middle-Late Iron Age	24*
Bornais M1	Outer Hebrides	Late Iron Age	1
Howe	Orkney	Late Iron Age	1
Udal XI XIII	Outer Hebrides	Late Iron Age 300 - 800 AD	2
Pool	Orkney	Late Iron Age Phase 6	1
Pool	Orkney	Late Iron Age / Viking Interface Phase 7	2
A'Cheardach Mhor Phase I & II	Outer Hebrides	Iron Age	1
Sollas wheel house B Midden	Outer Hebrides	Iron Age	3
Tofts Ness Phases 5 & 6	Orkney	Iron Age	1
Sollas wheel house B	Outer Hebrides	Iron Age	1
Skail Deerness	Orkney	Iron Age	6
Crosskirk broch	Mainland	Iron Age	2
Old Scatness	Shetland	Pre-Norse/Pictish (/LIA?)	2
Buckquoy	Orkney	Pre-Norse/Pictish (200AD- 8th century)	6
Udal Ixc X	Outer Hebrides	Viking	4
Udal VII IX	Outer Hebrides	800 - 1300 AD Norse	3
Buckquoy	Orkney	Norse (9th to 12th centuries AD)	3
Sandwick North	Shetland	Early / Middle Norse 11th-12th c	2
Bornais M2	Outer Hebrides	Middle Norse	10
Cille Pheadair	Outer Hebrides	Norse L10th/E11th - M-L 13th	15
Sandwick North	Shetland	Middle/Late Norse 12th-13th c	1
Quoygrew Fish Midden 2	Orkney	Middle-Late Norse 1066-1294AD	1
Old Scatness	Shetland	Late Norse	1
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	1
St Kilda Black House 8	Outer Hebrides	Pre blackhouse 10th-13th century onwards	47
Udal II VI	Outer Hebrides	1300 -1700 AD Late / Post Medieval	1
Quoygrew	Orkney	Late Medieval - Post Medieval	1
St Kilda Black House 8	Outer Hebrides	Modern c. 1830-1930	1117
St Kilda Black House 6	Outer Hebrides	Modern c. 1830-1930	8
St Kilda Black House G	Outer Hebrides	Modern c. 1830-1930	360

Table A5.13: Puffin NISP by site, period and location

SITE NAME	ISLAND	ISLAND GROUP	PERIOD	PUFFIN	NISP	% NISP
An Corran	Skye	Inner Hebrides	Mes	81	124	65.3
Cnoc Coig	Oronsay	Inner Hebrides	Mes	11	400	2.8
West Voe	Mainland	Shetland	Mes	1	9	11.1
Knap of Howar	Papa Westray	Orkney	Neo	3	254	1.2
Isbister	South Ronaldsay	Orkney	Neo	3	84	3.6
Links of Noltland	Westray	Orkney	Neo	17	331	5.1
Tofts Ness 1 & 2	Sanday	Orkney	Neo	1	211	0.5
Skara Brae	Mainland	Orkney	Neo	8	139	5.8
Pierowall Quarry	Westray	Orkney	LNeo	1	83	1.2
Northton	Harris	Outer Hebrides	LNeo	2	23	8.7
Point of Cott	Westray	Orkney	Neo	17	242	7.0
Udal	North Uist	Outer Hebrides	Beak	1	2	50.0
Northton	Harris	Outer Hebrides	Beak	6	28	21.4
Udal	North Uist	Outer Hebrides	EBA	2	16	12.5
Sligeanach	South Uist	Outer Hebrides	EBA	2	7	28.6
Cladh Hallan	South Uist	Outer Hebrides	LBA	8	307	2.6
Tofts Ness 4	Sanday	Orkney	LBA	1	186	0.5
Udal	North Uist	Outer Hebrides	EIA	2	40	5.0
Bu	Mainland	Orkney	EIA	2	270	0.7
Udal	North Uist	Outer Hebrides	MIA	5	141	3.5
Dun Mor Vaul	Tiree	Inner Hebrides	MIA	1	29	3.4
Howe	Mainland	Orkney	MIA	2	507	0.4
Sloc Sabhaid Baile Sear	Baile Sear	Outer Hebrides	MIA	1	30	3.3
Howe	Mainland	Orkney	M/LIA	1	84	1.2
Cnip	Lewis	Outer Hebrides	M/L(?)IA	5	36	13.9
Ceardach Ruadh Baile Sear	Baile Sear	Outer Hebrides	M/LIA	2	50	4.0
Dun Vulcan	South Uist	Outer Hebrides	M/LIA	29	384	7.6
Udal XI XIII	North Uist	Outer Hebrides	LIA	7	109	6.4
Bornais M1	South Uist	Outer Hebrides	LIA	1	315	0.3
Rough Island 41B	Shiant Isles	Outer Hebrides	LIA	224	244	91.8
Bostadh	Lewis	Outer Hebrides	LIA	36	61	59.0
Howe	Mainland	Orkney	LIA	5	490	1.0
Pool	Sanday	Orkney	LIA	1	109	0.9
Scalloway	Mainland	Shetland	LIA	4	32	12.5
Sollas wheel house B	North Uist	Outer Hebrides	IA	1	31	3.2
A'Cheardach Mhor Phase I & II	South Uist	Outer Hebrides	IA	1	3	33.3
Cill Donnain	South Uist	Outer Hebrides	IA	1	3	33.3
Scatness	Mainland	Shetland	IA	1	53	1.9
Tofts Ness Phases 5 & 6	Sanday	Orkney	IA	2	87	2.3
Skail Deerness	Mainland	Orkney	IA	9	442	2.0
Scalloway	Mainland	Shetland	IA	49	177	27.7
Pool	Sanday	Orkney	LIA/Vik	2	368	0.5

Brough Road (areas 1, 2 and 3)	Mainland	Orkney	LIA/N	9	135	6.7
Bornais M2	South Uist	Outer Hebrides	PN/Pict	1	13	7.7
Old Scatness	Mainland	Shetland	PN/Pict/ (LIA?)	4	49	8.2
Buckquoy	Mainland	Orkney	PN/Pict	5	79	6.3
Udal Ixc X	North Uist	Outer Hebrides	Vik	8	148	5.4
Bornais M2	South Uist	Outer Hebrides	EN	2	65	3.1
Bornais M2A	South Uist	Outer Hebrides	EN	12	154	7.8
Buckquoy	Mainland	Orkney	EN	1	9	11.1
Quoygreww Farm Midden ii	Westray	Orkney	EN	5	48	10.4
Sandwick North	Unst	Shetland	E/MN	1	109	0.9
Buckquoy	Mainland	Orkney	E/MN	2	142	1.4
Bornais M2	South Uist	Outer Hebrides	MN	10	514	1.9
Bornais M2A	South Uist	Outer Hebrides	MN	1	51	2.0
Quoygreww Fish Midden 2	Westray	Orkney	M/LN	5	68	7.4
Quoygreww Farm Midden iii	Westray	Orkney	M/LN	27	325	8.3
Bornais M2	South Uist	Outer Hebrides	LN	2	171	1.2
Bornais M2A	South Uist	Outer Hebrides	LN	3	195	1.5
Old Scatness	Mainland	Shetland	LN	1	36	2.8
Earl's Bu	Mainland	Orkney	LN	1	71	1.4
Bornais M3	South Uist	Outer Hebrides	MN	1	9	11.1
Bornais M3	South Uist	Outer Hebrides	LN	1	46	2.2
Newark Bay	Mainland	Orkney	N	1	35	2.9
Tuquoy	Westray	Orkney	N	4	360	1.1
Bornais M2 (Unphased Norse)	South Uist	Outer Hebrides	N	2	77	2.6
Jarlshof	Mainland	Shetland	N	1	30	3.3
Cille Pheadair	South Uist	Outer Hebrides	N	12	645	1.9
Pool	Sanday	Orkney	N	1	153	0.7
Beachview Burnside	Mainland	Orkney	LEN/LN	2	132	1.5
Beachview Studio Site	Mainland	Orkney	E/LN	5	146	3.4
Rough Island 41B	Shiant Isles	Outer Hebrides	N/EMed	22	26	84.6
Brough of Deerness	Mainland	Orkney	LN/EMed/Rece	2	59	3.4
Tuquoy	Westray	Orkney	LN/Med-PMed	2	136	1.5
Skaill Deerness	Mainland	Orkney	Med	1	15	6.7
St Kilda Black House 8	Hirta St Kilda	Outer Hebrides	Med/PMed	43	207	20.8
Udal II VI	North Uist	Outer Hebrides	L/PMed	7	150	4.7
Quoygreww	Westray	Orkney	L/PMed	7	149	4.7
House Island 15B	Shiant Isles	Outer Hebrides	PMed	78	106	73.6
Rough Island Sheiling 41B	Shiant Isles	Outer Hebrides	PMed	2	14	14.3
St Kilda Black House G	Hirta St Kilda	Outer Hebrides	Modern	52	434	12.0
St Kilda Black House 8	Hirta St Kilda	Outer Hebrides	Modern	2504	5353	46.8
St Kilda Black House 6	Hirta St Kilda	Outer Hebrides	Modern	3	52	5.8

Table A5.14: Puffin as a % NISP by Island group

	Average % NISP All Sites	average % NISP those with puffin
Inner Hebrides	5.5	23.8
Outer Hebrides	9.9	17.6
Shetland	5.2	9.6
Orkney	1.7	3.3

Table A5.15: Number of assemblages per frequency category for puffin as a % NISP by Island group (for sites which produced puffin)

	Hebrides	Northern Isles
Less than 1%	1	8
1-5%	16	19
5-10%	8	9
10-15%	5	4
15-20%	0	0
20-25%	2	0
25%+	10	1

Table A5.16: Number of assemblages Guillemot and Razorbill (combined) as a % NISP by Island group

Period	Average % NISP for with Guillemot/Razorbill	Average % of NISP All Sites
Mesolithic	26.3	21.9
Neolithic	11.8	4.8
Bronze Age	13.4	7.0
Iron Age	13.6	6.1
Pre-Norse/Pictish	8.2	8.2
Norse	10.1	9.0
Med/Post Med	11.2	6.0

Table A5.17: Number of sites represented at, sites as a % of total sites, and guillemot/razorbill combined as % of each period's NISP

	No site present at	% of total sites	% of Period NISP
Mesolithic	5	83.3	64.9
Neolithic	9	50.0	6.3
Bronze Age	9	52.9	2.1
Iron Age	26	44.8	5.6
Pre-Norse/Pictish	4	100.0	3.4
Norse	34	94.4	6.3

Table A5.18: Guillemot, razorbill and razorbill/guillemot NISP and % NISP by site, period and location

SITE NAME	ISLAND	ISLAND GROUP	PERIOD	NISP	RAZORBILL	% NISP	GUILLEMOT	% NISP	RAZORBILL / GUILLEMOT	% NISP
An Corran	Skye	Inner Hebrides	Mes	124		0.0	1	0.8		0.0
Sand	Skye	Inner Hebrides	Mes	1288	19	1.5	79	6.1	1024	79.5
Caisteal nan Gillean	Oronsay	Inner Hebrides	Mes	22	1	4.5	1	4.5		0.0
Cnoc Sligeach	Oronsay	Inner Hebrides	Mes	13	1	7.7	1	7.7		0.0
Cnoc Coig	Oronsay	Inner Hebrides	Mes	400	36	9.0	39	9.8	2	0.5
Carding Mill Bay I	Mainland	Mainland	ENeo	63	1	1.6	8	12.7		0.0
Quanterness cairn	Mainland	Orkney	Neo	128		0.0	5	3.9		0.0
Midhowe Cairn	Rousay	Orkney	Neo	8		0.0	1	12.5		0.0
Tofts Ness 1 & 2	Sanday	Orkney	Neo	211	1	0.5	3	1.4	1	0.5
Links of Noltland	Westray	Orkney	Neo	331	2	0.6	12	3.6		0.0
Point of Cott	Westray	Orkney	Neo	242	2	0.8	6	2.5		0.0
Knap of Howar	Papa Westray	Orkney	Neo	254	9	3.5	39	15.4		0.0
Skara Brae	Mainland	Orkney	Neo	139	7	5.0	1	0.7		0.0
Pierowall Quarry	Westray	Orkney	LNeo	83		0.0		0.0	1	1.2
Northton	Harris	Outer Hebrides	LNeo	23	4	17.4	4	17.4		0.0
Jarlshof Tr 1	Mainland	Shetland	LNeo/EBA	16		0.0	4	25.0	1	6.3
Northton	Harris	Outer Hebrides	Beak	15		0.0	1	6.7		0.0
Northton	Harris	Outer Hebrides	Beak	28		0.0	4	14.3		0.0
Tofts Ness 3	Sanday	Orkney	EBA	118		0.0	1	0.8		0.0
Point of Buckquoy (Area 6)	Mainland	Orkney	EBA	23		0.0	1	4.3		0.0
Udal	North Uist	Outer Hebrides	EBA	16		0.0	2	12.5		0.0
Kilellan Farm	Islay	Inner Hebrides	EBA	2	1	50.0		0.0		0.0
Tofts Ness 4	Sanday	Orkney	LBA	186		0.0	4	2.2	3	1.6
Cladh Hallan	South Uist	Outer Hebrides	LBA	307	2	0.7	7	2.3	2	0.7
Udal	North Uist	Outer Hebrides	LBA	4	1	25.0		0.0		0.0
Jarlshof	Mainland	Shetland	LBA/EIA	19	1	5.3		0.0		0.0
Cladh Hallan	South Uist	Outer Hebrides	EIA	41		0.0		0.0	1	2.4
Udal	North Uist	Outer Hebrides	EIA	40		0.0	2	5.0		0.0
Sligeanach	South Uist	Outer Hebrides	EIA	1		0.0	1	100.0		0.0
Bu	Mainland	Orkney	EIA	270	1	0.4		0.0	1	0.4
Howe	Mainland	Orkney	MIA	507		0.0	6	1.2	1	0.2
Udal	North Uist	Outer Hebrides	MIA	141	5	3.5	38	27.0		0.0
Cnip	Lewis	Outer Hebrides	M/(L?)IA	36		0.0	1	2.8		0.0

