The Zooarchaeology of Sand – interim report

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Introduction

This report is based on analysis of the mammal, bird and fish remains from the Mesolithic rock shelter site of Sand in north-west Scotland. The site was excavated as part of the Scotland's First Settlers Project (SFS), led by Karen Hardy and Caroline Wickham-Jones, following detailed survey along the coastline of the Inner Sound. Approximately one third of the material was analysed by the author in fulfilment of a MSc Zooarchaeology at the University of York (Gamble 2002). The data presented here combines results from that, and more recent analysis. The zooarchaeological significance of Sand is not to be underestimated. It is a substantial assemblage of mammal, bird and fish bone, from a period in Scottish prehistory with little faunal evidence.

Sand is north of Applecross, on the mainland peninsula directly opposite the island of Raasay to the west. The site itself is located north of Sand Bay (NG 6841 4934). The rock shelter consisted of a large terrace in front of a shallow, wide, rock overhang. Excavation on this sloping terrace revealed a large Mesolithic shell midden which had slumped onto a smaller later organic-rich silt deposit. The shell midden was composed of several contexts, the largest of which consisted of a dense mass of unconsolidated shells, mainly limpets (Hardy & Wickham-Jones 2000:50-57). No structural evidence was found in either midden (Hardy & Wickham-Jones 2000:57). Radiocarbon dated mammal bone from the deposits suggests that, despite their stratigraphic relationship, the lower midden is actually a younger deposit than the upper (shell) midden due to post-depositional movement of the latter (see appendix i for dating evidence).

Within the main shell midden there was no clear stratigraphy evident during fieldwork (six contexts were assigned after excavation based on observed slope, orientation and/or degree of fragmentation). It is unclear whether these represent distinct episodes of tipping or areas of post-depositional movement within the midden (Hardy & Wickham-Jones 2000:50-55). The lack of clear stratigraphy and absence of soil development and vegetational growth within the midden has been interpreted as evidence for rapid deposition of the shell midden material (Hardy & Wickham-Jones 2002). Clearly, the slumping of some of the shell midden deposits indicates that post-depositional down-slope movement is a major factor affecting interpretation at Sand. Thus, for the purposes of this report the main shell midden is treated as one context (see appendix ii for context information).

Excavation and recovery

The information given here is a summary of that provided in the Sand data structure report (Hardy & Wickham-Jones 2000:48-55). Open area excavation took place on the terrace of the Sand rock shelter, including both the midden deposits and the adjacent midden-free area. Outside of the midden no *in-situ* features were preserved, probably due to the steep slope, and the midden itself had begun to move down-slope. Approximately 90m^2 was excavated in two L-shaped trenches.

During excavation all material was wet sieved using a flotation machine: 1.0mm and 0.3mm sieves were used for the floating fraction and the heavy fraction was retained by a 1mm mesh. Some bone was also hand collected during excavation. During initial post-excavation the 1mm heavy fraction was sorted into the categories bird, mammal (burnt and un-burnt), fish, teeth and otoliths. The faunal material recovered from the floating fraction was minimal and was combined with the rest of the material prior to analysis.

Methods

Recording followed the York protocol (Harland *et al* 2003) which uses a system of quantification codes (QC) to distinguish between diagnostic and non-diagnostic elements. Under the York system, 17 diagnostic (QC1) mammal bone elements are routinely recorded in detail, including species, surface texture, weight, and element completeness. Elements with special interest such as antler, are recorded as QC4 elements. All other elements are listed as QC0.

Recording for the bird bone follows that of mammals, with 8 QC1 elements recorded in full. Eighteen diagnostic (QC1) fish bone elements are routinely recorded in detail as for bird and mammal, with the addition of an estimation of fish size. Special elements such as otoliths (QC4) are also recorded in detail, but will be considered in a future report. Vertebrae (QC2 elements) are identified to family or species level where possible, and all other (QC0) elements are recorded as unidentified. Gadidae vertebrae are further identified to 8 groups according to their place along the vertebral column (as defined in Barrett 1997).

For all classes of material QC0 refers to bones that were truly unidentifiable and those not routinely recorded in the York System protocol. All bone fragments were counted and weighed. Measurements taken on mammal and bird specimens followed those as defined in von den Driesch 1976, unless otherwise stated. Fish measurements followed those in Barrett 2001 (and references within) where possible, however it was necessary to use alternative measurements for some labridae specimens. All fish measurements used for labrids are defined in appendix iii. Metric data for all classes of material are provided in appendices iv-vi.

Analysis of the small mammal remains extracted during recording and the fish otoliths are currently under analysis, and will be included in the final report.

Mammal bone

Preservation

A total of 43,775 mammal bones weighing 1945g were recovered from the site. A subset of 222 QC1 elements were recorded in detail (table 1). With the exception of context 5, where surface texture was poor to fair, the surface texture of these elements from all contexts was generally fair to good (table 2; appendix vii). The completeness of elements was highly variable from less than 20% up to 100% complete (table 3).

Taxonomic abundance

The mammalian assemblage is dominated by wild terrestrial taxa (table 1). The most abundant species recorded was red deer (*Cervus elaphus)*, followed by *Sus* sp. assumed to be wild boar (*Sus scrofa*) and referred to as such from hereafter. Roe deer (*Capreolus capreolus*), fox (*Vulpes vulpes*), dog/wolf (*Canis*), otter (*Lutra lutra*) and badger (*Meles meles*) were also recorded at the site. Marine mammalian taxa are represented by one seal phalanx, unidentifiable to species, and one unidentified fragment of whale bone. There was one sheep pelvis in context 7 and one sheep metatarsal in context 2; the colour and texture of the specimen from context 2 suggests that it was probably intrusive. A few other caprine specimens, loose teeth and a calcaneum, were also identified (table 4). It is assumed that these are also likely to be intrusive if the archaeological dating is correct, although the early introduction of a few domesticates in otherwise Mesolithic contexts has recently been argued for Irish assemblages (Woodman and McCarthy 2003). Isolated teeth and one axis of *Bos* sp. were also recorded (table 4). The axis is clearly intrusive due to a metal cut mark, but it is not clear if the teeth are intrusive. As no mandibular third molars (or other typically measured elements) were recovered it is difficult to assess whether they represent wild aurochs or domestic cattle, but the latter seems probable based on qualitative assessment (O'Connor pers comm.).

Following the York protocol mammal elements not identifiable to genera were recorded as either 'large mammal', 'medium mammal 1' or 'medium mammal 2'. The first category was used to describe specimens which could have been red deer, cattle or large wild boar, medium mammal 1 was used for specimens the size of small cervids and wild boar, and medium mammal 2 for taxa such as otter, badger and canids.

Element representation and ageing evidence

Most of the identified QC1 elements were recovered from the main shell midden (context 2) and, to a lesser degree, from the organic-rich layer (context 5). Only these two contexts thus merit individual consideration of species and element distributions (see table 4). From context 2, QC1 elements were recorded for red deer, wild boar, roe deer, dog/wolf, fox, *Bos* sp., sheep and either sheep or goat. From context 5, QC1 elements were recorded for red deer, wild boar and *Bos* sp. Red deer was the most abundant species, followed by wild boar for both contexts. Apart from the relatively few diagnostic elements, as compared to the bird and fish assemblages (see below), the most striking observation regarding the mammal remains from Sand is the number of terminal appendicular elements as opposed to meat-bearing bones. In addition, 77 red deer antler specimens were recorded from these two contexts - 23 from context 2 and 43 from context 5 (table 5).

Figure 1 illustrates the QC1 element distribution for red deer and wild boar from the main shell midden context. Both species are best represented by metapodials and phalanges (excluding deer mandibles, where the count is inflated by a number of loose mandibular teeth). This pattern is replicated on a smaller scale in context 5, at least for red deer (figure 2).

A small number of specimens were juvenile or immature, based on juvenile cortex and unfused epiphyses. The majority of these were red deer and wild boar appendicular elements from context 2 (table 6). The sample is too small to justify consideration of tooth eruption and wear (there were, for example, no complete mandibles).

Bone modification

Nearly 30% of the mammal bone examined was burnt, two thirds of which was charred black rather than calcined white (table 7). Very few specimens were gnawed. Only 22 examples from the whole mammal assemblage showed signs of carnivore gnawing (table 8). One antler specimen from context 2 showed signs of ungulate gnawing, probably by deer. This gnawing is interesting as the same specimen also shows evidence of working, and could suggest the collection of shed antler for use at Sand.

Fifty-one specimens were possibly or definitely worked, cut, or deliberately modified in some way (table 9). Over 60% of these specimens came from the main shell midden context. This material will be considered in detail in the artefactual report by the excavators.

Unambiguous cut marks were relatively rare. The identified specimens from context 2 produced clear, fine cut marks on a red deer pelvis, scapula, 2^{nd} phalanx, and metatarsal. In context 5, a cut mark was noted on the 3^{rd} phalanx of a red deer. Some of these cut marks are consistent with skinning (e.g. phalanges), whereas others are more likely to derive from dismembering carcases (e.g. pelvis, scapula). No cut marks were noted on the potential fur-bearing species (wolf/dog, fox, otter and badger) which are rare in the assemblage overall. There is thus no evidence for large-scale fur exploitation at sand (cf. Trolle-Lassen 1987).

Discussion

A similar element distribution pattern for red deer and wild boar was observed at the Cnoc Coig shell midden, Oronsay. Here the relative abundance of terminal elements, along with worked bone recovered from the site, was interpreted as possible evidence for hide processing (Grigson and Mellars 1987:252-253). At Sand, given the high degree of fragmentation of the mammal bone, it is unclear if the bias towards terminal elements is the result of such an activity. The robustness and distinctive nature of these elements, even when incomplete, may have inflated their abundance.

Outram has advocated the assessment of bone fragmentation for evidence of bone marrow or grease extraction by applying a fracture freshness index (FFI) (Outram 2003, 2002, 2001). A valuable source of fat is stored in the medullary cavities of bones as marrow. Moreover, grease can be extracted from the cancellous bone of certain elements (Outram 2002:51). It is possible, given the highly fragmentary nature of the mammal bone assemblage, that bone fat or grease exploitation took place at Sand. As Outram's method is not standard zooarchaeological practice, it was not applied during initial analysis. However, reassessment of the mammal bone from the main shell midden using the FFI is now underway.

Bird bone

Preservation

A total of 16,331 bird bones weighing 2255.9g were recovered from the site, the majority of these came from the main shell midden (table 10). A subset of 1309 diagnostic (QC1) elements were analysed in detail. Based on the surface texture of the QC1 elements, the preservation of the bird bone is generally fair to good (table 11). Table 12 shows that most of the specimens were under 60% complete. Fewer than 2% of the bird bones were burnt, the majority of which were charred black rather than calcined white (table 13).

Taxonomic abundance

The bird bone assemblage from the site is made up almost exclusively of seabirds (table 13), in particular species belonging to the auk family (alcidae). Guillemot (*Uria aalge*) and razorbill (*Alca torda*) dominated the assemblage which also included rare specimens of other alcids, including the now extinct great auk (*Pinguinus impennis* also known as *Alca impennis*). Guillemots and razorbills have a very similar skeletal morphology and for this reason distinction beyond the razorbill/guillemot identification was often not possible. Distinction was regularly possible between the two species on well-preserved distal humerii. Guillemots are slightly bigger than razorbills but the two species do show some overlap in size, so this criterion alone is not reliable (Cramp 1985:170). Shag and cormorant present a similar problem. They are very similar osteologically, but the cormorant is the larger of the two.

A small number (7 QC1 specimens) of either shag (*Phalacrocorax aristotelis*) or cormorant (*Phalacrocorax carbo*) were recorded from context 2. Three thrush and chat family (Turdidae) QC1 specimens also from context 2 represent the only terrestrial species from the site. A total of 15 juvenile QC1 elements were recorded (all razorbill, guillemot or other Alcidae), 10 of which came from the main shell midden context (table 14).

Element representation and bone modification

Table 15 shows the element distribution of QC1 specimens. The assemblages from contexts 2 and 5 are large enough to discuss in detail. Figures 3 and 4 illustrate the combined alcid (auk family) QC1 element distribution for these layers. In the main shell midden context all QC1 elements are represented but, there is a bias towards the pectoral region and wing elements. In context 5 all QC1 elements apart from the tarsometatarsus are represented. The most abundant elements from this context are the coracoid and humerus, and the bias towards the pectoral and wing regions seems to be repeated. Given the robust and distinctive nature of both wing and leg elements in alcids, this does not seem to be a preservational bias.

Very few cut marks were recorded on the bird bone; 4 in total, 2 of which came from the main shell midden context (table 16). All the cut marks are very similar – a series of short parallel cuts below or on the head of the proximal end of the humerus, this is consistent with wing removal.

The potential resources provided by auks is highlighted by ethnographic and archaeological evidence from Inuit sites in Greenland (Gotfredson 1997:280). The breast and legs provide meat. The wings, whilst less meat rich, also provide a source of marrow. The skin is also a valuable resource (Gotfredson 1997:280) and in other enthnographic contexts they also served as a source of feathers.

Discussion

Auks are diving seabirds and spend much of their time outside the breeding season at sea (Cramp 1985). As Serjeantson has highlighted (1988:24), this means that there is a restricted period of time when they and their young are on land and therefore easily available for capture. Auks generally breed in May and June (Cramp 1985), and razorbills and guillemots brood for 34 days (Serjeantson 1988:24). The two species often form colonies together and prefer steep, rocky, sea-facing cliffs (Cramp 1985:171-178). If the birds were captured during the breeding season this suggests that the site was in use in late Spring or early Summer. There is, however, another period in the late summer and autumn, when the adult and young birds will also be vulnerable to predation (Serjeantson 2001:44). Adult auks have a complete moult at sea after breeding which leaves them flightless for 45-50 days as their primary feathers grow back (Cramp 1985:171-198). This represents a different type of hunting opportunity than the breeding season. Serjeantson (with specific reference to the great auk) suggests that birds could be taken from the water at that time using boats (2001:44).

Local observation confirms that large rafts of birds are seen on the water of the Inner Sound in late summer. If the assumption is made that razorbills and guillemots observed similar behaviour when Sand was in use, this places the time of capture towards the late summer and autumn. The small number of juvenile bones recorded from the site may be more consistent with this period than with the breeding season in late spring and early summer. However, adult birds were also targeted at breeding sites in recent centuries (Serjeantson 2001) and the age at which alcid bones loose the surface texture characteristic of juveniles is unknown.

Fish bone

Preservation

A total of 47,766 fish bones weighing 845.8 g were recovered from the site, a subset of 1248 QC1 elements (diagnostic cranial elements) and 12,715 QC2 elements (vertebrae) were recorded (table 17). The surface texture of the QC1 elements from Sand was generally good to fair (table 18). The percentage completeness of these same elements was more variable, with completeness ranging from 0-20% 100% (table 19). Less than 2% of the fish was burnt, most of which was charred black rather than calcined white (table 20).

Taxonomic abundance

Table 17 shows that the fish assemblage from Sand is dominated by two families, the wrasse family (labridae) and the cod family (gadidae). From the wrasse family, the most abundant species was ballan wrasse (*Labrus bergytla*). Cuckoo wrasse (*Labrus bimaculatus*), corkwing wrasse (*Symphodus (Crenilabrus) melops*) and goldsinny (*Ctenolabrus rupestris)* were also identified. Saithe (*Pollachius virens*) and pollack (*Pollachius pollachius*) were the most common gadid species identified; less common gadids included cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*) and whiting (*Merlangius merlangus*). Eel (*Anguilla anguilla*), herring (*Clupea harengus*), mackerel (*Scomber scombrus*), and horse mackerel (*Trachurus trachurus*) were also identified in modest numbers, followed by trace amounts of other taxa (Table 20).

Due to the small size of the specimens and the similar anatomy of saithe and pollack it was often difficult to distinguish between the two. Ambiguous specimens were recorded as *Pollachius*. Specimens which had the characteristics of either saithe, pollack or cod, but which could not be positively distinguished, were recorded as *Gadus/Pollachius*. Labrid elements were identified to species where possible. Specimens identified to either ballan wrasse or cuckoo wrasse were recorded as lbd1, those identified as either corkwing wrasse or goldsinny were recorded as lbd2. The habitat and behaviour of the most abundant taxa will be considered below.

Element representation and bone modification

The main shell midden context produced 10, 320 of the QC1 and QC2 elements from the site. A sizeable amount of material was also recovered from context 1 (160 QC1 and 2083 QC2). A much smaller assemblage was recorded from the organic rich layer, context 5: 54 QC1 and 496 QC2 elements (table 21). Nominal numbers of QC1 specimens were recorded from other contexts. Thus only the element distribution of the main shell midden context is considered in detail here.

Figure 5 shows the gadid and labrid QC1 element distributions for this context, combining all relevant data at the family level. Almost the full range of QC1 elements is present for both families, but the relative abundance of different elements is widely variable. The most abundant element by far is the wrasse infrapharyngeal. This is a very robust element with a distinctive morphology. Given these properties it is likely that its abundance has been exaggerated by taphonomic and analytical biases. Figure 6 shows the same QC1 element distribution without the infrapharyngeal. This figure implies that the element distribution of the gadids has also been influenced by preservation, as more robust elements such as the premaxilla and dentary are most common. The paucity of gadid appendicular elements (e.g. cleithrum, supracleithrum and scapula) could be interpreted in butchery terms as these elements are sometimes left in dried fish after removal of the head and thus removed from the catch site (e.g. Barrett 1997). However, gadid abdominal and caudal vertebrae are both abundant (figure 7). In the case of dried fish some or all of these elements should also be underrepresented. Rather than the paucity or absence of certain elements being interpreted as the result of fish processing, it thus seems more plausible that it is due to preservation bias.