Dunan Ruadh (PY10)	Pabbay	Outer Hebrides	M/LIA	360		0.0		0.0	5	1.4
Ceardach Ruadh Baile Sear	Baile Sear	Outer Hebrides	M/LIA	50		0.0	3	6.0		0.0
Dun Vulcan	South Uist	Outer Hebrides	M/LIA	384	9	2.3	31	8.1	18	4.7
Bornais M1	South Uist	Outer Hebrides	LIA	315		0.0		0.0	2	0.6
Scalloway	Mainland	Shetland	LIA	32		0.0	2	6.3		0.0
Bostadh	Lewis	Outer Hebrides	LIA	61		0.0	8	13.1		0.0
Howe	Mainland	Orkney	LIA	490	2	0.4	8	1.6	2	0.4
Rough Island 41B	Shiant Isles	Outer Hebrides	LIA	244	5	2.0	1	0.4	6	2.5
Udal XI XIII	North Uist	Outer Hebrides	LIA	109	3	2.8	6	5.5		0.0
Pool	Sanday	Orkney	LIA	109	9	8.3	7	6.4		0.0
Sheader (SY14)	Sandray	Outer Hebrides	IA	4		0.0		0.0	1	25.0
Scalloway	Mainland	Shetland	IA	177		0.0	4	2.3		0.0
Scatness	Mainland	Shetland	IA	53		0.0	2	3.8		0.0
Northton	Harris	Outer Hebrides	IA	3		0.0	2	66.7		0.0
Milla Skerra Sandwich	Unst	Shetland	IA	113	2	1.8	12	10.6		0.0
Skaill Deerness	Mainland	Orkney	IA	442	10	2.3	18	4.1	6	1.4
Sollas wheel house B	North Uist	Outer Hebrides	IA	31	1	3.2	1	3.2		0.0
Crosskirk broch	Mainland	Mainland	IA	122	5	4.1	2	1.6	4	3.3
Tofts Ness Phases 5 & 6	Sanday	Orkney	IA	87	4	4.6	1	1.1		0.0
Saevar Howe	Mainland	Orkney	LIA/PN/Pict	7		0.0		0.0	1	14.3
Pool	Sanday	Orkney	LIA/Vik	368	14	3.8	2	0.5	3	0.8
Brough Road (areas 1, 2 and 3)	Mainland	Orkney	LIA/N	135	3	2.2	4	3.0		0.0
Old Scatness	Mainland	Shetland	PN/Pict/(LIA?)	49		0.0		0.0	1	2.0
Bornais M2	South Uist	Outer Hebrides	PN/Pict	13		0.0	1	7.7		0.0
Buckquoy	Mainland	Orkney	PN/Pict	79		0.0	7	8.9		0.0
Udal lxc X	North Uist	Outer Hebrides	Vik	148	2	1.4	10	6.8		0.0
Skaill Deerness	Mainland	Orkney	Vik	240	7	2.9	8	3.3	4	1.7
Old Scatness	Mainland	Shetland	Vik/EN	63		0.0	1	1.6		0.0
Saevar Howe	Mainland	Orkney	EN	27		0.0		0.0	1	3.7
Quoygrew Farm Midden ii	Westray	Orkney	EN	48		0.0		0.0	4	8.3
Bornais M2A	South Uist	Outer Hebrides	EN	154		0.0	2	1.3		0.0
Bornais M2	South Uist	Outer Hebrides	EN	65	1	1.5	4	6.2		0.0
Sandwich North	Unst	Shetland	E/MN	109	1	0.9	24	22.0	2	1.8
Buckquoy	Mainland	Orkney	E/MN	142	2	1.4	6	4.2		0.0
Bornais M2	South Uist	Outer Hebrides	MN	514	2	0.4	8	1.6	1	0.2
Quoygrew Farm Midden iii	Westray	Orkney	M/LN	325		0.0		0.0	38	11.7
Quoygrew Fish Midden 2	Westray	Orkney	M/LN	68		0.0		0.0	9	13.2

Sandwick North	Unst	Shetland	M/LN	40		0.0	10	25.0	4	10.0
Beachview Studio Site	Mainland	Orkney	E/LN	146		0.0	3	2.1	1	0.7
Beachview Burnside	Mainland	Orkney	LEN/LN	132		0.0	8	6.1	4	3.0
Old Scatness	Mainland	Shetland	LN	36		0.0	2	5.6		0.0
Sandwick North	Unst	Shetland	LN	3		0.0	1	33.3		0.0
Bornais M2A	South Uist	Outer Hebrides	LN	195	2	1.0	12	6.2		0.0
Bornais M2	South Uist	Outer Hebrides	LN	171	2	1.2	2	1.2	1	0.6
Robert's Haven	Mainland	Mainland	LN/Med	10		0.0		0.0	1	10.0
Tuquoy	Westray	Orkney	LN/Med-Pmed	136	6	4.4	6	4.4		0.0
Bostadh	Lewis	Outer Hebrides	N	8		0.0	3	37.5		0.0
Bornais M1	South Uist	Outer Hebrides	EN	17		0.0		0.0	2	11.8
Bornais M1	South Uist	Outer Hebrides	MN	51		0.0		0.0	6	11.8
Bornais M3	South Uist	Outer Hebrides	MN	9		0.0		1.8	2	22.2
Bornais M3	South Uist	Outer Hebrides	LN	46		0.0	1	1.8	2	6.5
Bornais M2 (Unphased Norse)	South Uist	Outer Hebrides	N	77		0.0	2	2.6		0.0
Jarlshof	Mainland	Shetland	N	30		0.0	1	3.3		0.0
St Magnus' Kirk Birsay	Mainland	Orkney	N	52		0.0	2	3.8		0.0
Udal VII IX	North Uist	Outer Hebrides	N	98		0.0	6	6.1		0.0
Cille Pheadair	South Uist	Outer Hebrides	N	645	2	0.3	6	0.9	5	0.8
Tuquoy	Westray	Orkney	N	360	9	2.5	8	2.2		0.0
Pool	Sanday	Orkney	N	153	4	2.6	7	4.6	2	1.3
Rough Island 41B	Shiant Isles	Outer Hebrides	N/EM	26	3	11.5		0.0		0.0
St Kilda Black House 8	Hirta St Kilda	Outer Hebrides	Med/PMed	207	10	4.8	38	18.4		0.0
Newark Bay	Mainland	Orkney	LMed	96	1	1.0	7	7.3		0.0
Quoygrew	Westray	Orkney	Lmed/PMed	149		0.0		0.0	19	12.8
Udal II VI	North Uist	Outer Hebrides	Lmed/PMed	150		0.0	20	13.3		0.0
House Island 15B	Shiant Isles	Outer Hebrides	Pmed	106	8	7.5		0.0		0.0
St Kilda Black House G	Hirta St Kilda	Outer Hebrides	Modern	434		0.0	3	0.7		0.0
Howe	Mainland	Orkney	Recent	218	1	0.5	5	2.3		0.0
St Kilda Black House 8	Hirta St Kilda	Outer Hebrides	Modern	5353	320	6.0	786	14.7		0.0
Dun Vulcan	South Uist	Outer Hebrides	LIA/Med/Pmed	4		0.0	1	25.0	1	25.0

Table A5.19: Mesolithic NISP by seasonal category (*cf.* season data in grey at bottom)

	SITE NAME	An Corran	Cnoc Coig	Caisdeal nan Gilleann	Cnoc Sligeach	Prìory Midden	Sand	West Voe	Total
SEASON	SPECIES	IH	IH	IH	IH	IH	IH	SH	
Passage	SKUA <i>CF.</i> POMARINE	2							2
Resident	COMMON GULL		1						1
Resident	BLACK HEADED GULL		1						1
Resident	RED BREASTED MERGANSER				1				1
Resident	RINGED PLOVER				1				1
Resident	WATER RAIL		1		1				2
Resident	WHITE TAILED EAGLE	2							2
Resident	SPARROW HAWK		2						2
Resident	SHELDUCK		2						2
Resident	RAVEN		3						3
Resident	GREAT BLACK BACKED GULL		3						3
Resident	WILLOW TIT	3							3
Resident	MALLARD		2					1	3
Resident	WOODCOCK		4						4
Resident	BLACK GUILLEMOT		5						5
Resident	BUZZARD		9						9
Resident	CORMORANT/SHAG	2					7		9
Resident	SHAG		8		1			2	11
Resident	EIDER		16					1	17
Resident	CORMORANT	5	20		1			1	27
Resident/Winter	GREYLAG GOOSE		9						9
Resident/Winter	GOOSE SP		12		1				13
Summer	BLACKTAILED GODWIT		1						1
Summer	SANDWICH TERN		1						1
Summer	COMMON TERN				1				1
Summer	CORNCRAKE		2						2
Summer	SPOTTED CRAKE		3						3
Summer	MANX SHEARWATER		3						3
Summer	FULMAR		8						8
Summer	QUAIL		11						11
Summer	GANNET	1	16		1			1	19
Summer	RAZORBILL		36	1	1		19		57
Summer	PUFFIN	81	11					1	93
Summer	GREAT AUK	17	58	18	1		11	1	106
Summer	GUILLEMOT	1	39	1	1		79		121
Summer	RAZORBILL / GUILLEMOT		2				1024		1026
Summer/Passage	GREENSHANK		1						1
Summer/Resident	SNIFE		3						3
Summer/Resident	HERRING / LESSER BLACK BACKED GULL		4						4
Summer/Resident	TEAL		14						14
Summer/Winter	REDWING		1						1
Summer/Winter	CRANE		1						1
Summer/Winter	COMMON SCOTER		3						3
Summer/Winter	CURLEW		8						8
Winter	GREAT NORTHERN DIVER		1						1
Winter	VELVET SCOTER		1						1
Winter	LITTLE AUK		1				1		2
Winter	LONG TAILED DUCK		2						2
Winter	WHOOOPER SWAN		6						6
<i>cf.</i> Resident	GULL <i>CF.</i> GREAT BLACK BACKED							1	1
<i>cf.</i> Resident	DUCK <i>CF.</i> SHELDUCK				1				1
<i>cf.</i> Resident	SWAN SP			2					2
<i>cf.</i> Summer/Resident	BLACKBIRD / RING OUSEL		3						3
<i>cf.</i> Summer/Winter	SANDPIPER SP		1						1
<i>cf.</i> Winter	WADER <i>CF.</i> KNOT		1						1
<i>cf.</i> Winter	BEWICK'S SWAN		29						29

Table A5.20: Neolithic NISP by seasonal category (*cf.* season data in grey at bottom)

	SITE NAME	Point of Cott	Quarterness cairn	Pierowall Quarry	Pierowall Quarry	Howe	Udal	Knap of Howar	Isbister	Links of Nolthead	Tofts Ness 1 & 2	Skara Brae	Pool	Eilean Domhnuill Loch Olabhat	Northton	Holm of Papa Westray	Midhowe Cairn	Blackhammer	Knowe of Ramsay	
SEASON	SPECIES	OR	OR	OR	OR	OR	OH	OR	OR	OR	OR	OR	OR	OH	OH	OR	OR	OR	OR	
Domestic	DOMESTIC FOWL																			
Resident	LITTLE GREBE							1												
Resident	JACKDAW											1								
Resident	WHITE TAILED / GOLDEN EAGLE																1			
Resident	BARN OWL												1							
Resident	MISTLE THRUSH		1																	
Resident	RINGED PLOVER											1								
Resident	COOT											2								
Resident	CORVID <i>CF.</i> MAGPIE				2															
Resident	PEREGRINE FALCON											1		1						
Resident	BLACK HEADED GULL		1							1										
Resident	WREN		2																	
Resident	MALLARD								1		1									
Resident	TUFTED DUCK											2								
Resident	CORVID SP	1								1										
Resident	LAPWING	2	1																	
Resident	WATER RAIL									4										
Resident	KESTREL								1	2		1								
Resident	HERRING GULL	1										3								
Resident	GOOSANDER									4										
Resident	WOODCOCK								3			2								
Resident	HOODED CROW											5								
Resident	GOSHAWK		2						3											
Resident	BLACK GUILLEMOT							4				1								
Resident	RED BREASTED MERGANSER	4									2									
Resident	COMMON GULL							2	1	2	2									
Resident	EIDER							3	1	2	1									
Resident	SHELDUCK							1		7										
Resident	RAVEN		1					1	6		1									
Resident	SHORT EARED OWL								10	1										

Resident	BUZZARD		2		2			1		2	3						1		
Resident	SONGTHRUSH		2	7	2														
Resident	GROUSE (RED/WILLOW)		12					1											
Resident	BLACKBIRD		10		1					2		6							
Resident	OYSTERCATCHER	1	8			1	1	1		4	3								
Resident	CORMORANT/SHAG				2					12	8								
Resident	SKYLARK		14					2		2		7							
Resident	SHAG	3			1		14	2	4	6	1		3						
Resident	ROOK/CROW			1	1			13	24								1		
Resident	STARLING	17	1		22	1			3		2								
Resident	CORMORANT	1			2			9	31	8	1		1				2	1	4
Resident	GREAT BLACK BACKED GULL	1	1		3		17	26	16	37	1		1						
Resident	WHITE TAILED EAGLE	139							98							1			1
Resident/Winter	LARGE GOOSE		1																
Resident/Winter	GOOSE SP								2										
Resident/Winter	GOOSE CF. WHITE FRONT/ PINK FOOT								4								1		1
Resident/Winter	LARGE GREY GOOSE CF. GREYLAG	1			2			3											
Resident/Winter	GREYLAG / BEAN GOOSE								4		3								
Resident/Winter	GREY GOOSE SP								3		5								
Resident/Winter	GREYLAG GOOSE							12	2		5								
Summer	BLACKTAILED GODWIT		1																
Summer	QUAIL		1																
Summer	CORNCRAKE							1											
Summer	SPOTTED CRAKE							1											
Summer	LEACH'S PETREL		1																
Summer	RED -THROATED DIVER										1								
Summer	RAZORBILL / GUILLEMOT				1					1									
Summer	BLACK-THROATED DIVER							3											
Summer	SANDWICH TERN							1			3								
Summer	MANX SHEARWATER							1	1	1	4								
Summer	KITTIWAKE	3									4								
Summer	SWALLOW								1										
Summer	RAZORBILL	2						9	2	1	7		4						
Summer	FULMAR	2						17	1		9								
Summer	PUFFIN	17			1		3	3	17	1	8		2						
Summer	GREAT AUK				1		35		6	23	5					1			1
Summer	GUILLEMOT	6	5				39		12	3	1		4			1			
Summer	GANNET	2	7	1	10		24		27	11	20		2			1	2		7
Summer/Passage	SKUA SP						1									1			
Summer/Passage	GREENSHANK		2																
Summer/Passage	GREAT SKUA							5											
Summer/Resident	LESSER BLACK BACKED GULL										1								
Summer/Resident	TEAL	1									5								
Summer/Resident	SNIPE	11	4					2	2	3	2								