Only one possible cut mark was recorded on a fish specimen – a ballan wrasse caudal vertebrae (SFS4-6028) from the main shell midden context

Fish size

Table 22 shows that the majority of fish bones at Sand came from small (150-300mm) to medium (300-500mm) sized fish, based on comparison with reference specimens of known total length (TL). The size distribution for the wrasse and cod family is shown in more detail in figure 8.

Less qualitative estimates of fish total length can be calculated using measurements of QC1 elements (given in appendix vi) and regression equations relating them to total length (Desse and Desse-Berset 1996:172). Equations exist for selected measurements of the gadid species typically abundant on archaeological sites of all periods in Scotland (e.g. Jones 1991:161-162). Equations are also available for labrids of the Pacific Ocean (cf. Leach 2001), but unfortunately the osteology of Atlantic labrids is not well researched.

Research connected with the use of corkwing wrasse, rock cook and goldsinny as cleaner fish on salmon farms in Scotland (Treasurer 1996:74) does provide limited regression equations for the operculum and otolith (Treasurer 1994). However, the wrasse otolith is too small for routine recovery and the operculum measurement requires complete preservation. Thus detailed analysis of the wrasse size distributions must await further research.

In the case of gadids, Jones' regression equations were applied to measurements taken on the premaxillae of specimens identified as saithe, pollack, and *Pollachius* (table 23; Figure 9). All but one of the calculated size estimates are under 400mm. The lack of large fish suggests that deep-sea fishing methods were not used at the site. The relatively normal distribution of the data contrasts with the polymodal distributions of saithe otolith measurements from the Cnoc Coig and Cnoc Sligeach shell middens on Oronsay interpreted as evidence for seasonal fisheries (in which age cohorts appeared as modes in the measurement data) (Mellars and Wilkinson 1980:26). It is thus likely that the Sand fishery was not strongly seasonal, or that changes in seasonality through a potentially lengthy period of occupation have created a composite assemblage. The pattern from Sand is similar to that for cod at the Danish Mesolithic site of Maglemosegård (Enghoff 1994:75). In a review of fishing at several coastal sites, Enghoff found that the same cluster of small specimens was replicated for several coastal taxa. From this patterning, Enghoff proposed that an indiscriminate ‘catchall’ method of fishing was employed, probably using stationary traps or nets (1994:83-84). Given the small size of gadids and labrids – and indeed most other taxa – from Sand, a similar interpretation may be appropriate (see below).

Discussion

The assemblage was dominated by wrasse, saithe and pollack. Wrasse are small to medium fish, ranging from the ballan at an average total length of 300-500mm TL to the goldsinny and rock cook at around 100-140mm TL (Sayer and Treasurer 1996:3-7). All the species are associated with rocky shores and they are generally shallow water fish. Treasurer has conducted several studies regarding the capture of wrasse, including the use of fyke nets and creels). Baited and unbaited creels and traps were successful although larger species such as ballan and cuckoo were underrepresented (probably due to the small apertures of the fishing gear). Perhaps of most relevance here are the by-catches found associated with these wrasse fishing techniques: saithe, pollack, cod, conger eel, scorpion fish, rockling, flatfish and dogfish species (1996:75). Apart from conger eel, all of these taxa are represented at Sand.

Both saithe and pollack are found in the waters surrounding the west coast of Scotland and local fishermen attest to the abundance of pollack (*lythe*) around the coast of the Applecross Peninsula. The behaviour of saithe would make them more likely to be caught in greater abundance, as they form small shoals throughout the year (Whitehead *et al* 1986:691). Only sexually mature, adult pollack, shoal during the spawning period (Whitehead *et al* 1986:690). However, the fish are often found in numbers on reefs, with young pollack found closer to the shore than adults, and today are a common catch of anglers (Wheeler 1969:272-273, Whitehead *et al*. 1986:690).

The young of both saithe and pollack are found close to the shore in their 1st and 2nd years (Wheeler 1969:272-275). Based on growth estimates for saithe given by Wheeler (1969:167), one year old fish reach c.150mm TL, two year olds c.300mm TL, and three year old fish 450mm TL. The size of specimens of saithe and pollack from Sand are under 400mm (figure 9), suggesting that young and therefore inshore fish were caught. The dominance of taxa with small maximum total lengths (the wrasses), and of small specimens from species with large maximum lengths (saithe and pollack), suggests that a narrow size range was deliberately targeted. The bi-catch evidence from the experimental wrasse capture techniques, and the similarity between the Sand data and Enghoff's (1994) Danish cases, suggests the use of stationary nets or traps as the primary fishing method at Sand.

Summary

Excavation at Sand has produced one of the largest Mesolithic faunal assemblages in Britain. Substantial quantities of mammal, bird and fish bone have been analysed. This analysis has revealed a focus on a narrow suite of local resources, including wild terrestrial mammals, seabirds and littoral zone fish. The highly fragmentary nature of the mammal assemblage makes interpretation difficult. Tentative suggestions prior to further analysis, are the possible skinning of red deer and wild boar, and the extraction of bone fat and grease. The bird remains are dominated almost exclusively by razorbills and guillemots, and their behavioural and breeding patterns place the time of capture in late spring and early summer, or late summer and autumn. The fish assemblage is dominated by fish from the cod family and wrasse family. Based on the size and species of fish it is likely that stationary traps and nets were the primary method of fishing at Sand.

Acknowledgments

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Figures

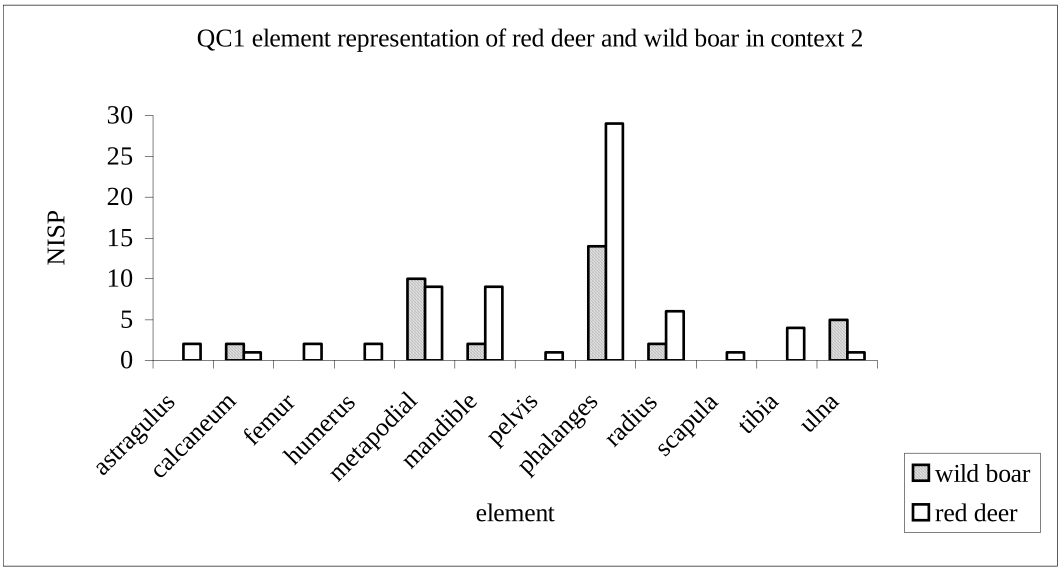

Figure 1. QC1 element representation of red deer and wild boar in context 2 (red deer totals include specimens identified as red deer? and mandible totals includes isolated mandibular teeth)