Summer/Resident	HERRING / LBB GULL					6		10	28				2				
Summer/Winter	DUNLIN									1							
Summer/Winter	WIDGEON									1							
Summer/Winter	DIVER SP	1		1													
Summer/Winter	LITTLE AUK / COMMON TERN			2													
Summer/Winter	GOLDEN PLOVER									4							
Summer/Winter	REDSHANK					1		1		1		1					
Summer/Winter	REDWING		5							5							
Summer/Winter	CURLEW					2	2		2	2							1
Winter	KNOT	1															
Winter	BRENT / BARNACLE GOOSE											1					
Winter	BRAMBLING		2														
Winter	GREY PLOVER					1		1									
Winter	PINTAIL									2							
Winter	GREAT NORTHERN DIVER					1		2		1							
Winter	POCHARD								4								
Winter	VELVET SCOTER					1		4									
Winter	TURNSTONE					1	4										
Winter	WHOOPEE SWAN					3		1		2							
Winter	LITTLE AUK	2		1				3	1								
Winter / Passage	SPOTTED REDSHANK					1											
<i>cf. resident</i>	GREAT CRESTED GREBE									1							
<i>cf. Resident</i>	DUCK <i>CF.</i> R-B MERGANSER									1							
<i>cf. Resident</i>	<i>CF.</i> WREN		1														
<i>cf. Resident</i>	<i>CF.</i> STARLING			1													
<i>cf. resident</i>	WADER <i>CF.</i> OYSTERCATCHER									1							
<i>cf. Resident</i>	DUCK <i>CF.</i> MALLARD			1													
<i>cf. Resident</i>	DUCK <i>CF.</i> EIDER			1						1							
<i>cf. Resident</i>	<i>CF.</i> TIT		1	1													
<i>cf. resident</i>	<i>CF.</i> LINNET		1					1									
<i>cf. resident</i>	GOLDCREST		2														
<i>cf. Resident</i>	GULL <i>CF.</i> COMMON									3							
<i>cf. resident</i>	<i>CF.</i> TWITE		2	1													
<i>cf. resident</i>	<i>CF.</i> BLACKBIRD			1	3												
<i>cf. Resident</i>	<i>CF.</i> BUZZARD		2	3													
<i>cf. Resident</i>	SWAN SP			1						7							
<i>cf. Resident</i>	GULL <i>CF.</i> GBB			1						15							
<i>cf. summer</i>	<i>CF.</i> RING OUSEL		1														
<i>cf. summer</i>	GULL <i>CF.</i> KITTIWAKE									2							
<i>cf. summer</i>	<i>CF.</i> WHEATEAR		3					2									
<i>cf. Summer/Passage</i>	WADER <i>CF.</i> GREENSHANK							1									
<i>cf. summer/passage</i>	<i>CF.</i> WARBLER		2	1				1									
<i>cf. Summer/Resident</i>	<i>CF.</i> WAGTAIL		2														
<i>cf. Summer/Resident</i>	WADER <i>CF.</i> SNIPE												3				

<i>cf. Summer/Resident</i>	BLACKBIRD / RING OUSEL		3																	
<i>cf. Summer/Resident</i>	GULL <i>CF.</i> HERRING / LBB			3					1		11									
<i>cf. Summer/Winter</i>	<i>CF.</i> REDWING		1																	
<i>cf. Summer/Winter</i>	WADER <i>CF.</i> REDSHANK			1																
<i>cf. Winter</i>	BUZZARD <i>CF.</i> ROUGH LEGGED									1										
<i>cf. Winter</i>	DUCK <i>CF.</i> SCAUP										1									
<i>cf. Winter</i>	<i>CF.</i> FIELDFARE		3																	
<i>cf. Winter</i>	SWAN <i>CF.</i> WHOOPER										3									
<i>cf. Winter</i>	BARNACLE SIZE GOOSE							10												1

Table A5.21: Bronze Age NISP by seasonal category (*cf.* season data in grey at bottom)

	SITE NAME	Rosinish	Cladh Hallan	Cladh Hallan	Udal	Udal	Udal	Bay of Moaness	Ardnave	Killellan Farm	Point of Buckquoy (Area 6)	Point of Buckquoy (Cuttings 5 and 6)	Isbister	Tofts Ness 3	Tofts Ness 4	Northton	Northton	Sligeanach	Total
	ISLAND GROUP	OH	OH	OH	OH	OH	OH	OR	IH	IH	OR	OR	OR	OR	OR	OH	OH	OH	
Resident	MOORHEN										1								1
Resident	WATER RAIL			1															1
Resident	GALLIFORM SP			1															1
Resident	RED GROUSE / PTARMIGAN			1															1
Resident	GOLDEN EAGLE											1							1
Resident	EAGLE <i>CF.</i> WHITE TAILED			1															1
Resident	GOSHAWK														1				1
Resident	RED BREASTED MERGANSER			1															1
Resident	BLACKBIRD										1								1
Resident	MISTLE THRUSH											1							1
Resident	SKYLARK					1	1												2
Resident	LAPWING			1										1					2
Resident	MALLARD														2				2
Resident	SHELDUCK			2															2
Resident	ROOK/CROW			2												1			3
Resident	EIDER													2	1				3
Resident	OWL <i>CF.</i> SHORT EARED													1	3				4

Resident	ROCK / STOCK DOVE			3								1					4
Resident	PEREGRINE FALCON											1	3				4
Resident	BLACK GUILLEMOT			1								1			2		4
Resident	STARLING			2		2											4
Resident	CORMORANT/SHAG			3								2		1			6
Resident	OYSTERCATCHER			1								1		1	3		6
Resident	GROUSE (RED/WILLOW)			9													9
Resident	SHAG			13				1		1		5		3	1		24
Resident	RAVEN											1	31				32
Resident	CORMORANT	2		16								6		6	4		34
Resident	GREAT BLACK BACKED GULL			9								24	3				36
Resident	WHITE TAILED EAGLE										641		1				642
Resident/Winter	GREY GOOSE SP											1	1				2
Resident/Winter	LARGE GREY GOOSE		2														2
Resident/Winter	GREYLAG / BEAN GOOSE											4					4
Resident/Winter	LARGE GREY GOOSE <i>CF.</i> GREYLAG			10													10
Resident/Winter	GOOSE SP			8		3						1					12
Summer	SWALLOW												1				1
Summer	CRAKE <i>CF.</i> CORNCRAKE											1	1				2
Summer	MANX SHEARWATER	1		1										1		1	4
Summer	RAZORBILL			2			1			1							4
Summer	RAZORBILL / GUILLEMOT			2									3				5
Summer	FULMAR			5				1			1						7
Summer	GUILLEMOT			7		2				1		1	4	4	1		20
Summer	PUFFIN			8	1	2							1	6		2	20
Summer	GREAT AUK			14	1	2	1					7			1		26
Summer	GANNET	1	1	102		1				1		9	2				117
Summer/Resident	RED KITE										1						1
Summer/Resident	PUFFIN / BLACK GUILLEMOT												1			1	2
Summer/Resident	TEAL			1								1	1				3
Summer/Resident	SNIPE			4						1							5
Summer/Resident	HERRING / LESSER BLACK BACKED GULL			5								14	4	1		1	25
Summer/Winter	DUNLIN			2													2
Summer/Winter	GODWIT SP												2				2

Summer/Winter	REDSHANK				2					1							3
Summer/Winter	REDWING									4							4
Summer/Winter	GOLDEN PLOVER			2					1	1							4
Summer/Winter	CRANE			2							1						4
Summer/Winter	CURLEW	1		7						1						1	10
Winter	JACKSNIFE			2													2
Winter	GREAT NORTHERN DIVER		1	2												1	4
Winter	BRENT / BARNACLE GOOSE			5													5
Winter	LITTLE AUK			1						1			2		1	1	6
<i>cf. resident</i>	GREBE <i>CF. GREAT CRESTED</i>												1				1
<i>cf. Resident</i>	RAIL <i>CF. WATER</i>												1				1
<i>cf. Resident</i>	COLUMBA SP												1				1
<i>cf. Resident</i>	DUCK <i>CF. RED BREASTED MERGANSER</i>												1				1
<i>cf. Resident</i>	<i>CF. NUTHATCH</i>									1							1
<i>cf. resident</i>	WADER <i>CF. OYSTERCATCHER</i>												1				1
<i>cf. Resident</i>	DUCK <i>CF. MALLARD</i>			1										1			2
<i>cf. Resident</i>	<i>CF. BUZZARD</i>			1									2				3
<i>cf. Resident</i>	<i>CF. MEDOW PIPIT</i>									4							4
<i>cf. Resident</i>	GULL <i>CF. GREAT BLACK BACKED</i>												12				12
<i>cf. Resident</i>	SWAN SP			16									1	5			22
<i>cf. summer</i>	GULL <i>CF. KITTIWAKE</i>													1			1
<i>cf. Summer</i>	TERN <i>CF. SANDWICH TERN</i>									1							1
<i>cf. summer</i>	AUK <i>CF. GUILLEMOT</i>	1															1
<i>cf. summer</i>	SHEARWATER <i>CF. MANX</i>																1
<i>cf. Summer / Vagrant</i>	CRAKE <i>CF. LITTLE CRAKE</i>									1							1
<i>cf. Summer/Resident</i>	WADER <i>CF. SNIPE</i>												5	1			6
<i>cf. Summer/Resident</i>	GULL <i>CF. HERRING / LESSER BLACK BACKED</i>				1	1							6				8
<i>cf. Summer/Winter</i>	WADER <i>CF. REDSHANK</i>														1		1
<i>cf. Summer/Winter</i>	PLOVER <i>CF. GOLDEN</i>												2				2
<i>cf. Summer/Winter</i>	SANDPIPER SP								2	6			24				32
<i>cf. Summer/Winter</i>	WADER <i>CF. CURLEW</i>	1	1	4													6
<i>cf. Winter</i>	BEWICK'S SWAN												1				1
<i>cf. Winter</i>	DUCK <i>CF. POCHARD</i>													1			1
<i>cf. Winter</i>	SWAN <i>CF. WHOOPER</i>			4										1			5

Table A5.22a: Iron Age NISP by seasonal category (cf. season data in grey at bottom)

	SITE NAME	Dunan Ruadh (PY10)	Sheader (SY14)	Mingulay (MY384)	Bornais M1	Rough Island 41B	Dun Vulan	Sollas wheelhouse A	Sollas wheel house B Midden	Sollas wheel house B	Sollas Post-Wheelhouse B Refill	Udal	Udal	Udal XI XIII	A'Cheardach Mhor Phase I & II	A'Cheardach Mhor IV	A'Cheardach Bheag	Bostadh	Beirgh	Cnip	Cill Donnain
Season	ISLAND GROUP	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH
Domestic	DOMESTIC DUCK																				
Domestic	GOOSE <i>CF.</i> DOMESTIC						3														
Domestic	DOMESTIC FOWL						6														
Passage	SOOTY SHEARWATER						1							2							
Resident	GALLIFORM SP																				
Resident	JACKDAW																				
Resident	TAWNY OWL																				
Resident	WHITE TAILED / GOLDEN EAGLE																				
Resident	BARN OWL																				
Resident	BUZZARD / GOSHAWK																				
Resident	WREN																				
Resident	GOOSANDER																				
Resident	TWITE												2								
Resident	OWL <i>CF.</i> SHORT EARED																				
Resident	BLACK GROUSE									1			1	1							
Resident	HOODED CROW																				
Resident	EAGLE <i>CF.</i> WHITE TAILED																				
Resident	SHELDUCK																				
Resident	MOORHEN																				
Resident	WATER RAIL																				
Resident	CHOUGH																				
Resident	BLACK HEADED GULL																				
Resident	SPARROW									1		2	1								
Resident	COMMON GULL																				
Resident	RED BREASTED MERGANSER																				
Resident	DUNNOCK												6								
Resident	GREY HERON						3														
Resident	PEREGRINE FALCON				1																
Resident	ROBIN											4	3								

Summer	SPOTTED CRAKE																			
Summer	RED -THROATED DIVER						1													
Summer	SWALLOW																			
Summer	KITTIWAKE										1									1
Summer	RAZORBILL / GUILLEMOT	5	1		2	6	18													
Summer	RAZORBILL					5	9			1			5		3					
Summer	FULMAR				1		3			3	1		6		2		1			
Summer	MANX SHEARWATER	18		20	12		11			1				3	7				1	
Summer	GUILLEMOT					1	31			1		2	38	6					8	1
Summer	GREAT AUK	1			9		43	2		5		5	8	2						11
Summer	GANNET	3	1		5		24	1	1	2		2	7	33			1		1	2
Summer	PUFFIN				1	224	29			1		2	5	7	1				36	5
Summer/Passage	GREAT SKUA																			
Summer/Passage	GREENSHANK																			
Summer/Resident	LESSER BLACK BACKED GULL																			
Summer/Resident	RED KITE																			
Summer/Resident	SMALL FALCO SP																			
Summer/Resident	CHAFFINCH													2						
Summer/Resident	TEAL						2													
Summer/Resident	PUFFIN / BLACK GUILLEMOT	15					1													
Summer/Resident	PIED WAGTAIL						1			5		3	5							
Summer/Resident	SNIPE	4					1													
Summer/Resident	HERRING / LESSER BLACK BACKED				138		5							7					1	
Summer/Winter	GODWIT SP																			
Summer/Winter	DIVER SP																		1	2
Summer/Winter	WIDGEON																			
Summer/Winter	COMMON SCOTER																			
Summer/Winter	DUNLIN																			
Summer/Winter	REDSHANK						1								1					
Summer/Winter	CRANE				1															
Summer/Winter	REDWING																			
Summer/Winter	GOLDEN PLOVER	2					1													
Summer/Winter	CURLEW				5		1						1	1						
Vagrant	GADFLY PETREL CF. FEAS																			2
Winter	SLAVONIAN GREBE																			
Winter	VELVET SCOTER																			
Winter	KNOT											1								
Winter	GREEN SANDPIPER														1					
Winter	POCHARD																			
Winter	SMEW																			
Winter	LONG TAILED DUCK																			
Winter	GREY PLOVER																			
Winter	BAR-TAILED GODWIT												1							

Winter	BRENT / BARNACLE GOOSE					1													
Winter	GOLDENEYE																		
Winter	BRENT GOOSE				2	3											3		
Winter	FIELDFARE							1											
Winter	GREAT NORTHERN DIVER				1	3													
Winter	TURNSTONE					2													
Winter	WHOOPEER SWAN																		
Winter	LITTLE AUK	4				6							1						
<i>cf.</i> Resident	COLUMBA SP																		
<i>cf.</i> Resident	RAPTOR																		
<i>cf.</i> Resident	CF. SKYLARK	1																	
<i>cf.</i> Resident	CF. SONGTHRUSH	1																	
<i>cf.</i> Resident	DUCK CF. SHELDUCK				2														
<i>cf.</i> Resident	DUCK CF. EIDER				2														
<i>cf.</i> resident	WADER CF. OYSTERCATCHER				2														
<i>cf.</i> Resident	CF. TIT																		
<i>cf.</i> Resident	DUCK CF. MALLARD				3														
<i>cf.</i> Resident	GULL CF. GREAT BLACK BACKED						1			2	4								
<i>cf.</i> Resident	SWAN SP					2													
<i>cf.</i> Resident	GULL CF. COMMON				12								6						
<i>cf.</i> Resident/Winter	DUCK CF. GADWALL																		
<i>cf.</i> summer	GULL CF. KITTIWAKE	1																	
<i>cf.</i> summer	SHOVELER																		
<i>cf.</i> summer/passage	CF. WARBLER																		
<i>cf.</i> Summer/Passage	WADER CF. GREENSHANK																		
<i>cf.</i> Summer/Resident	DUCK CF. TEAL				1														
<i>cf.</i> Summer/Resident	BLACKBIRD / RING OUSEL																		
<i>cf.</i> Summer/Resident	GULL CF. HERRING / LESSER BLACK								5		3								1
<i>cf.</i> Summer/Winter	DUCK CF. WIDGEON																		
<i>cf.</i> Summer/Winter	SANDPIPER SP																		
<i>cf.</i> Summer/Winter	PLOVER CF. GOLDEN												3						
<i>cf.</i> Summer/Winter	WADER CF. REDSHANK																		
<i>cf.</i> Winter	BUZZARD CF. ROUGH LEGGED																		
<i>cf.</i> Winter	WADER CF. KNOT	1																	
<i>cf.</i> Winter	SWAN CF. BEWICK'S													1					
<i>cf.</i> Winter	DUCK CF. POCHARD																		
<i>cf.</i> Winter	WADER CF. BAR-TAILED GODWIT				2														
<i>cf.</i> Winter	BARNACLE SIZE GOOSE																		

Table A5.22b: Iron Age NISP by seasonal category (*cf.* season data in grey at bottom).

	SITE NAME	Hornish Point	Ceardach Ruadh Baile Sear	Sloc Sabhaid Baile Sear	Askernish	Bac Mhic Connain	Bruach a Tuath	Rosinish	North of Reilig Odhrain	Dun Cul Bhuirg	Dun Mor Vault	Dun Mor Vault	Killellan Farm	Pierowall Quarry	Howe	Howe	Howe	Howe	Tofts Ness Phases 5 & 6	Gurness
Season	ISLAND GROUP	OH	OH	OH	OH	OH	OH	OH	IH	IH	IH	IH	IH	OR	OR	OR	OR	OR	OR	OR
Domestic	DUCK <i>CF.</i> DOMESTIC																			
Domestic	GOOSE <i>CF.</i> DOMESTIC															1			2	
Domestic	DOMESTIC FOWL															5	3			
Passage	SOOTY SHEARWATER															1				
Resident	GALLIFORM SP				1															
Resident	JACKDAW													1						
Resident	TAWNY OWL															1				
Resident	WHITE TAILED / GOLDEN EAGLE																	1		
Resident	BARN OWL										1									
Resident	BUZZARD / GOSHAWK																		1	
Resident	WREN														1					
Resident	GOOSANDER															1				
Resident	TWITE																			
Resident	OWL <i>CF.</i> SHORT EARED																		1	1
Resident	BLACK GROUSE																			
Resident	HOODED CROW																			
Resident	EAGLE <i>CF.</i> WHITE TAILED																			
Resident	SHELDUCK															1		1		
Resident	MOORHEN																		4	
Resident	WATER RAIL															2				
Resident	CHOUGH																			
Resident	BLACK HEADED GULL															1		2		
Resident	SPARROW																			
Resident	COMMON GULL															1		1		
Resident	RED BREASTED MERGANSER															2		4		4
Resident	DUNNOCK																			
Resident	GREY HERON															1				
Resident	PEREGRINE FALCON							2					1		1	2				
Resident	ROBIN																			
Resident	WOODCOCK																			2

Winter	GOLDENEYE											4	3				
Winter	BRENT GOOSE																
Winter	FIELDFARE										2	5	2				
Winter	GREAT NORTHERN DIVER										2		2				
Winter	TURNSTONE											4	8	2			
Winter	WHOOPEE SWAN	1									2	9	5	2		1	
Winter	LITTLE AUK							4			1	6	5	2		1	
<i>cf.</i> Resident	COLUMBA SP																
<i>cf.</i> Resident	RAPTOR											1					
<i>cf.</i> Resident	<i>CF.</i> SKYLARK																
<i>cf.</i> Resident	<i>CF.</i> SONGTHRUSH																
<i>cf.</i> Resident	DUCK <i>CF.</i> SHELDUCK																
<i>cf.</i> Resident	DUCK <i>CF.</i> EIDER																
<i>cf.</i> resident	WADER <i>CF.</i> OYSTERCATCHER																
<i>cf.</i> Resident	<i>CF.</i> TIT											6					
<i>cf.</i> Resident	DUCK <i>CF.</i> MALLARD				1							5					
<i>cf.</i> Resident	GULL <i>CF.</i> GREAT BLACK BACKED																3
<i>cf.</i> Resident	SWAN SP																12
<i>cf.</i> Resident	GULL <i>CF.</i> COMMON																2
<i>cf.</i> Resident/Winter	DUCK <i>CF.</i> GADWALL											4					
<i>cf.</i> summer	GULL <i>CF.</i> KITTIWAKE																1
<i>cf.</i> summer	SHOVELER																
<i>cf.</i> summer/passage	<i>CF.</i> WARBLER											1					
<i>cf.</i> Summer/Passage	WADER <i>CF.</i> GREENSHANK	2															
<i>cf.</i> Summer/Resident	DUCK <i>CF.</i> TEAL																
<i>cf.</i> Summer/Resident	BLACKBIRD / RING OUSEL											4	5				
<i>cf.</i> Summer/Resident	GULL <i>CF.</i> HERRING / LESSER BLACK	1				1											2
<i>cf.</i> Summer/Winter	DUCK <i>CF.</i> WIDGEON	1															
<i>cf.</i> Summer/Winter	SANDPIPER SP											1					1
<i>cf.</i> Summer/Winter	PLOVER <i>CF.</i> GOLDEN																
<i>cf.</i> Summer/Winter	WADER <i>CF.</i> REDSHANK	2								1							
<i>cf.</i> Winter	BUZZARD <i>CF.</i> ROUGH LEGGED										1						
<i>cf.</i> Winter	WADER <i>CF.</i> KNOT																
<i>cf.</i> Winter	SWAN <i>CF.</i> BEWICK'S																
<i>cf.</i> Winter	DUCK <i>CF.</i> POCHARD																
<i>cf.</i> Winter	WADER <i>CF.</i> BAR-TAILED GODWIT																
<i>cf.</i> Winter	BARNACLE SIZE GOOSE																2

Table A5.22b: Iron Age NISP by seasonal category (*cf.* season data in grey at bottom).

	SITE NAME	Pool	Pool	Skaill Deeriness	Cladh Hallan	Northton	Northton	Sligeanach	Bu	Broch of Ayre	Midhowe Broch	St Boniface's Church	Calf of Eday	Milla Skerra Sandwick	Scatness	Scalloway	Scalloway	Scalloway	Jarlshof	
Season	ISLAND GROUP	OR	OR	OR	OH	OH	OH	OH	OR	OR	OR	OR	OR	SH	SH	SH	SH	SH	SH	
Domestic	DOMESTIC DUCK																			
Domestic	GOOSE <i>CF.</i> DOMESTIC																			
Domestic	DOMESTIC FOWL		1	3							1	1					1	23		
Passage	SOOTY SHEARWATER																			
Resident	GALLIFORM SP																			
Resident	JACKDAW																			
Resident	TAWNY OWL																			
Resident	WHITE TAILED / GOLDEN EAGLE																			
Resident	BARN OWL																			
Resident	BUZZARD / GOSHAWK																			
Resident	WREN																			
Resident	GOOSANDER																			
Resident	TWITE																			
Resident	OWL <i>CF.</i> SHORT EARED			1																
Resident	BLACK GROUSE														3					
Resident	HOODED CROW																			
Resident	EAGLE <i>CF.</i> WHITE TAILED											3								
Resident	SHELDUCK			1																
Resident	MOORHEN																			
Resident	WATER RAIL			1	1															
Resident	CHOUGH								4											
Resident	BLACK HEADED GULL								1											
Resident	SPARROW																			
Resident	COMMON GULL																			
Resident	RED BREASTED MERGANSER																			
Resident	DUNNOCK																			
Resident	GREY HERON		1								1							1		
Resident	PEREGRINE FALCON																			
Resident	ROBIN																			
Resident	WOODCOCK								5											
Resident	MERLIN								3				1							

Summer	SWALLOW																			
Summer	KITTIWAKE																		3	4
Summer	RAZORBILL / GUILLEMOT			6	1					1										
Summer	RAZORBILL		9	10						1				2						
Summer	FULMAR		1	6	1															
Summer	MANX SHEARWATER	1		2														1		
Summer	GUILLEMOT		7	18			2	1						12	2			2	4	
Summer	GREAT AUK	1	1	61						1				28		2			2	
Summer	GANNET		13	81	1	1				27	4	1		21				5	14	
Summer	PUFFIN		1	9						2					1			4	49	
Summer/Passage	GREAT SKUA									3										
Summer/Passage	GREENSHANK									2										
Summer/Resident	LESSER BLACK BACKED GULL																			
Summer/Resident	RED KITE																			
Summer/Resident	SMALL FALCO SP			2																
Summer/Resident	CHAFFINCH																			
Summer/Resident	TEAL			2						3									4	
Summer/Resident	PUFFIN / BLACK GUILLEMOT																			
Summer/Resident	PIED WAGTAIL									3										
Summer/Resident	SNIPE									3								2	14	
Summer/Resident	HERRING / LESSER BLACK BACKED GULL		3	26	2								1							
Summer/Winter	GODWIT SP																			
Summer/Winter	DIVER SP																			
Summer/Winter	WIDGEON																			
Summer/Winter	COMMON SCOTER									2										
Summer/Winter	DUNLIN				1					2										
Summer/Winter	REDSHANK									2										
Summer/Winter	CRANE																			
Summer/Winter	REDWING									6										
Summer/Winter	GOLDEN PLOVER									14										
Summer/Winter	CURLEW			3	3													1	3	
Vagrant	GADFLY PETREL <i>CF.</i> FEAS																			
Winter	SLAVONIAN GREBE																			
Winter	VELVET SCOTER																			
Winter	KNOT																			
Winter	GREEN SANDPIPER																			
Winter	POCHARD																			
Winter	SMEW																			
Winter	LONG TAILED DUCK																			
Winter	GREY PLOVER																			
Winter	BAR-TAILED GODWIT																	1	2	
Winter	BRENT / BARNACLE GOOSE																			
Winter	GOLDENEYE																			

Winter	BRENT GOOSE																	
Winter	FIELDFARE																	
Winter	GREAT NORTHERN DIVER					1				1	2							
Winter	TURNSTONE									3								
Winter	WHOOPEER SWAN																	
Winter	LITTLE AUK			2						4						2	5	
<i>cf. Resident</i>	COLUMBA SP												1					
<i>cf. Resident</i>	RAPTOR																	
<i>cf. Resident</i>	CF. SKYLARK																	
<i>cf. Resident</i>	CF. SONGTHRUSH																	
<i>cf. Resident</i>	DUCK CF. SHELDUCK																	
<i>cf. Resident</i>	DUCK CF. EIDER									1								
<i>cf. resident</i>	WADER CF. OYSTERCATCHER											1						
<i>cf. Resident</i>	CF. TIT																	
<i>cf. Resident</i>	DUCK CF. MALLARD																	
<i>cf. Resident</i>	GULL CF. GREAT BLACK BACKED	1																
<i>cf. Resident</i>	SWAN SP		2	1	1						1							
<i>cf. Resident</i>	GULL CF. COMMON																	
<i>cf. Resident/Winter</i>	DUCK CF. GADWALL																	
<i>cf. summer</i>	GULL CF. KITTIWAKE																	
<i>cf. summer</i>	SHOVELER															2		
<i>cf. summer/passage</i>	CF. WARBLER									1								
<i>cf. Summer/Passage</i>	WADER CF. GREENSHANK																	
<i>cf. Summer/Resident</i>	DUCK CF. TEAL																	
<i>cf. Summer/Resident</i>	BLACKBIRD / RING OUSEL																	
<i>cf. Summer/Resident</i>	GULL CF. HERRING / LESSER BLACK BACKED	1	3								2							
<i>cf. Summer/Winter</i>	DUCK CF. WIDGEON																	
<i>cf. Summer/Winter</i>	SANDPIPER SP																	
<i>cf. Summer/Winter</i>	PLOVER CF. GOLDEN																	
<i>cf. Summer/Winter</i>	WADER CF. REDSHANK																	
<i>cf. Winter</i>	BUZZARD CF. ROUGH LEGGED																	
<i>cf. Winter</i>	WADER CF. KNOT																	
<i>cf. Winter</i>	SWAN CF. BEWICK'S																	
<i>cf. Winter</i>	DUCK CF. POCHARD																1	
<i>cf. Winter</i>	WADER CF. BAR-TAILED GODWIT																	
<i>cf. Winter</i>	BARNACLE SIZE GOOSE																	

Table A5.23: Pre-Norse/Pictish NISP by seasonal category (*cf.* season data in grey at bottom)