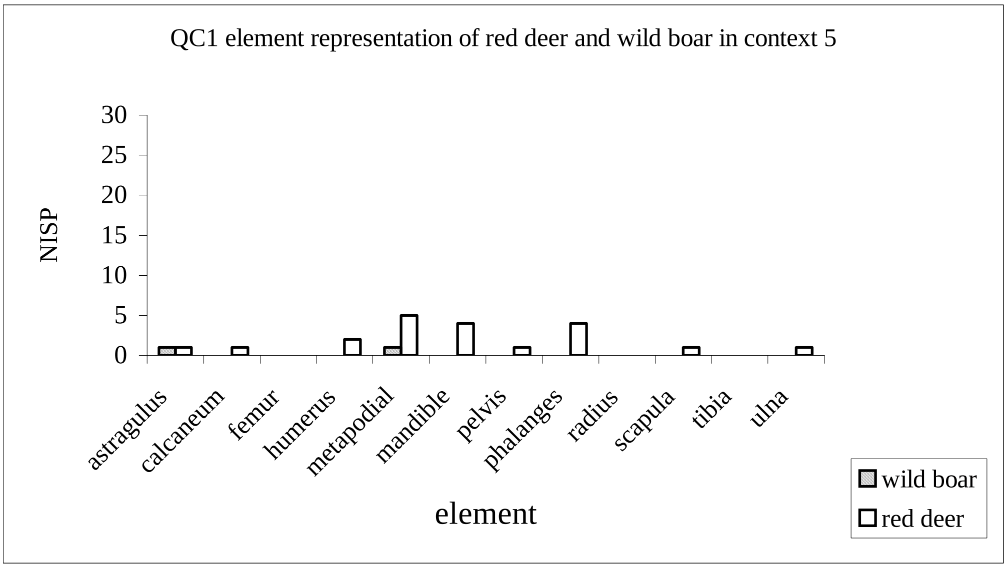

Figure 2. QC1 element representation of red deer and wild boar in context 5

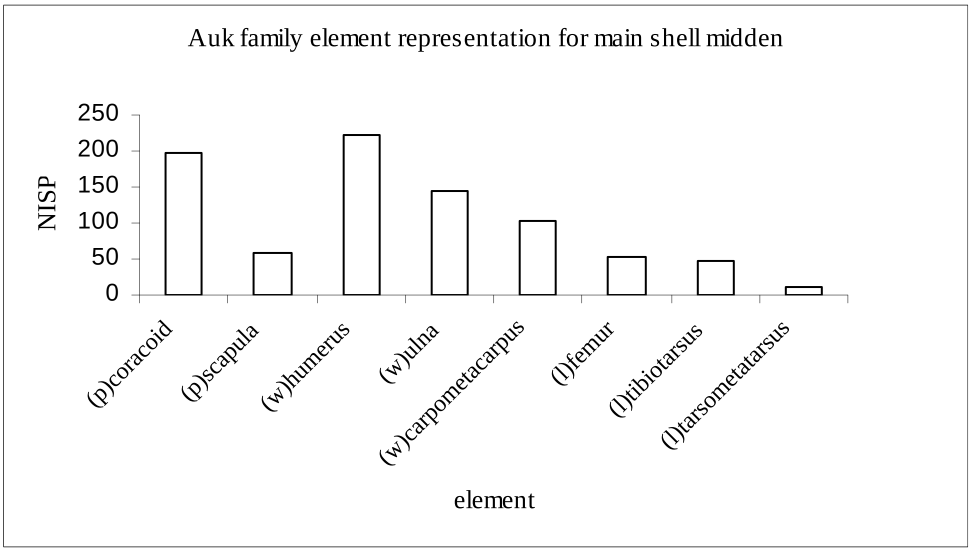

Figure 3. Auk family QC1 element representation for context 2 (p=pectoral; w=wing; l=leg)

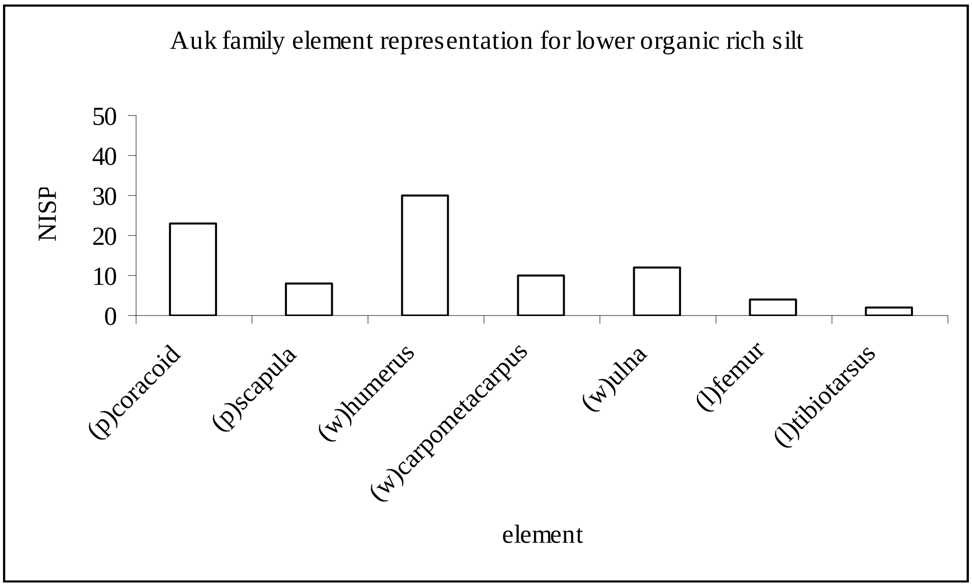

Figure 4. Auk family QC1 element representation for context 5 (p=pectoral; w=wing; l=leg)

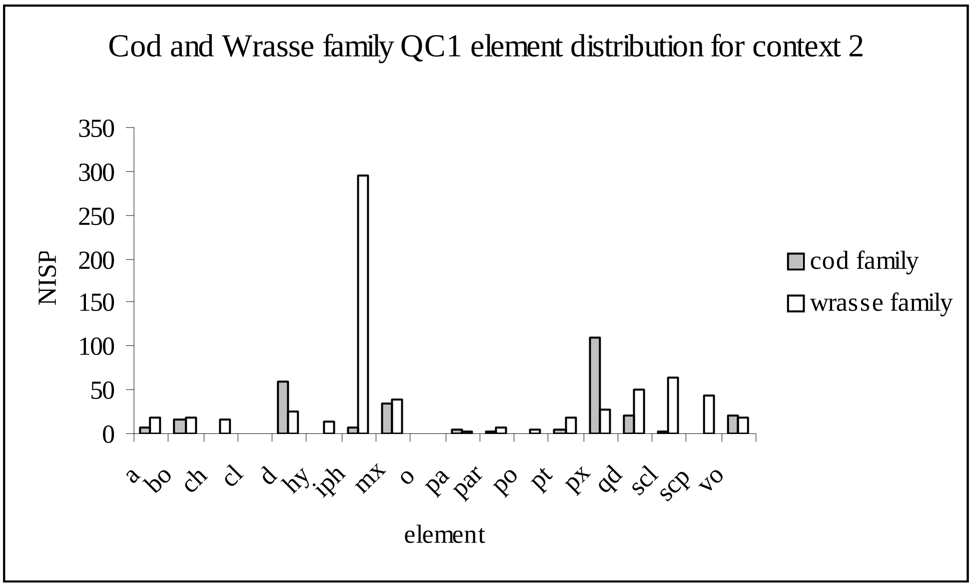

Figure 5. Gadid and labrid QC1 element distribution for context 2 (see appendix ix for definition of element abbreviations)

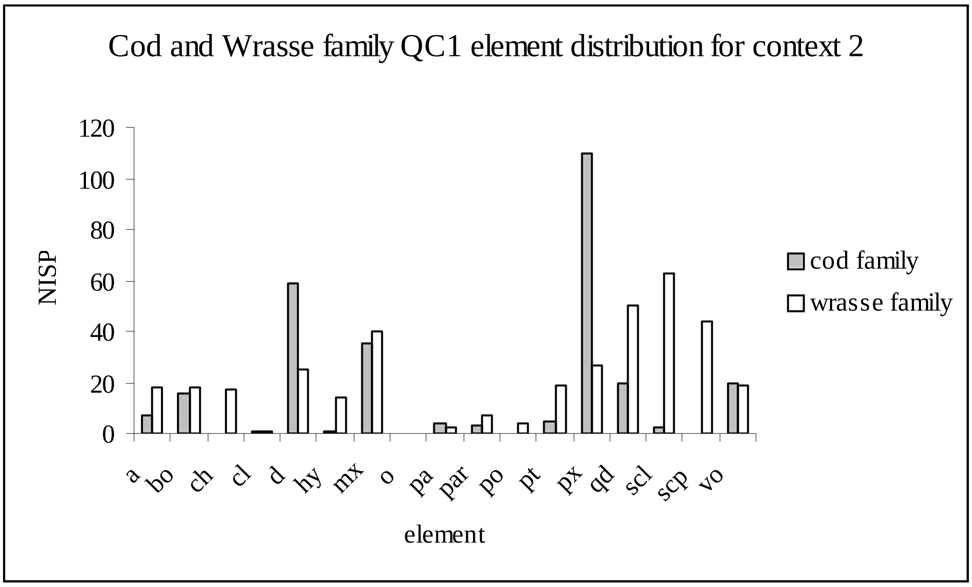

Figure 6. Gadid and labrid QC1 element distribution for context 2, without the wrasse infraphyrngeal (see appendix ix for definition of element abbreviations)