	SITE NAME	Bornais M2	Buckquoy	Old Scatness	Saevar Howe	Total
Season	ISLAND GROUP	OH	OR	SH	OR	
Domestic	DOMESTIC FOWL		1		1	2
Resident	WHITE TAILED EAGLE	1				1
Resident	HERRING GULL				1	1
Resident	BLACK HEADED GULL		1			1
Resident	BLACK GUILLEMOT		1			1
Resident	STARLING		1			1
Resident	MOORHEN			2		2
Resident	EIDER			2		2
Resident	CORMORANT		1	1	1	3
Resident	GREAT BLACK BACKED GULL			4		4
Resident	SHAG			15	1	16
Resident/Winter	GLAUCOUS / GREAT BLACK BACKED GULL		1			1
Resident/Winter	LARGE GREY GOOSE <i>CF.</i> GREYLAG	2				2
Summer	OSPREY		1			1
Summer	GREAT AUK		1			1
Summer	RAZORBILL / GUILLEMOT			1	1	2
Summer	MANX SHEARWATER	1	3			4
Summer	FULMAR		6	2		8
Summer	GUILLEMOT	1	7			8
Summer	PUFFIN	1	5	4		10
Summer	GANNET		27	2	2	31
Summer/Resident	SNIPE			1		1
Summer/Resident	HERRING / LESSER BLACK BACKED GULL			5		5
Summer/Winter	WIDGEON		1			1
Winter	LITTLE AUK		1			1
Winter	TURNSTONE		2			2
Winter	GREAT NORTHERN DIVER		9			9
<i>cf.</i> Domestic	GALLIFORM <i>CF.</i> DOMESTIC FOWL	1				1
<i>cf.</i> Domestic	<i>CF.</i> DOMESTIC GOOSE	1				1
<i>cf.</i> Resident	SMALL PASSERINE <i>CF.</i> STARLING			1		1
<i>cf.</i> Resident	GULL <i>CF.</i> COMMON	2				2
<i>cf.</i> Summer	AUK <i>CF.</i> GREAT			1		1
<i>cf.</i> Summer/Resident	WADER <i>CF.</i> SNIPE	1				1
<i>cf.</i> Summer/Resident	DUCK <i>CF.</i> TEAL			1		1

Table A5.24: Norse NISP by seasonal category (*cf.* season data in grey at bottom).

	SITE NAME	Rough Island 41B	Udal Ixc X	Udal VII IX	Bostadh	Cille Pheadair	Bornais (Combined)	Jarlishof	Old Scatness	Old Scatness	Sandwick North	Sandwick North	Sandwick North	St Magnus' Kirk Birsay	Beachview Burnside	Beachview Studio Site	Buckquoy	Newark Bay	Tuquoy	Buckquoy	Pool	Saevar Howe	Earl's Bu	Skaill Deerness	Quoygrew Farm Midden ii	Quoygrew Farm Midden iii	Quoygrew Fish Midden 2	
	ISLAND GROUP	OH	OH	OH	OH	OH	OH	SH	SH	SH	SH	SH	SH	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR
Domestic	GOOSE <i>CF.</i> DOMESTIC						1										1											
Domestic	DOMESTIC FOWL BANTAM						1																					
Domestic	DOMESTIC FOWL BANTAM SIZE					10																						
Domestic	DOMESTIC FOWL		19	26		22	96	1	4	1	7	3		4	9	14	10	2	89	1	4	2	22	14	1	14	1	
Passage	SHEARWATER <i>CF.</i> GREAT					2																						
Passage	LARGE SHEARWATER SP					6																						
Resident	SHORT EARED OWL						1																					
Resident	COOT		1																									
Resident	COMMON PARTRIDGE			1																								
Resident	RED GROUSE / PTARMIGAN													1														
Resident	HOODED CROW							1																				
Resident	CORVID <i>CF.</i> MAGPIE							1																				
Resident	TAWNY OWL																	1										
Resident	KESTREL														1													
Resident	PEREGRINE FALCON							1																				
Resident	BLACK GUILLEMOT		1																									
Resident	RED BREASTED MERGANSER						1																					
Resident	SONGTHRUSH						1																					
Resident	SKYLARK						1																					
Resident	WATER RAIL						1																	1				
Resident	WOODCOCK						2																					
Resident	BLACKBIRD																											
Resident	DUNNOCK						2																					
Resident	RINGED PLOVER															2												
Resident	GROUSE SP		1																									
Resident	BLACK GROUSE		2					1																				
Resident	GREY HERON		1					1			1													2				
Resident	BLACK HEADED GULL							1																	1	1		
Resident	WOODPIGEON															6												
Resident	WHITE TAILED / GOLDEN EAGLE						1																1				2	
Resident	LAPWING													4										2				

Summer	MANX SHEARWATER		3	13		4	20			2		1			6	10		2	1			2	1			2	1	4	1
Summer	GUILLEMOT		10	6	3	6	31	1	1	2	24	10	1	2	8	3	6		8		7	2			8		1	4	1
Summer	RAZORBILL / GUILLEMOT					5	14				2	4		4	1					2	1			4	4	38	9		
Summer	PUFFIN	22	8			12	34	1		1	1			2	5	2	1	4	1	1		1		5	27	5			
Summer	GANNET		23	23		32	56	1	4	2	34	1		3	33	42	47		24	1	57	9		20	1	15	14		
Summer/Passage	GREAT SKUA								1																				
Summer/Passage	SKUA SP																1												
Summer/Passage	GREENSHANK																1												
Summer/Resident	SMALL GULL / SKUA						3																						
Summer/Resident	PUFFIN / BLACK GUILLEMOT														2				2										
Summer/Resident	TEAL					3	4												2										
Summer/Resident	SNIFE		1				2											1										3	
Summer/Resident	HERRING / LBB GULL		3	3	2	54	142	1			2			2	3	3		5		8				32	3	40	8		
Summer/Winter	DIVER SP										1																		
Summer/Winter	DUNLIN																1												
Summer/Winter	WIDGEON																1												
Summer/Winter	LITTLE AUK / COMMON TERN																				2								
Summer/Winter	CRANE					4	2																						
Summer/Winter	GOLDEN PLOVER					17	2							3				4							3				
Summer/Winter	CURLEW			1		5	11	1				1			2			1							2				
Vagrant	GADFLY PETREL CF. FEAS		7																										
Winter	SLAVONIAN GREBE							1																					
Winter	VELVET SCOTER							1																					
Winter	GREY PLOVER																			1									
Winter	TURNSTONE						1																						
Winter	KNOT		1																										
Winter	BARNACLE GOOSE			2																									
Winter	GOLDENEYE															2													
Winter	WHOOPEE SWAN						1	1									3												
Winter	LITTLE AUK					2											3								2				
Winter	BRENT / BARNACLE GOOSE					1	8			1							3												
Winter	GREAT NORTHERN DIVER					1	21						1		3	4			1		2			1					
cf. Domestic	CF. DOMESTIC GOOSE						2																						
cf. Domestic	GALLIFORM CF. DOMESTIC FOWL					3	33											15		1									
cf. Resident	RAPTOR						1																						
cf. Resident	WADER CF. LAPWING					1	1																						
cf. Resident	GALLIFORM CF. RED GROUSE					3	1																						
cf. Resident	CF. RED-BREADED MERGANSER						4																						
cf. Resident	SWAN SP						6																						
cf. Resident	DUCK CF. MALLARD / SHELDUCK					3	3																						
cf. Resident	WADER CF. OYSTERCATCHER					1	6																						
cf. Resident	CF. SONGTHRUSH		5	3																									
cf. Resident	GULL CF. BLACK HEADED																		10										

Summer	GANNET	64		2		12	57									18	591	24	10
Summer	GUILLEMOT	38			1		20									3	786		5
Summer	FULMAR	47				1	1									360	1117	8	
Summer	PUFFIN	43	2	78		7	7									52	2504	3	
Summer/Resident	TEAL																		1
Summer/Resident	RED KITE																		2
Summer/Resident	PUFFIN / BLACK GUILLEMOT																		
Summer/Resident	SNIPE																	3	2
Summer/Resident	HERRING / LBB GULL					7	2											4	1
Summer/Winter	GOLDEN PLOVER																		6
Summer/Winter	CURLEW									1									
Winter	FIELDFARE																		1
Winter	KNOT																		1
Winter	WHOOPE SWAN																		1
Winter	SMEW									1									
Winter	GREY PLOVER																		1
Winter	TURNSTONE																		2
Winter	RUFF									1									2
Winter	LITTLE AUK					2				19									1
<i>cf. Domestic</i>	<i>CF. DOMESTIC GOOSE</i>																		
<i>cf. Resident</i>	<i>RAPTOR</i>																		
<i>cf. Resident</i>	<i>SMALL PASSERINE CF. STARLING</i>																		
<i>cf. Resident</i>	<i>COLUMBA SP</i>																		
<i>cf. Resident</i>	<i>CF. SONGTHRUSH</i>						1												
<i>cf. Resident</i>	<i>GULL CF. COMMON</i>						3												
<i>cf. summer</i>	<i>CF. RING OUSEL</i>																		
<i>cf. summer</i>	<i>SHOVELER</i>																		2
<i>cf. Summer/Resident</i>	<i>GULL CF. HERRING /LBB</i>																		
<i>cf. Winter</i>	<i>SWAN CF. WHOOPER</i>						1												
<i>cf. Winter</i>	<i>DUCK CF. POCHARD</i>																		

Table A5.26: Butchery and Working data for all sites outside of South Uist

SITE NAME	ISLAND GROUP	PERIOD	SPECIES	ELEMENT	LOCATION	TYPE	NO.	COMMENTS
West Voe	Shetland	Mesolithic	Puffin	Humerus	Proximal	Knife Cut	1	Three fine cuts on head indicating wing removal.
Cnoc Coig	Inner Hebrides	Mesolithic	Bird Sp.	Unknown		Worked	7	Delicate awls
Sand	Inner Hebrides	Mesolithic	Razorbill / Guillemot	Humerus		Knife Cut	2	medio-lateral cut mark below proximal head, fine scratches visible over entire shaft. Second example medio-lateral cut mark c.2 mm on medial surface of shaft & 2 parallel cut marks on head

Sand	Inner Hebrides	Mesolithic	Razorbill / Guillemot	Ulna	Shaft	Knife Cut	1	4 very fine, sporadic cut marks, approx medio-laterally, along shaft
Sand	Inner Hebrides	Mesolithic	Razorbill / Guillemot	Humerus	Prox	Possible Cut	1	possible cut mark below crista lateralis of proximal head
Sand	Inner Hebrides	Mesolithic	Unknown	Unknown		Worked	1	'There was one small fine point from Sand (BT56, B1BNE Spit 4, Context 24). It has been carefully made on a small round piece of bird bone.'
Carding Mill Bay 1	Mainland	Early Neolithic	Razorbill	Humerus	Lateral surface	Knife Cut	1	Also this is a burnt specimen. However, not sure how many more burnt specimens
Northton	Outer Hebrides	Late Neolithic	Gannet	Humerus		Knife Cut	1	Juvenile and Rodent gnawed
Northton	Outer Hebrides	Late Neolithic	Herring / Lesser black backed gull	Femur	shaft	Knife Cut	1	Multiple on shaft
Northton	Outer Hebrides	Late Neolithic	Peregrine Falcon	Tarsometatarsus	Shaft	Knife Cut	1	Zones three and four multiple
Northton	Outer Hebrides	Late Neolithic	Shag	Coracoid	Proximal	Possible Peeling	1	
Quanterness cairn	Orkney	Neolithic	Gannet	Sternum	Central	Chop	3	
Skara Brae	Orkney	Neolithic	Gannet	Humerus	distal	Worked	1	Awl / point distal humerus. Need reference for this
Tofts Ness 1 & 2	Orkney	Neolithic	Great Auk	Coracoid	Mid bone	Knife Cut	1	
Tofts Ness 1 & 2	Orkney	Neolithic	Unknown	Unknown		Worked	11	6 of these are points/awls. The others are unknown
Links of Noltland	Orkney	Neolithic	Gannet	Humerus	Proximal shaft	Possibly Butchered	1	
Links of Noltland	Orkney	Neolithic	Gannet	Humerus	cf Mid shaft	Butchered	1	
Links of Noltland	Orkney	Neolithic	Gannet	Humerus	cf Proximal shaft	Butchered	1	
Links of Noltland	Orkney	Neolithic	Gannet	Ulna	cf Distal Shaft	Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Gannet	Ulna	cf Proximal Shaft	Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Gannet	Ulna	cf Distal Shaft	Butchered	1	
Links of Noltland	Orkney	Neolithic	Gannet	Ulna	cf Midshaft	Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Gannet	Carpometacarpus		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Shag	Ulna		Possible Butchered	1	
Links of	Orkney	Neolithic	Cormorant	Coracoid		Possible	1	

Noltland						Butchered		
Links of Noltland	Orkney	Neolithic	Cormorant	Humerus		Butchered	2	
Links of Noltland	Orkney	Neolithic	Goose Sp	Ulna		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Duck Sp	Humerus		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Duck Sp	Ulna		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Snipe	Humerus		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Herring / Lesser black backed gull	Scapula		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Herring / Lesser black backed gull	Humerus		Butchered	1	
Links of Noltland	Orkney	Neolithic	Herring / Lesser black backed gull	Radius		Butchered	1	
Links of Noltland	Orkney	Neolithic	Herring / Lesser black backed gull	Carpometacarpus		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Great Black Backed Gull	Humerus		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Great Black Backed Gull	Humerus		Butchered	1	
Links of Noltland	Orkney	Neolithic	Great Black Backed Gull	Radius		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Guillemot	Humerus		Possible Butchered	2	
Links of Noltland	Orkney	Neolithic	Guillemot	Femur		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Guillemot	Tibiotarsus		Possible Butchered	2	
Links of Noltland	Orkney	Neolithic	Puffin	Humerus		Possible Butchered	1	
Links of Noltland	Orkney	Neolithic	Great Auk	Humerus		Butchered	1	Text says definate, record sheet possible
Links of Noltland	Orkney	Neolithic	Great Auk	Femur		Butchered	1	Text says definate, record sheet possible
Links of Noltland	Orkney	Neolithic	Unknown	Mixed	Unknown	Unknown	6	
Links of Noltland	Orkney	Neolithic	Unknown cf Great Auk from text	Tibiotarsus		Worked	1	Apparently there is one worked into a tool, but only rec in text and not in recod sheets
Rosinish	Outer	Beaker	Unidentified	Long Bone cf	Shaft	Knife Cut	1	

	Hebrides			tibio-tarsus or tarso-metatarsus				
Northton	Outer Hebrides	Beaker V/VI	Cormorant	Femur	Proximal	Knife Cut	1	
Northton	Outer Hebrides	Beaker VII	Shag	Humerus	Proximal Articulation	Knife Cuts	1	
Ardnave	Inner Hebrides	Bronze age	Possibly Crane	Ulna		Worked	1	Bird, ulna, L shaft. Ditch of Period 2 house. The shaft of the ulna of a bird (possibly a crane) from the ditch of the Period 2 house, has both ends cut off squarely to form a tube of irregular section.
Tofts Ness 3	Orkney	Early Bronze Age	Unknown	Unknown		Worked	2	Points awl. Min number
Jarlshof	Shetland	Late Bronze Age / Early Iron Age	Unknown	Unknown		Worked	3	Points. Not clear which phase they are from. Could be from BA or IA
Midhowe Broch	Orkney	(Middle) Iron Age	cf Goose or Eagle sp	Ulna	Shaft	Worked	1	Worked into a tube. "Tube formed from the middle portion of the ulna of a large bird, such as the Wild Goose or Fish Eagle, measuring 6 1/2 inches long and 1/2 inch in diameter"
Midhowe Broch	Orkney	(Middle) Iron Age	Unknown	Leg Bone of tibiotarsus	Shaft	Worked	1	"Pin or borer made from the leg bone of a bird, 2 3/4 inches long"
Howe	Orkney	Early Iron Age	Gannet	Multiple. Wing, leg, head.		Knife Cuts		One Skeleton repeated butchery. Legs and Wings removed. Cuts on head could indicate splitting to dry/preserve or (I think) skinning
Howe	Orkney	Early Iron Age	Great Auk	Legs	Unknown	Knife Cut	1	Pair of legs showing cut off from body. Hacked.
Saevar Howe	Orkney	Early Norse	Unknown	Unknown of Ulna	Shaft	Worked	1	"there is no indication of perforation, the likeliest explanation is that it was intended as a needle case, as the ends have been chamfered."
Skaill Deerness	Orkney	Iron Age	Gannet	Unknown	Unknown	Knife Cut	1	1+
Skaill Deerness	Orkney	Iron Age	Shag	Unknown	Unknown	Knife Cut	1	1+
Skaill Deerness	Orkney	Iron Age	Great Auk	Unknown	Unknown	Knife Cut	1	1+
Skaill Deerness	Orkney	Iron Age	Gannet	Humerus	Ends	Worked	1	Both ends sawn off to make a tube.
Bac Mhic Connain	Outer Hebrides	Iron Age	Crane	Tibiotarsus		Worked	1	Worked into tube 250mm long
St Boniface's Church	Orkney	Iron Age	Goose Sp	Unknown		Knife Cut	3	
Tofts Ness Phases 5 & 6	Orkney	Iron Age	Unknown	Unknown		Worked	1	Min. Unknown form
Milla Skerra Sandwick	Shetland	Iron Age	Cormorant	Femur		Knife cuts	1	Juvenile individual
Milla Skerra Sandwick	Shetland	Iron Age	Gannet	Humerus	Prox	Knife Cut	1	4 cuts prox
Milla Skerra Sandwick	Shetland	Iron Age	Great Auk	Humerus		Knife nicks	1	Several nicks

Bostadh	Outer Hebrides	Late Iron Age	Brent Goose	Unknown	Unknown	Butchered	1	
Howe	Orkney	Late Iron Age	Whooper Swan	Unknown	Unknown	Knife Cut	1	Some butchery, just lists species. Report suggests that feet wings and heads were removed from the birds. Smoke, cook, dry.
Howe	Orkney	Late Iron Age	Greylag / domestic goose	Unknown	Unknown	Knife Cut	1	Some butchery, just lists species. Report suggests that feet wings and heads were removed from the birds. Smoke, cook, dry.
Howe	Orkney	Late Iron Age	Domestic Fowl	Unknown	Unknown	Knife Cut	1	Some butchery, just lists species. Report suggests that feet wings and heads were removed from the birds. Smoke, cook, dry.
Howe	Orkney	Late Iron Age	Gannet	Ulna		Worked	2	Smoothed.
Pool	Orkney	Late Iron Age Phase 6	Grey Goose Sp	Humerus	Unknown	Knife Cut	1	
Sloc Sabhaid Baile Sear	Outer Hebrides	Middle Iron Age	Gannet	Humerus	Distal	Knife Cut	1	
Sloc Sabhaid Baile Sear	Outer Hebrides	Middle Iron Age	Gannet	Tibiotarsus		Knife Cut	1	
Sloc Sabhaid Baile Sear	Outer Hebrides	Middle Iron Age	Great Auk	Femur	Shaft	Knife Cut	1	
Sloc Sabhaid Baile Sear	Outer Hebrides	Middle Iron Age	Large Goose	Carpometacarpus		Knife Cut	1	
Sloc Sabhaid Baile Sear	Outer Hebrides	Middle Iron Age	Large Goose	Radius	Proximal	Knife Cut	1	
Sloc Sabhaid Baile Sear	Outer Hebrides	Middle Iron Age	Puffin	Humerus		Knife Cut	1	
Cnip	Outer Hebrides	Middle Iron Age	Shag	Femur	Proximal	Knife Cut	1	
Cnip	Outer Hebrides	Middle Iron Age	Grouse Sp	Humerus	Proximal	Knife Cut	1	
Howe	Orkney	Middle Iron Age	Great Auk	Unknown		Knife Cut	2	'knife cuts were also found on other great auk bones in phase 7'
Howe	Orkney	Middle Iron Age	Guillemot	Articulated Wings		Tool	1	Suggested that these are a brush or winnower. Found inside broch tower.
Howe	Orkney	Middle Iron Age	Goose Sp	Ulna	Shaft	Worked	2	Late MIA, rubbed down. One square sectioned shaft. Other sawn at one end and broken by use. Some suggest whistles.
Scalloway	Shetland	Middle Iron Age Phase 2	Unknown	Longbone		Worked	1	One bird bone worked into an Awl. No information on Phase or species. Scalloway says 'Very few if any butchery marks of any kind were evident'
Ceardach Ruadh Baile Sear	Outer Hebrides	Middle-Late Iron Age	Great Auk	Ulna	Olecranon process	Knife cut	1	
Foshigarry	Outer Hebrides	Middle-Late Iron Age	Gull	Radius		Worked	1	Bone Point
Rough Island 41B	Outer Hebrides	Late Iron Age	Puffin	Humerus	Shaft	Scrape	1	Juvenile. 'Scrapes' on shaft

Rough Island 41B	Outer Hebrides	Late Iron Age	Puffin	Tibio-Tarsus		Scrape	1	Scrape
Rough Island 41B	Outer Hebrides	Late Iron Age	Puffin	Femur	Femoral head	Knife Cut	1	Cut beneath ball.
Rough Island 41B	Outer Hebrides	Late Iron Age	Puffin	Femur	Femoral head	Knife Cut	1	Cut beneath ball.
Rough Island 41B	Outer Hebrides	Late Iron Age	Puffin	Humerus		Knife Cut	1	
Rough Island 41B	Outer Hebrides	Late Iron Age	Puffin	Humerus	Proximal	Knife Cut	1	
Rough Island 41B	Outer Hebrides	Late Iron Age	Puffin	Humerus	Distal	Knife Cut	1	
Rough Island 41B	Outer Hebrides	Late Iron Age	Puffin	Humerus	Proximal	Knife Cut	1	
Rough Island 41B	Outer Hebrides	Late Iron Age	Puffin	Humerus		Knife Cut	1	
Rough Island 41B	Outer Hebrides	Late Iron Age	Puffin	Ulna	Distal shaft (Z5/6)	Knife Cut	1	Cut
Rough Island 41B	Outer Hebrides	Late Iron Age	Shag	Radius	Shaft	Knife Cut	1	
Pool	Orkney	Late Iron Age / Viking Interface Phase 7	Goose	Ulna	Shaft	Worked	2	Needle Case
Pool	Orkney	Late Iron Age / Viking Interface Phase 7	Seabird	Unknown	Unknown	Knife Cut	9	
Pool	Orkney	Late Iron Age / Viking Interface Phase 7	Domestic Fowl	Tibiotarsus	Unknown	Knife Cut	1	
Pool	Orkney	Late Iron Age / Viking Interface Phase 7	Red Breasted Merganser	Radius	Unknown	Knife Cut	1	
Pool	Orkney	Late Iron Age / Viking Interface Phase 7	Oystercatcher	Humerus	Unknown	Knife Cut	1	
Old Scatness	Shetland	Pre-Norse/Pictish (/LIA?)	Gull	Humerus, coracoid and Furcula	Unknown	Knife Cuts	3	Small Cuts
Saevar Howe	Orkney	Early Norse	cf Gannet	Ulna	Shaft	Worked	1	"Although it is broken, it is clear that in form it was a needle case. The break in fact occurs at the weakest point where there are still visible the remains of two holes at right-angles to each other."
Quoygrew Farm Midden iii	Orkney	Middle-Late Norse 1035-1261AD	Cormorant	Sternum		Probably Cut	1	'cut?'

Quoygre Farm Midden iii	Orkney	Middle-Late Norse 1035-1261AD	Duck Sp	Carpometacarpus		Chop	1	
Quoygre Farm Midden iii	Orkney	Middle-Late Norse 1035-1261AD	Unidentified	Tibiotarsus		Cut	1	
Quoygre Farm Midden iii	Orkney	Middle-Late Norse 1035-1261AD	Herring / Lesser Black Backed Gull	Humerus	Distal Epiphysis	Probable Chop	1	On posterior facets of distal epiphysis
Quoygre Farm Midden iii	Orkney	Middle-Late Norse 1035-1261AD	Unidentified	Humerus	Proximal	Knife Cut	1	Series of shallow cut marks on the proximal joint surface
Quoygre Farm Midden iii	Orkney	Middle-Late Norse 1035-1261AD	Unidentified	Humerus		Cut	1	
Quoygre Farm Midden iii	Orkney	Middle-Late Norse 1035-1261AD	Unidentified	Vertebra		Cut	1	
Quoygre Farm Midden 2	Orkney	Middle-Late Norse 1066-1294AD	Manx Shearwater	Humerus	Distal Epiphysis	Cut	1	3 cut marks on distal end
Tuquoy	Orkney	Norse	Cf Domestic Fowl	Humerus	Shaft	Knife Cut	1	
Tuquoy	Orkney	Norse	Cormorant	Femur	Shaft	Knife Cut	1	
Tuquoy	Orkney	Norse	Cormorant	Humerus	Shaft	Chop	1	
Tuquoy	Orkney	Norse	Domestic Fowl	Coracoid	Unknown	Knife Cut	1	
Tuquoy	Orkney	Norse	Domestic Fowl	Scapula	Proximal	Knife Cut	1	
Tuquoy	Orkney	Norse	Domestic Fowl	Synsacrum		Knife Cut	1	
Tuquoy	Orkney	Norse	Domestic Fowl	Tarsometatarsus		Chop / Shave	1	Unsure if this is chop & shave or chop / shave
Tuquoy	Orkney	Norse	Domestic Fowl	Tarsometatarsus	Proximal	Knife Cut	1	
Tuquoy	Orkney	Norse	Domestic Fowl	Tibiotarsus	Distal joint	Chop	1	This appears to be on the distal joint, but again codes not completely clear.
Tuquoy	Orkney	Norse	Domestic Fowl	Ulna	Proximal	Knife Cut	2	One on joint one just proximal
Tuquoy	Orkney	Norse	Gannet	Synsacrum		Knife Cut and Chop	1	
Tuquoy	Orkney	Norse	Greylag / Domestic Goose	Femur	Proximal	Knife Cut	1	
Tuquoy	Orkney	Norse	Greylag / Domestic Goose	Humerus	Proximal	Knife Cut	1	
Tuquoy	Orkney	Norse	Razorbill	Humerus	Mid Shaft	Knife Cut	1	
Tuquoy	Orkney	Norse	Shag	Coracoid		Knife Cut	2	
Tuquoy	Orkney	Norse	Shag	Femur	Mid Shaft	Knife Cut	1	
Tuquoy	Orkney	Norse	Shag	Tarsometatarsus	Proximal	Knife Cut	1	

Pool	Orkney	Norse Phase 8	Great Auk	TibioTarsus	Distal End	Knife Cut	1	
Rough Island 41B	Outer Hebrides	Norse/Early Medieval	Puffin	Humerus	Shaft	Possible Knife Cut	1	Abraded cut marks or rodent gnawing
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Columba Sp	Humerus	Proximal	Chop	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Cormorant	Ulna	Proximal	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Domestic Fowl	Femur	Proximal	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Domestic Fowl	Humerus	Proximal	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Domestic Fowl	Radius	Proximal and Distal	Knife Cut	1	Two sets of knife cuts
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Domestic Fowl	Tarsometatarsus	Proximal	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Domestic Fowl	Tibiotarsus	Distal	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Domestic Fowl	Vertebrae	Proximal	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Shag	Femur	Midshaft	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Shag	Humerus	Midshaft	Knife Cut	2	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Shag	Humerus		Chop	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Shag	Tibiotarsus		Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Duck / Goose	Furcula	Midshaft	Chop / Split	1	

Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Greylag / Domestic Goose	Humerus	Proximal	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Guillemot	Humerus	Proximal	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Guillemot	Radius	Proximal	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Mallard / Domestic Duck	Coracoid	Proximal	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Mallard / Domestic Duck	Ulna	Midshaft	Knife Cut	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Mallard / Domestic Duck	Vertebrae		Chop / Split	1	
Tuquoy	Orkney	Late Norse/Medieval - Post Medieval	Shag / Cormorant	Femur	Midshaft	Knife Cut	1	
Quoygrew	Orkney	Late Medieval - Post Medieval	Unidentified	Humerus	Distal epiphysis	Cut	1	Accross distal epiphysis. Phase 5
Quoygrew	Orkney	Late Medieval - Post Medieval	Shag	Coracoid		Probable Chop	1	Phase 5
Quoygrew	Orkney	Late Medieval - Post Medieval	Unidentified	Furcula		Cut	1	Phase 5
Quoygrew	Orkney	Late Medieval - Post Medieval	Unidentified	Rib		Cut	1	Phase 5
Quoygrew	Orkney	Late Medieval - Post Medieval	Cormorant	Radius		Cut	1	Two marks below [proximal?] epiphysis. Phase 5
Quoygrew	Orkney	Late Medieval - Post Medieval	Unidentified	Vertebra		Cut	1	Phase 5
Quoygrew	Orkney	Late Medieval - Post Medieval	Cormorant	Pelvis		Cut	1	Phase 6
Quoygrew	Orkney	Late Medieval - Post Medieval	Unidentified	Pelvis		Probable Cut	1	Phase 6
Quoygrew	Orkney	Late Medieval - Post Medieval	Domestic Fowl	Femur		Chop	1	'chops'. Phase v.ii
Quoygrew	Orkney	Late Medieval - Post Medieval	Unidentified	Humerus	Shaft and distal	Probable chop	1	On shaft and across the distal epiphysis. Phase v.ii
Quoygrew	Orkney	Late Medieval - Post Medieval	Unidentified	Tibiotarsus		Probable Cut	1	Phase v.ii

House Island 15B	Outer Hebrides	Post-Medieval	Puffin	Femur	Femoral head	Knife Cut	1	Butchery on ball
House Island 15B	Outer Hebrides	Post-Medieval	Puffin	Humerus		Knife Cut	1	Two knife cut marks
House Island 15B	Outer Hebrides	Post-Medieval	Puffin	Humerus	Dist/Shaft	Knife Cut	1	
House Island 15B	Outer Hebrides	Post-Medieval	Puffin	Humerus	1	Knife Cut	1	
House Island 15B	Outer Hebrides	Post-Medieval	Puffin	Tibio-Tarsus	Distal (Zone 7)	Knife Cut	1	
House Island 15B	Outer Hebrides	Post-Medieval	Shag	Humerus		Knife Cut	1	
House Island 15B	Outer Hebrides	Post-Medieval	Shag	Humerus	Distal (Zone 7)	Knife Cut	1	
House Island 15B	Outer Hebrides	Post-Medieval	Shag	Humerus	Distal (Zone 7)	Knife Cut	1	
House Island 15B	Outer Hebrides	Post-Medieval	Shag	Humerus	Distal (Zone 5/6)	Knife Cut	1	
St Kilda Black House 8	Outer Hebrides	Modern c. 1830-1930	Gannet	Premaxilla	Between beak and skull	Knife cut	1	
St Kilda Black House 8	Outer Hebrides	Modern c. 1830-1930	Gannet	Coracoid	Distal end cut off	Knife cut	1	
St Kilda Black House 8	Outer Hebrides	Modern c. 1830-1930	Gannet	Femur	Proximal head	Knife cut	2	
St Kilda Black House 8	Outer Hebrides	Modern c. 1830-1930	Gannet	Sternum	Midline on inner surface	Knife cut	1	May indicate splitting of bird from the back.
St Kilda Black House 8	Outer Hebrides	Modern c. 1830-1930	Fulmar	Humerus	Proximal	Knife cut	1	
St Kilda Black House 8	Outer Hebrides	Modern c. 1830-1930	Fulmar	Radius	Distal	Knife cut	1	
St Kilda Black House 8	Outer Hebrides	Modern c. 1830-1930	Razorbill	Humerus		Knife cut	1	
St Kilda Black House 6	Outer Hebrides	Modern c. 1830-1930	Gannet	Carpometacarpus	Proximal	Knife Cut	3	Proposed wing-brushes

APPENDIX TO CHAPTER SIX

THE WIDER ISLAND WORLD

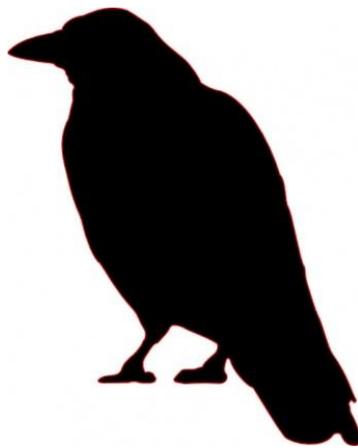


Table A6.1: Names in English, Latin and Icelandic

English Name	Latin Name	Icelandic Name
Puffin	<i>Fratercula arctica</i>	Lundi
Guillemot	<i>Uria aalge / lomvia</i>	Langvía/ Stuttnefja
Great Auk	<i>Pinguinus impennis</i>	Geirfugl
Gannet	<i>Morus bassanus</i>	Súla
Sooty / Great Shearwater	<i>Puffinus griseus / gravis</i>	Gráskrofa / Hettuskrofa
Great Black-Backed Gull	<i>Larus Marinus</i>	Svarbakur
Razorbill	<i>Alca torda</i>	Álka
Cormorant	<i>Phalacrocorax carbo</i>	Dílaskarfi
Domestic Fowl	<i>Gallus (gallus) domesticus</i>	Hænsni
Herring/Lesser Black-Backed Gull	<i>Larus argentatus / fuscus</i>	Silfurmáfur / Sílamáfur
Kittiwake	<i>Rissa tridactyla</i>	Rita
Raven	<i>Corvus corax</i>	Hrafn
Auk	<i>Alcidae</i>	Svartfuglaætt
Eider Duck	<i>Somateria mollissima</i>	æðarfugl
Goose Sp.	<i>Anserini</i>	Gæs
Grouse cf. Rock Ptarmigan	<i>Lagopus cf. muta</i>	Rjúpa
Swan Sp.	<i>Cygnus</i>	Svanur
Duck cf. Mallard	<i>cf. Anas platyrhynchos</i>	önd cf. Stokkönd
Falcon cf. Gyr	<i>Falco rusticolus</i>	Fálki
Black Guillemot	<i>Cepphus grylle</i>	Teista
White-Tailed Eagle	<i>Haliaeetus albicilla</i>	Haförn
Common Gull	<i>Larus canus</i>	Stormmáfur
Tufted Duck	<i>Aythya fuligula</i>	Skúfönd
Goldeneye	<i>Bucephala clangula / islandica</i>	Hvinönd / Húsönd
Greylag Goose	<i>Anser Anser</i>	Grágæs
Fulmar	<i>Fulmarus glacialis</i>	Fýll
Grebe Sp.	<i>Podicipedidae</i>	Goði cf. Flórgoði
Wader	<i>Charadrii / Scolopacidae</i>	Vaðið fuglinn
Shag	<i>Phalacrocorax aristotelis</i>	Toppskarfur
Oystercatcher	<i>Haematopus ostralegus</i>	Tjaldur
Gull	<i>Laridae</i>	Máfaætt

Table A6.2: Frequency of elements gnawed

Element	Gnawed	Possibly gnawed
Humerus	13	5
Carpometatarsus	1	
Coracoid	1	
Radius	1	
Tibiotarsus	1	
Ulna	1	1
Femur		2

Figure A6.1: Changes in species frequencies at Alpingisreit by periods/phase

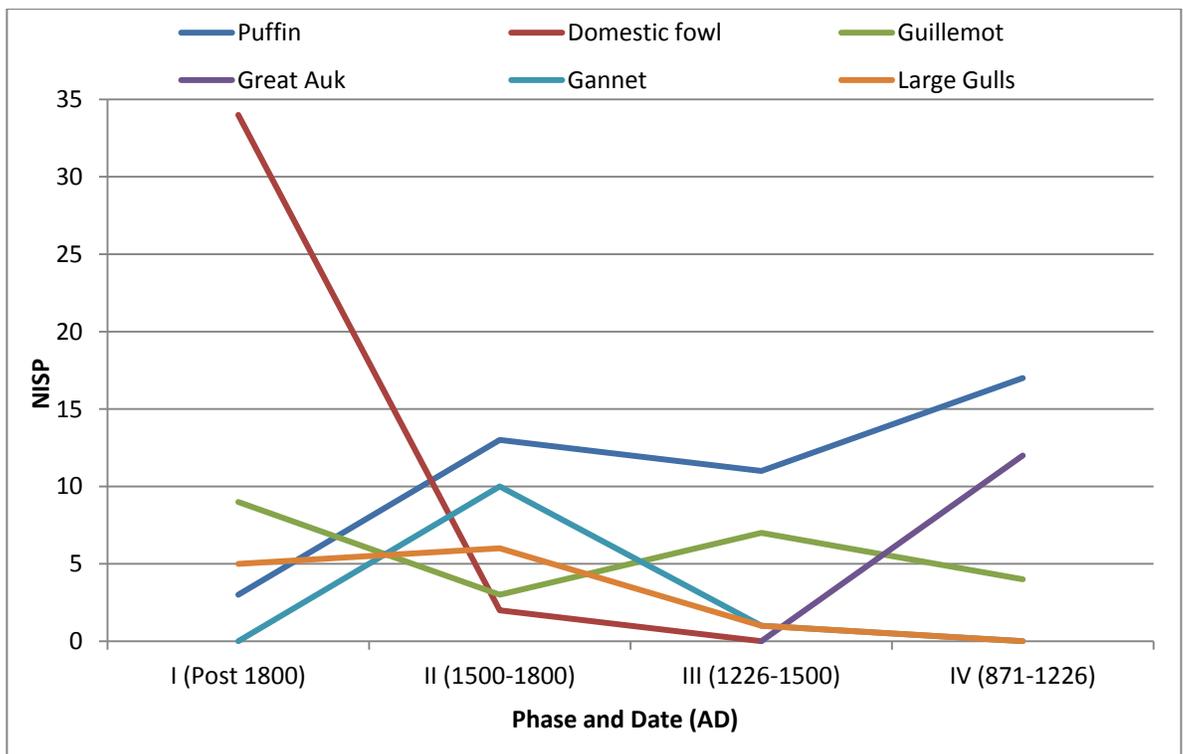
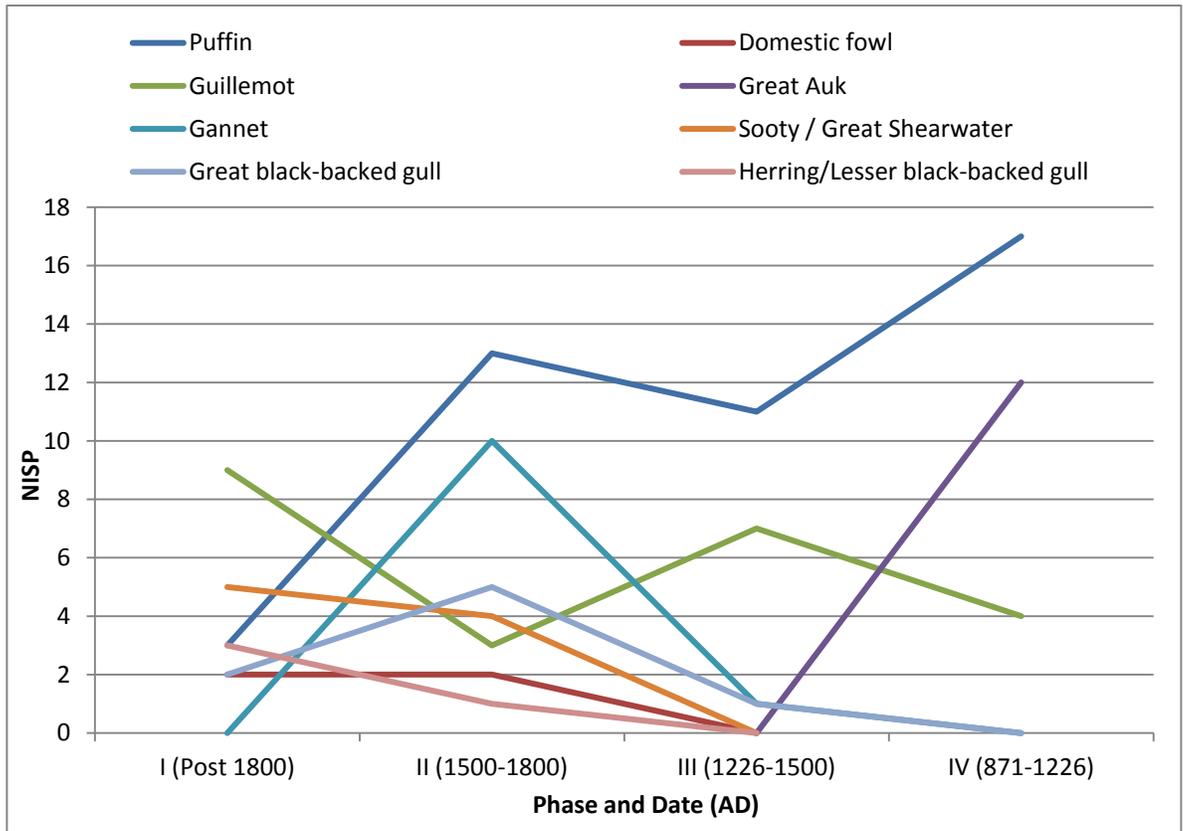


Figure A6.2: Birds as a proportion of the faunal assemblage for Alþingisreit (Mammal and Fish NISPs from (Pálsdóttir 2010).