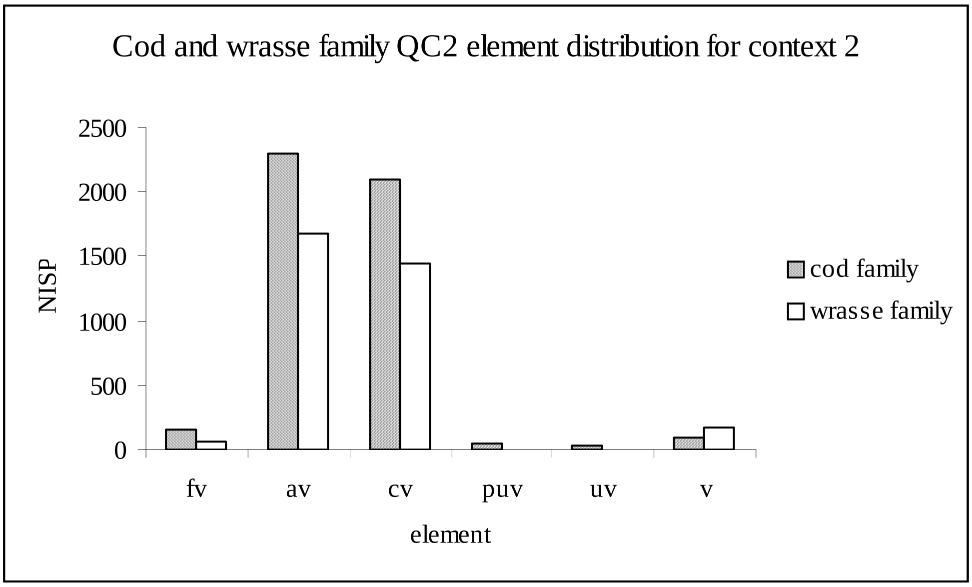

Figure 7. Gadid and labrid QC2 element distribution for context 2 (appendix ix for definition of element abbreviations)

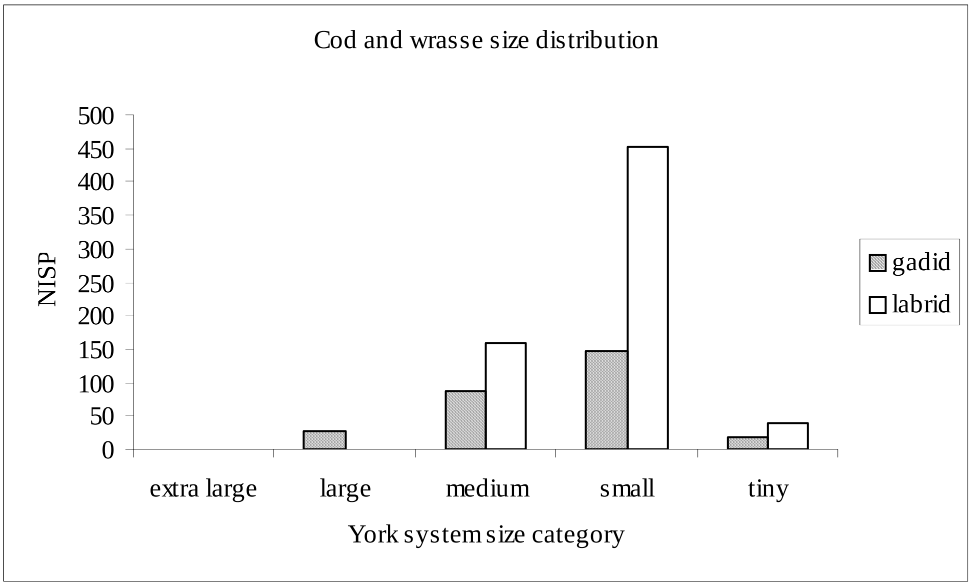

Figure 8. Gadid and labrid QC1 element size distribution for context 2 (size categories defined in table 22)

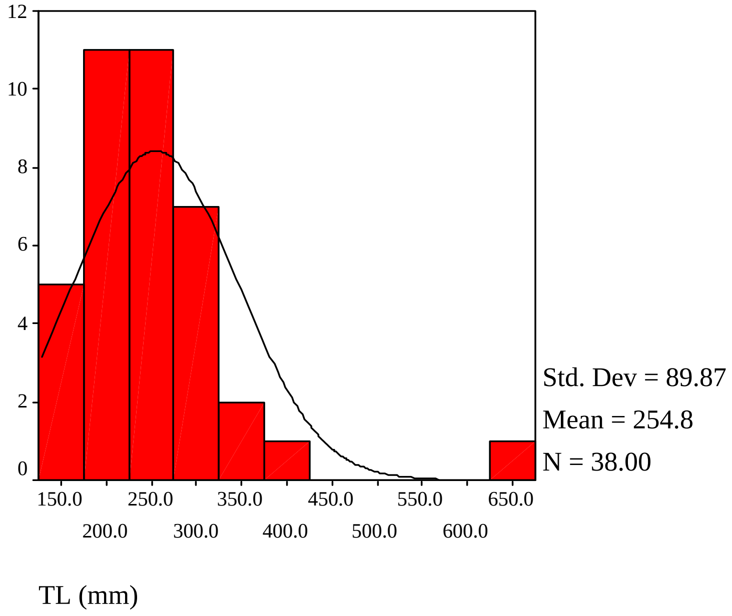

Figure 9. Total length estimate based on saithe, pollack and *Pollachius* premaxilla 1 measurement

Tables

Taxon/context	1	2	3	4	5	6	7	8	unprov	Total
whale sp.		+								
dog/wolf		2								2
fox		1								1
canid	1									1
badger					+					
otter		+								
seal sp.	1									1
wild boar	1	35		+	2	+	2			40
red deer	10	65		1	20	3	2		2	103
red deer?	1	3			1					5
roe deer		4								4
roe deer?		2								2
cervid	1	4					+		3	8
bos	2	1			1		1			5
sheep		1					1			2
sheep/goat	+	1			+	+	+			1
large mammal	5	11			3	1	3			23
medium mammal 1		9			2					11
medium mammal 2		+							+	
unidentified mammal	1	9			3					13
Total QC1	23	148		1	32	4	9		5	222
QC4	5	29		1	43				1	79
QC0	10210	16461	81	1473	6597	2566	5622	24	440	43474
Total mammal	10238	16638	81	1475	6672	2570	5631	24	446	43775

Table 1. Number of Identified specimens from Sand by context (+ indicates taxon identified by QC0 element only). QC4 specimens are predominantly antler.

Texture/context	1	2	3	4	5	6	7	unprov	Total
Excellent					1				1
Good	3	76			3	1	2	2	87
Fair	14	46			9	1	3	2	75
Poor	1	5			10		1		17
Total	18	127			23	2	6	4	180

Table 2. Surface texture by context based on mammal QC1 elements

% completeness/context	1	2	3	4	5	6	7	unprov	Total
0-20%	6	37			12		3		58
21-40%	5	45		1	7	1	2	3	64
41-60%	1	13			1	1		1	17
61-80%		5							5
81-100%	5	22			3		1		31
Total	17	122		1	23	2	6	4	175

Table 3. Percentage completeness by context based on mammal QC1 elements

Taxon	element	1	2	3	4	5	6	7	unprov	Total
dog/wolf	scap		1							1
	ulna		1							1
fox	scap		1							1
canid	m/c	1								1
seal sp.	phal1	1								1
wild boar	astr					1				1
	calc		2							2
	m/c3		1							1
	m/c4		1							1
	m/p		6							6
	m/t					1				1
	m/t3		1							1
	m/t4		1							1
	mand		2					1		3
	phal1		3							3
	phal2	1	8					1		10
	phal3		3							3
	rad		2							2
	ulna		5							5
red deer	astr	2	2			1			1	6
	calc	2	1			1				4
	fem		1							1
	hum	1	2		1	2				6
	m/p	1	7			5				13
	m/t		2							2
	mand	1	9			4	1	1		16
	pel		1			1			1	3
	phal	1	3							4
	phal1	1	12			2	1			16
	phal2	1	6			1		1		9
	phal3		8			1				9
	rad		4							4
	rad/uln		1							1
	scap		1			1	1			3
	tib		4							4
	ulna		1			1				2
red deer?	fem		1							1
	hum					1				1
	m/p	1								1
	rad		2							2
roe deer	mand		2							2
	pel		1							1
	scap		1							1
roe deer?	m/p		2							2

cervid	m/c		1						1
	m/p		2						2
	pel							3	3
	phal1		1						1
	rad	1							1
bos	mand	2	1		1		1		5
sheep	m/t		1						1
	pel						1		1
sheep/goat	calc		1						1
large mammal	hum		2						2
	m/p	3	3		3		1		10
	m/t		1						1
	mand					1			1
	pel		1						1
	phal	1					2		3
	phal3		1						1
	scap	1	3						4
medium mammal1	astr		1						1
	hum				2				2
	m/p		3						3
	mand		2						2
	phal		3						3
unidentified mammal	hum				1				1
	m/p	1	1		2				4
	phal		5						5
	phal3		1						1
	rad		1						1
	ulna		1						1
Total		23	148	1	32	4	9	5	222

Table 4. Mammal QC1 element representation by context (see appendix ix for definition of element abbreviation)

context	**NISP**	**unshed**	**worked?**	**worked**
1	5		1	
2	28		2	2
4	1			
5	43	2		2
Total	77	2	3	4

Table 5. Number of identified specimens of antler

context	boneid	taxon	element	juvcor	prox	dist	total
1	360	red deer	hum		u		
1	406	deer	rad	yes	u		
1	2538	canid	m/c			u	
1	3741	large mammal	m/p	yes		u	
subtotal							4
2	225	wild boar	phal2	yes	u	fg	
2	486	wild boar	phal2	yes	u		
2	487	wild boar	rad/uln	yes	u		
2	1835	wild boar	rad		u		
2	1859	red deer	m/p		u		
2	1864	red deer?	rad	yes		u	
2	1879	wild boar	ulna		u		
2	1881	wild boar	phal1		fg		
2	1882	wild boar	ulna		u		
2	1892	medium mammal1	phal	yes			
2	1905	wild boar	phal1		fg		
2	1907	wild boar	m/p	yes		u	
2	1917	red deer	tib	yes			
2	1933	roe deer?	m/p		u		
2	1943	wild boar	calc	yes	u	u	
2	1949	red deer	ulna		u		
2	1998	red deer	rad		u		
2	2015	red deer	rad	yes		u	
2	2018	deer	m/p		u		
2	2028	medium mammal1	m/p	yes		u	
2	2036	large mammal	m/p		u		
2	2037	sheep	m/t		u		
2	2048	red deer	hum	yes	u	u	
2	2064	red deer	astr	yes		u	
2	2065	wild boar	calc	yes	u	u	
2	2066	wild boar	m/p	yes	u	u	
2	2096	wild boar	phal2	yes	u	u	
2	2116	red deer	phal		u		
2	2120	wild boar	phal1		fg		
2	2470	wild boar	ulna		u		
2	2508	wild boar	m/p		u		
2	2509	wild boar	m/p		u		
2	2510	wild boar	m/p		u		
2	2511	wild boar	m/p		u		
2	2512	wild boar	ulna		u		
2	3180	red deer?	fem	yes			
subtotal							36
5	562	red deer	ulna	yes			
5	431	red deer	phal1	yes			
subtotal							2

unprov	351	deer	pel	yes	
unprov	352	deer	pel	yes	
subtotal					2
total					44

Table 6. Juvenile and immature mammal QC1 specimens. Juvenile cortex is abbreviated to juvcor, proximal epiphysis to prox and distal epiphysis to dist. A fusing epiphysis is indicated by fg, an unfused epiphysis by u (see appendix ix for definition of element abbreviation).

Burning/context	1	2	3	4	5	6	7	8	unprov	Total
calcined	1031	777	9	81	289	209	1086	1	29	3512
charred	2682	3477	10	218	641	525	1132	4	173	8862
Total	3713	4254	19	299	930	734	2218	5	202	12374

Table 7. Burnt mammal bone by context

Bone modification/context	1	2	5	6	Total
carnivore gnawing	4	11	6	1	22
rodent gnawing		2			2
root etching	3	6	3	1	13
root etching & carnivore gnawing		2			2
ungulate gnawing		1			1
Total	7	22	9	2	40

Table 8. Bone modification (all quantification codes)

context	bone id	taxon	element	modification	notes
1	SFS4-166	unid mammal	ui	worked?	pos rounded end?
1	SFS4-4	unid mammal	ui	worked	bevel-ended tool,both ends rounded and abraded
1	SFS4-3614	unid mammal	ui	cut	three cut marks
1	SFS4-22	unid mammal	ui	worked	bevel-ended
1	SFS4-3268	unid mammal	shaft	cut	small medio-lateral cut mark across shaft
1	SFS4-3257	unid mammal	ui	cut	
1	SFS4-24	red deer	antler	worked?	abraded at tip, unclear if worked
1	SFS4-203	unid mammal	ui	worked?	pos. striations & slight bevelling at one end of frag
2	SFS4-6	unid mammal	ui	cut	shallow cut marks visible on one side of tool
				worked	frag rounded at both ends. more

					rounded & abraded at one end
2	SFS4-393	large mammal	metapodial	worked	bevelling at one end, working to point at other
2	SFS4-149	unid mammal	ui	worked?	slightly abraded at tip
2	SFS4-6993	*Bos* sp.	axis	cut	metal cut mark on condyle
2	SFS4-3193	large mammal	shaft	worked	worked, rounded at end
2	SFS4-574	unid mammal	unidentified	worked?	possiby worked into arrow-shape, but no clear cut marks
2	SFS4-418	unid mammal	unidentified	worked?	bevel-ended but striations ambiguous
2	SFS4-193	unid mammal	unidentified	worked	rounded end of frag
2	SFS4-16	red deer	antler	worked?	some abrasion but unclear if from human use
2	SFS4-394	unid mammal	shaft	worked	bevel-ended
2	SFS4-3188	large mammal	shaft	worked	bevel-ended
2	SFS4-3172	red deer	antler	worked	evidence of use at end of tine - shine & abrasion
2	SFS4-148	unid mammal	ui	cut	series fine parallel cut marks along length of fragment
2	SFS4-19	unid mammal	ui	worked	bevel-ended
2	SFS4-147	unid mammal	ui	worked & cut	striations visible at rounded end. fine irregular cut marks
2	SFS4-25	unid mammal	ui	worked	Bevel-ended both ends
2	SFS4-3189	large mammal	shaft	worked	roughly bevel-ended, looks like been worked as for lithic, ie knapped/retouched
2	SFS4-3190	large mammal	shaft	worked?	pos broken to point but no evidence of wear
2	SFS4-20	red deer	metatarsal	cut	series fine cut marks at end of shaft frag, just before proximal end, medio-laterally
2	SFS4-379	red deer	phal 2	cut	small but clear cut mark at proximal end, dorso-ventrally

2	SFS4-1884	red deer	antler	worked	tips of antler worked and also at base of frag
2	SFS4-3179	unid mammal	ui	cut	cut mark
2	SFS4-2065	wild boar	calcaneum	cut?	possible small parallel cuts above distal end?
2	SFS4-151	unid mammal	ui	cut	cut across length of frag
2	SFS4-23	large mammal	scapula	cut	fine cut marks over curve of scap blade edge
2	SFS4-7	red deer	radius	chop?	chop/split towards proximal epip on posterior side
2	SFS4-3185	large mammal	shaft	worked	bevel-ended
2	SFS4-3194	large mammal	shaft	worked	bevel-ended
2	SFS4-3186	large mammal	shaft	worked	bevel-ended
2	SFS4-400	unid mammal	metapodial	worked	bevelled at both ends
2	SFS4-15	unid mammal	ui	worked	bevel-ended, striations visible
2	SFS4-14	red deer	antler	worked?	abrasion at tine tip pos. from use?
2	SFS4-13	unid mammal	ui	worked	end of broken b-e tool, rounded abraded end
2	SFS4-12	red deer	metapodial	chop?	possible chop
2	SFS4-3538	red deer	pelvis	cut	3 fine cut marks across ventral surface, zone 5
2	SFS4-573	unid mammal	ui	worked	small frag worked to cylindrical shape and point
5	SFS4-2	red deer	antler	worked	abrasion at tip pos worked?
5	SFS4-401	red deer	antler	worked	bevel-ended
5	SFS4-399	unid mammal	ui	worked	bevel-ended
5	SFS4-3250	red deer	phal 3	cut?	pos cut mark on medial side, dorsal-ventrally, zone 1
6	SFS4-3763	unid mammal	ui	worked	bevel-ended
7	SFS4-3191	large mammal	metapodial	worked	roughly bevel-ended, looks knapped/retouched.
7	SFS4-3213	unid mammal	shaft	worked	bevel-ended

7	SFS4-3221	unid mammal	shaft	worked	bevel-ended scraper-type tool?
7	SFS4-3764	unid mammal	ui	worked?	High degree of polish but unclear if worked
unprov	SFS4-6969	unid mammal	rib	cut	deep cut mark towards articular end of rib

Table 9. Evidence of working (see appendix ix for definition of element abbreviations)

Taxon/context	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**unprov**	**Total**
Shag/Cormorant		7								7
Razorbill	2	11			1					14
Razorbill?		5								5
Guillemot	18	41		1	2					62
Guillemot?		18								18
Razorbill/Guillemot	211	672		37	70	9	19	2	2	1022
Little Auk		1								1
Puffin?	2									2
Great Auk	2	7			1	1				11
Auk family	35	80		2	15	7	5			144
Thrush and chat family		3								3
Unidentified QC1	10	7		2	1					20
Total QC1	280	852		42	90	17	24	2	2	1309
QC0	3290	8207	8	583	2376	212	319	9	18	15022
Total	3570	9059	8	625	2466	229	343	11	20	16331