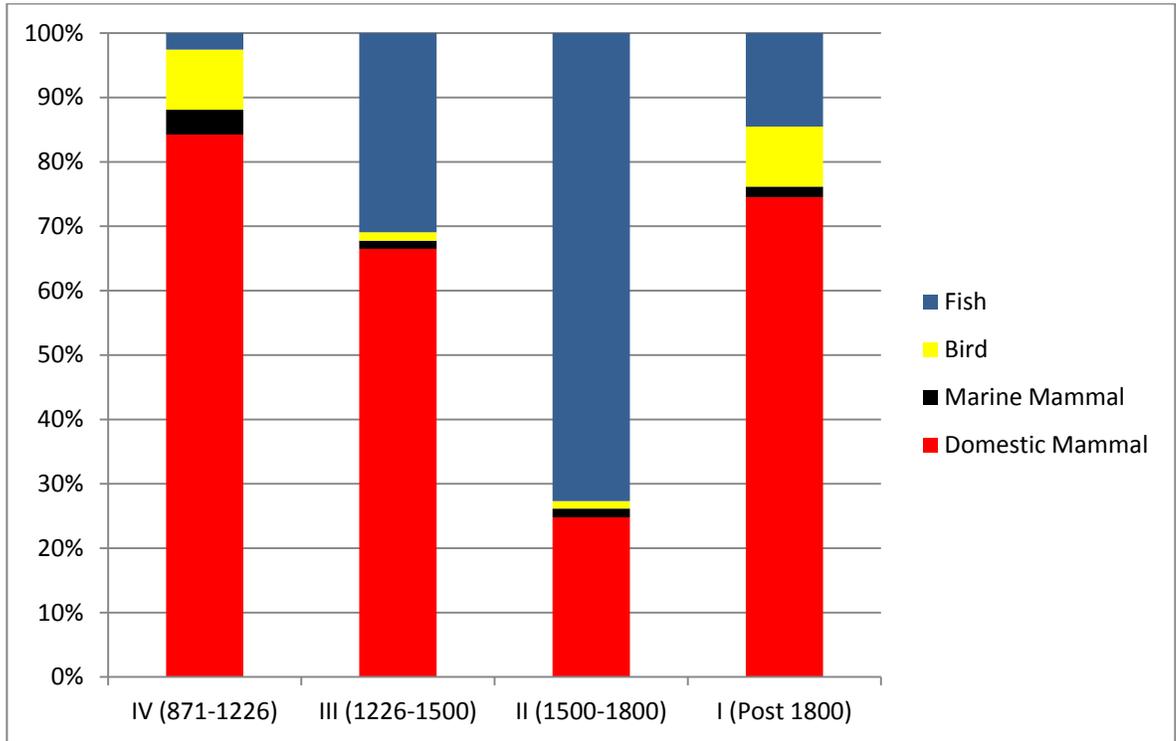


Figure A6.3: Icelandic Late Medieval taxa as % NISP (from Harrison 2006)

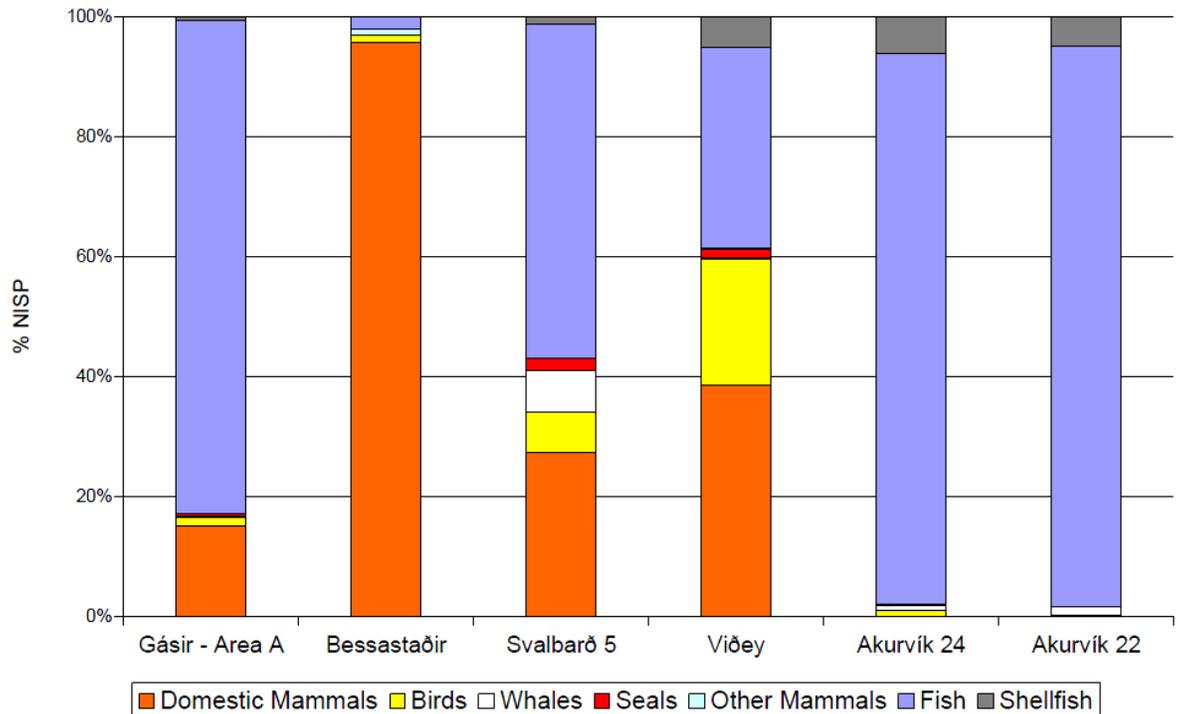


Figure A6.4: Taxa as percentage NISP by data and place (Thurston and Fisher 2007, 199)

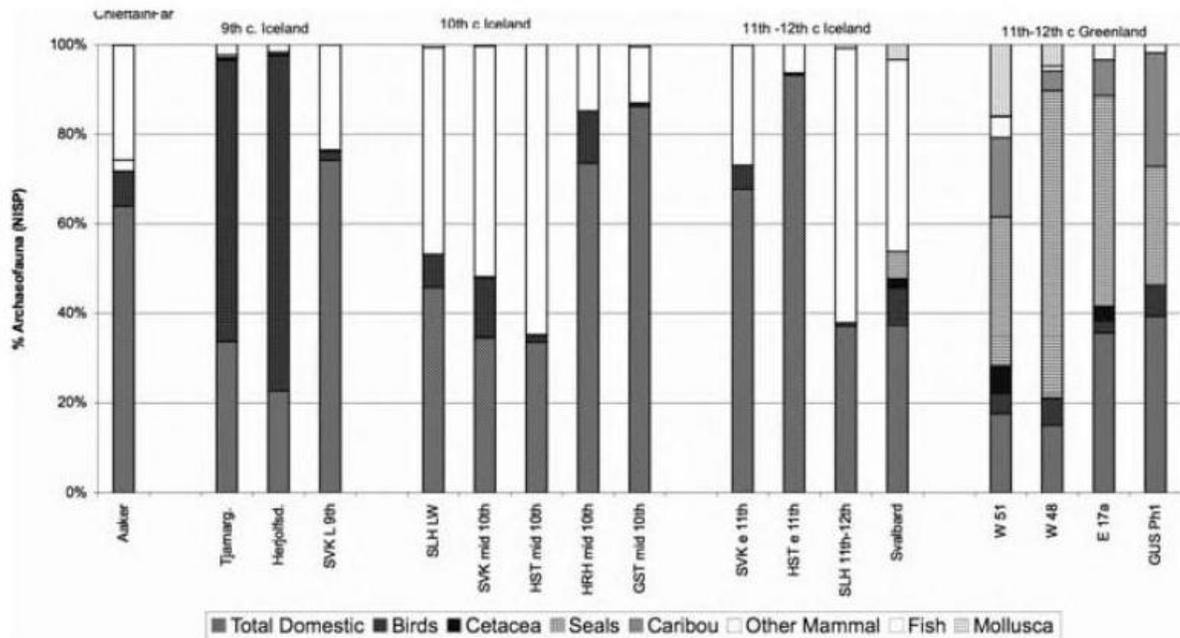


Table A6.3: Avian NISP from sites in the vicinity of Lake Myvatn in Iceland (Table from McGovern *et al.* 2006, 193).

NISP bone count for birds from the Mývatnssveit archaeofauna, with the presence of eggshell concentrations indicated (SVK = Sveigakot, HST = Hofstaðir, HRH = Hrisheimar, SBO = Steinbogi, SLH = Selhagi)

Site	SVK 1	SVK 2	HRH 2	HST 3	SLH 1	SVK 3	HST 4	SLH 2	SBO
Date in centuries	9th-10th	10th	10th	10th	10th	11th	Late 10th-11th	12th	Late 12th-13th
Species	Species common name								
Anatidae sp.	Duck sp.		2 + egg	egg	1 + egg	3	1 + egg	egg	
<i>Anas platyrhynchos</i>	Mallard	1				3	1		1
<i>Aythya</i> sp.	Scaup or tufted duck	3				1	1		16
<i>Somateria</i> sp.	Eider duck							2	
<i>Gavia</i> sp.	Diver sp.			1		4			
<i>Gavia immer</i>	Great N Diver			2		1			
<i>Gavia stellata</i>	Red throated diver					1			
<i>Podiceps auritus</i>	Slavonian grebe	1				1			
Anserini sp.	Goose sp.	2							
<i>Cygnus</i> sp.	Swan sp.	1	2	1	4				
<i>Lagopus mutus</i>	Ptarmigan	13	346	230 + egg	16 + egg	3 + egg	338	85	egg
<i>Corvus corax</i>	Raven		4						
<i>Larus</i> sp.	Gull sp		2						
<i>Alca torda</i>	Razorbill								1
<i>Uria</i> sp.	Murre or Guillemot			6 + egg			2 + egg		1
<i>Fratercula arctica</i>	Puffin			1					
<i>Alle alle</i>	Little auk							3	
Procellariidae sp.	Shearwater or fulmar.					egg			egg
Aves sp.	Bird species indet.	11	274	109	52	13	177	64	33

Table A6.4: Sites considered in ‘Wider Island World’ comparison

Site	Date	Location	Reference
Undir Junkarinsflótti	9th to 13th century	Faroe	Brewington 2010; Church <i>et al.</i> 2005
Sondum	Early Norse / Norse 9th +	Faroe	Brewington and McGovern 2008; McGovern <i>et al.</i> 2004
Argisbrekka	Viking/Early Norse	Faroe	Brewington and McGovern 2008; Gotfredsen 2007
Tjarnargata 4	9 th and 10 th century	Iceland, Reykjavik, coastal	Amorosi, 1996
Herjólfssdalur	9 th and 10 th century	Iceland, Heimaey	Amorosi, 1996; Hermanns-Auðardóttir 1989; Hermanns-Auðardóttir 1991
Surtshellir-Víhishellir	late 9 th -10 th century	Iceland, Inland, northwest	Ólafsson <i>et al.</i> 2006, 398-399
Sveigakot	9 th and 10 th century and 11th	Iceland, Inland, Lake Mývatn	Sveigakot 2001
Hrisheimar	10th century	Iceland, Inland, Lake Mývatn	McGovern <i>et al.</i> 2006
Hofstaðir	10th-11th	Iceland, Inland, Lake Mývatn	McGovern <i>et al.</i> 2006
Selhagi	10th-12th	Iceland, Inland, Lake Mývatn	McGovern <i>et al.</i> 2006
Steinbogi	12th-13th	Iceland, Inland, Lake Mývatn	McGovern <i>et al.</i> 2006
Miðbær	AD 1250-1700	Iceland Island Flatey in Breiðafjörður	Amundsen 2004
Gásir	14th Century	Iceland, Coastal, North Eyjafjörður	Harrison <i>et al.</i> 2008, 106
Gjögur	15th century	Iceland, Northwest, coastal	Krivogorskaya <i>et al.</i> 2006
Akurvík	15th century	Iceland, Northwest, coastal	Krivogorskaya <i>et al.</i> 2006
Bessastaðir	Late Medieval	Iceland, Reykjavik, coastal	Amorosi 1996
Skriðuklaustur	Late Medieval	Iceland, Inland, east.	Hamilton-Dyer 2010; Pálsdóttir 2006

APPENDIX TO CHAPTER SEVEN

COUNTING BIRDS BEFORE THEY HATCH



Table A7.1: Eggshell analysis of specimens from Bornais examined by SEM and optical microscope (raw notes).

Specimen	Phase	Thicness mm	Mean Pores/mm ²	Hatched?	Range Mammillae/mm ²	Mean Mammillae/mm ²	Species
1	LN	0.58-0.6	0.5	Relatively late in development.	40 - 56	47.2 +- 6.4	<i>cf. Domestic Goose</i>
2	MN	0.27-0.28	0.5-0.7	Newly Laid	34 - 50	39.7 +- 5.4	Domestic Fowl
3	LN	0.59-0.62	0.5-0.6	Midway through development	26 - 54	45.6 +- 11.3	<i>cf. Great Auk</i>
4	LN	0.26-0.29	1.05	Early in lay, few days old. Approching first signs of reabsortion.	80 - 118	91.2 +- 15.7	<i>cf. domestic fowl, maybe wild duck</i>
5	LN	0.50-0.55	0.8 - a little blocked	Vaired. Quite new, but perhaps approaching half way.	40 - 50	43.2 +- 4.1	<i>cf. greylag goose. Possibly Swan.</i>
6	EN	0.28-0.31	0.3ish could be blocked	Fairly late comparable, but would not say hatched	68-86	80 +- 7.9	Dammaged but Large Gull sp. <i>cf. herring</i>
7	LN	0.28-0.29	0.6 Blocked	Early in lay, few days old. Approching first signs of reabsortion.	38 - 48	43.2 +- 3.6	<i>cf. cormorant</i>
8	MN	0.27-0.29	Blocked/None Present	Very first signs of reabsorbtion, before halfway	120 - 172	144 +- 20.0	Small gull <i>cf. common</i>
9	MN	0.55-0.58	c.0.2	Newly Laid	70 - 92	82 +- 8.6	auk <i>cf. guillemot or shag, greylay?</i>
10	LIA	0.49-0.53	0.95	Newly Laid	18 - 42	32 +- 10.4	Auk <i>cf. Razorbill</i>
11	LIA	0.46-0.47	c.0.2	Newly Laid	24 - 54	41.8 +- 11.6	<i>cf. auk</i>
12	LIA	0.25-0.26	0.3? Surface smooth blocked?	Newly Laid	62 - 86	68.8 +- 9.8	Herring Gull/ duck, wild gali
13	EN	0.43-0.47	1	First Stages of reabsortsion	36 - 62	51.6 +- 11.2	<i>cf. Herring Gull</i>
14	MN	0.23-0.26	Very smooth, no pores visible.	First Stages of reabsortsion	96 - 118	106.4 +- 9.6	<i>cf. puffin?</i>
15	PN/Pict	0.51-0.53	0.5 - 0.8	Newly Laid	50 - 56	51.6 +- 2.6	<i>cf. Domestic Fowl</i>
16	EN	0.49-0.52	0.6	Newly Laid	58 - 72	65.6 +- 5.5	<i>cf. Domestic Fowl</i>
17	MN	0.64-0.67	0.1 poor condition	Newly Laid	50 - 64	58.4 +- 6.2	gannet/goose
18	LN	0.31-0.35	0.3 v smooth tiny pores	Newly Laid	38 - 52	47.6 +- 5.9	<i>cf. Domestic Fowl</i>
19	MN	0.67-0.69	0.4	Very first signs of reabsorbtion, before halfway	96 - 126	109.6 +- 13.7	<i>cf. Domestic Goose</i>