Table 10. Number of identified specimens (NISP)

Texture/context	**1**	**2**	**4**	**5**	**6**	**7**	**8**	**unprov**	**Total**
Excellent	1	8			1				10
Good	175	634	5	21	2	4		2	843
Fair	100	197	37	67	13	18	2		434
Poor	1	7		2	1	2			13
Total	277	846	42	90	17	24	2	2	1300

Table 11. Texture of bird QC1 elements from Sand by context

Completeness/context	**1**	**2**	**4**	**5**	**6**	**7**	**8**	**unprov**	**Total**
0-20%	65	116	10	11	1	4			207
21-40%	149	433	24	53	9	15	2	2	687
41-60%	48	201	8	21	5	2			285
61-80%	9	59		3		3			74
81-100%	6	39		2	2				49
Total	277	848	42	90	17	24	2	2	1302

Table 12. Percentage completeness of bird QC1 elements from Sand by context

Burning/context	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Charred	93	83		1	22	4	57		260
Calcined	1	2			1		1		5
Total	94	85		1	23	4	58		265

Table 13. Burning by context

Taxon/Context	**Element**	**1**	**2**	**5**	**Total**
Razorbill/Guillemot	Carpometacarpus		1		1
	Coracoid		2		2
	Humerus		1		1
	Ulna	1			1
Auk family	Coracoid		2		2
	Femur		1		1
	Humerus	2	3	1	6
	Scapula	1			1
Total		4	10	1	15

Table 14. Juvenile and immature bird QC1 elements

Taxon	**Element**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**unprov**	**Total**
Shag/Cormorant	coraB		4								4
	fem		2								2
	humB		1								1
Razorbill	coraB		1								1
	humB	2	10			1					13
Razorbill?	coraB		4								4
	humB		1								1
Guillemot	carpo	1	4								5
	coraB	1	2								3
	humB	15	34		1	2					52
	ulnaB	1	1								2
Guillemot?	carpo		4								4
	coraB		4								4
	fem		1								1
	humB		6								6
	scap		1								1
	tarso		1								1
	ulnaB		1								1
Razorbill/Guillemot	carpo	31	90		5	10	3	4	1		144

	coraB	66	164	15	17	3	3			268
	fem	12	42	1	4					59
	humB	40	141	9	20		3			213
	scap	11	51		7		5			74
	tarso		6							6
	tibio	12	42		2	1	3		1	61
	ulnaB	39	136	7	10	2	1	1	1	197
Little Auk	tarso		1							1
Puffin?	coraB	1								1
	humB	1								1
Great Auk	carpo		1							1
	coraB	1	1			1				3
	humB	1	3		1					5
	scap		1							1
	ulnaB		1							1
Auk family	carpo	4	4	1			1			10
	coraB	4	22	1	6	1	3			37
	fem	1	10							11
	humB	17	27		6		1			51
	scap	5	4		1	2				12
	tarso	2	2			1				5
	tibio	1	6			3				10
	ulnaB	1	5		2					8
Thrush and Chat family	coraB		1							1
	humB		2							2
Unidentified bird	carpo		3							3
	coraB		1							1
	fem	1	2							3
	humB	4		2	1					7
	tarso		1							1
	ulnaB	5								5
Total		280	852	42	90	17	24	2	2	1309

Table 15. Bird QC1 element representation by context and species (see appendix ix for definition of element abbreviations)

Phase	**Taxon**	**Element**	**Bone ID**	**Description**
1	Razorbill/Guillemot	humB	SFS4-4120	medio-lateral cut mark below proximal head
2	Razorbill/Guillemot	ulnaB	SFS4-4283	four very fine sporadic cut marks, approximately medio-laterally the shaft
2	Razorbill/Guillemot	humB	SFS4-5052	medio-lateral small cut mark (c.2mm) on medial surface of shaft. Also two parallel cut marks on proximal head
4	Razorbill/Guillemot	humB	SFS4-4328	possible cut mark below crista lateralis of proximal head

Table 16. Worked bird bone (see appendix ix for definition of element abbreviations)

Taxon	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**unprov**	**Total**
tope shark		1							1
dogfish families	1	9							10
ray family	+	+				+			
elasamobranch	1	3							4
herring	27	104		1	11	9	7	9	168
eel		12							12
eel?		1							1
salmon family	1						3		4
rockling sp.	1	2							3
saithe	107	297		6	2	9	23	9	453
pollack	12	105			1	2			120
saithe/pollack	160	876		12	11	18	11		1088
cod	8	91		3	1		6		109
cod/saithe/pollack	218	1423		13	17	7	34	6	1718
haddock	3	2			1				6
haddock?		1							1
whiting		4			1				5
whiting?	1	2							3
Norway pout/bib/poor cod	3			1					4
cod family	411	849	1	33	131	31	70	1	1527
gurnard family		1							1
scorpion fish family		3							3
Atlantic horse mackerel	1	10							11
Atlantic horse mackerel?		1							1
sea bream family		1							1
sea bream family?							1		1
corkwing wrasse	22	44		1	2	1	1		71
corkwing wrasse?	1	5							6
goldsinny	1								1
corkwing wrasse/goldsinny	6	59				2	10		77
ballan wrasse	94	222		1	15	19	9		360
ballan wrasse?		3							3
cuckoo wrasse	1	15							16
cuckoo wrasse?		3							3
ballan/cuckoo wrasse	511	931		29	36	49	124	8	1688
wrasse family	218	4103		8	282	48	78		4737
eelpout family								1	1
butterfish		17		1					18
sandeel family		5							5
Atlantic mackerel	11	159			7	1	5		183
perch order	1								1

plaice						1			1
plaice family		3					1		4
flatfish order		1							1
unidentified fish	422	952	1	10	32	56	59		1532
QC1 & QC2	2243	10320	2	119	550	253	442	34	13963
QC0 & QC4	3914	24831	1	302	2863	585	1236	71	33803
Total fish	6157	35151	3	421	3413	838	1678	105	47766

Table 17 . Number of identified specimens (NISP)

Texture/context	**1**	**2**	**4**	**5**	**6**	**7**	**unprov**	**Total**
Excellent	7	21		1	1	4		34
Good	84	552	1	20	9	15	1	682
Fair	60	356	2	23	15	15		471
Poor	9	28	2	9	3	1		52
Total	160	957	5	53	28	35	1	1239

Table 18. Texture of fish QC1 elements by context

Completeness/context	**1**	**2**	**4**	**5**	**6**	**7**	**unprov**	**total**
0-20%	25	141		8	3	4		181
21-40%	60	283	4	22	12	11		392
41-60%	42	191		3	9	8		253
61-80%	21	187		7	2	8	1	226
81-100%	12	149	1	13	2	4		181
Total	160	951	5	53	28	35	1	1233

Table 19. Completeness of fish QC1 elements by context

Burning/context	**1**	**2**	**4**	**5**	**6**	**7**	**unprov**	**Total**
calcined		43		6	2	1		52
charred	95	478	1	59	11	12	2	658
Total	95	521	1	65	13	13	2	710

Table 20. Burning of fish bone by context

Taxon	**Element**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**unprov**	**Total**
tope shark	v		1							1
dogfish families	mvc	1	9							10
elasmobranch	mvc	1	3							4
herring	av	17	54			5	5	6	7	94
	av3		1							1
	cv	10	35		1	6	4	1	2	59

	cv2		1						1
	puv		1						1
	v		11						11
	uv		1						1
eel	bo		1						1
	vo		1						1
	av		3						3
	cv		7						7
eel?	qd		1						1
salmon family	cv	1					1		2
	v						2		2
rockling sp.	av		1						1
	av1	1							1
	cv1		1						1
saithe	bo	3	5				1		9
	d	3	11						14
	hy	2							2
	iph	1	1						2
	mx	4	8			2	1		15
	pa		2			1			3
	par		2						2
	pt		1						1
	px	10	33				1		44
	qd	6	9					1	16
	scl	1							1
	vo	1	5						6
	av	2							2
	av1	12	47	2	1	3	6		71
	av2	17	30	2	1	1	5	1	57
	av3	18	60			1	5	1	85
	cv		4						4
	cv1	13	52	2			2	2	71
	cv2	12	22			1	1	3	39
	fv	2	5				1	1	9
pollack	a		1						1
	bo		3						3
	d		6						6
	mx		3						3
	px		10						10
	qd		1						1
	av		1						1
	av1	2	7						9
	av2		7			1			8
	av3	6	38		1	1			46
	cv	2							2

	cv1	2	15					17
	cv2		13					13
saithe/pollack	a				1			1
	bo		1					1
	cl		1					1
	d	2	11					13
	hy					1		1
	iph		5					5
	mx	1	6	1		1		9
	pa		1					1
	pt	1						1
	px	7	23		1			31
	qd		1			1		2
	scl	1	1					2
	vo	1	3					4
	av	6	283			4		293
	av1	49	53	7	4	5	5	123
	av2	29	26	1	1	3	1	61
	av3	33	66	1	2	1	3	106
	cv		311		2			313
	cv1	11	24					35
	cv2	16	32	2		2	2	54
	fv	3	25					28
	puv		2					2
	v		1					1
cod	bo		1					1
	d		5					5
	hy	1						1
	mx		1					1
	par			1				1
	px		4				1	5
	qd	1	4					5
	vo		2					2
	av		14					14
	av1	3	5	1	1			10
	av2		3				1	4
	av3	1	3				2	6
	cv		41					41
	cv1	1	1	1			1	4
	cv2		5					5
	fv	1	2				1	4
cod/saithe/pollack	a		1					1
	bo		1					1
	d	4	9					13
	hy		1					1
	iph	2	1					3
	mx	1	8					9
	pt	1	1					2
	px	6	13				4	23

	qd	2									2
	vo			5							5
	av	4		430		3	7		1	1	446
	av1	53		83		1		2	11	1	151
	av2	19		40					4		63
	av3	35		127		6			1	2	171
	cv	22		396		1	7	2	2		430
	cv1	48		167				2	8	2	227
	cv2	17		55		2	1	1	3		79
	fv	3		15			2				20
	puv			2							2
	uv			1							1
	v	1		67							68
haddock	par						1				1
	pt			1							1
	cv		2								2
	cv1		1								1
	cv2			1							1
haddock?	av1			1							1
whiting	px			1							1
	av			3							3
	cv						1				1
whiting?	av			2							2
	cv		1								1
Norway pout/bib/poor cod	av		1			1					2
	av1		1								1
	cv1		1								1
cod family	a	3		5			1				9
	bo	1		5					1		7
	d	2		17			1	1			21
	hy	1									1
	iph			1							1
	mx	2		9					1		12
	pa	2		1							3
	par	1		1							2
	pt	1		2			1				4
	px	13		26		1	7	3	2		52
	qd			5							5
	scl	1		1							2
	vo			5					1		6
	av	39		197	1	2	68	8	8		323
	av1	70		86		5	6	7	6		180
	av2	9		15		1			1		26
	av3	33		43			3		13	1	93

	cv	101	238	6	38	11	9	403
	cv1	35	60	1	1		8	105
	cv2	19	17	1	2		8	47
	fv	17	19	1	2			39
	puv	1			1			2
	v	60	96	15		1	12	184
gurnard family	av		1					1
scorpion fish family	av		1					1
	fv		1					1
	uv		1					1
Atlantic horse mackerel	av	1	4					5
	cv		6					6
Atlantic horse mackerel?	av		1					1
sea bream family	cv		1					1
sea bream family?	v						1	1
corkwing wrasse	iph	3	22		1	1		27
	po		4					4
	qd		1					1
	vo	1					1	2
	av	11	8		1			20
	cv	7	7	1				15
	v		2					2
corkwing wrasse?	px		1					1
	qd		1					1
	vo		1					1
	av	1	2					3
goldsinny	iph	1						1
corkwing wrasse/goldsinny	av	4	33			1	2	40
	cv	2	22			1	8	33
	cv2		4					4
ballan wrasse	a	7	9		3	1		20
	bo		2					2
	ch		5		1	1		7
	d	1	5					6
	iph	8	37		1		1	47
	mx	3	6					9
	pa	1					1	2
	par	1	2					3
	pt	1	4		2	1	1	9
	px					1	1	2
	qd	2	12		1	1		16

	scl	2	6			1	3		12
	scp		1						1
	vo		4						4
	av	49	91	1	4	10	1		156
	cv	17	27		3	1			48
	fv	2	8			2	1		13
	puv		1						1
	uv		2						2
ballan wrasse?	px		2						2
	uv		1						1
cuckoo wrasse	iph		2						2
	pt		1						1
	qd		1						1
	scl		2						2
	vo		1						1
	av	1	2						3
	cv		5						5
	fv		1						1
cuckoo wrasse?	iph		2						2
	vo		1						1
ballan/cuckoo wrasse	a		1						1
	bo		1						1
	iph	2	1			2			5
	mx	1	1			1			3
	o	1							1
	pa	1							1
	par		1						1
	qd		1						1
	scl		3						3
	scp		3						3
	vo		1						1
	av	287	452	22	24	34	84	5	908
	av1		1						1
	cv	194	448	6	10	10	29	3	700
	fv	20	13	1	2	2	9		47
	puv	5	2				2		9
	uv		2						2
wrasse family	a	1	8		1				10
	bo	2	15			2	1		20
	ch		12		3		2		17
	cl		1						1
	d	2	20		4				26
	hy	3	14			1	1		19
	iph	8	232	1	9	1			251
	mx	2	33		5	2	3		45

	pa	1	2							3
	par	1	4							5
	pt	3	14			1				18
	px	1	24				1	2		28
	qd	3	34			5	1	3		46
	scl	1	52		1	2	1			57
	scp	3	40			1		3		47
	vo	3	11			1				15
	av	76	1715		5	129	20	36		1981
	cv	80	1585			96	14	21		1796
	fv	17	133		1	20	3	4		178
	puv	10	39			4	1	2		56
	uv	1	20			1				22
	v		95				1			96
eelpout family	av								1	1
butterfish	av		13							13
	cv		4		1					5
sandeel family	av		5							5
Atlantic mackerel	av	2	66			1		1		70
	av3	2								2
	cv	6	86			6	1	4		103
	v	1	7							8
peciformes order	par	1								1
flatfish order	v		1							1
plaice	av						1			1
plaice family	av		2							2
	cv		1					1		2
unidentified fish	bo		2							2
	px		1							1
	qd		2							2
	av	5	12		1			1		19
	cv	11	11		2			2		26
	fv	1	1							2
	mvc		2							2
	puv							1		1
	uv	17	2							19
	v	388	919	1	7	32	56	55		1458
Total QC1		160	963		5	54	29	36	1	1248
Total QC2		2083	9357	2	114	496	224	406	33	12715
QC0&QC4		3914	24831	1	302	2863	585	1236	71	33803
Total fish		6157	35151	3	421	3413	838	1678	105	47766

Table 21. Fish QC1 element representation by context (see appendix ix for definition of element abbreviations)

Size category	1	2	4	5	6	7
large (501-800mm TL)	3	30	1	4	1	
medium (301-500mmTL)	52	245		13	8	14
small (151-300mm TL)	101	602	3	31	19	17
tiny (>150mm TL)	4	58	1	2		4
extra large (801-1000mm TL)		1				
Total	160	936	5	50	28	35

Table 22. QC1 element York system size category

phase	bone id	taxon	element	M1	Estimated TL in mm
2	SFS4-1030	pv	px	3.53	296.86
2	SFS4-1031	pv	px	2.41	195.08
2	SFS4-1032	pv	px	4.05	345.30
2	SFS4-1035	pv	px	4.39	377.32
2	SFS4-1036	pv	px	3.5	294.09
2	SFS4-1037	pv	px	3.19	265.56
2	SFS4-1039	pv	px	3.79	321.00
2	SFS4-12184	pv	px	4.05	345.30
2	SFS4-13373	pv	px	2.62	213.86
2	SFS4-1673	pv	px	3.43	287.62
2	SFS4-593	pv	px	2.39	193.30
2	SFS4-6143	pv	px	3.41	285.78
2	SFS4-6738	pv	px	2.45	198.65
2	SFS4-6739	pv	px	2.42	195.97
2	SFS4-6740	pv	px	2.58	210.27
2	SFS4-6885	pv	px	3.77	319.14
2	SFS4-6910	pv	px	3.42	286.70
2	SFS4-6911	pv	px	3.08	255.51
2	SFS4-7052	pv	px	3.16	262.82
2	SFS4-7203	pv	px	7.43	673.11
2	SFS4-7306	pv	px	2.6	212.07
2	SFS4-7417	pv	px	2.02	160.65
2	SFS4-891	pv	px	2.72	222.86
2	SFS4-1038	pp	px	2.78	191.34
2	SFS4-1040	pp	px	3.79	264.11
2	SFS4-2631	pp	px	2.55	174.90
2	SFS4-2924	pp	px	3.66	254.69
2	SFS4-888	pp	px	3.5	243.13
2	SFS4-889	pp	px	3.4	235.91
2	SFS4-890	pp	px	2.45	167.78
2	SFS4-1220	p	px	3.24	260.91
2	SFS4-12234	p	px	2.92	232.95
2	SFS4-12350	p	px	2.81	223.40
2	SFS4-12961	p	px	3.3	266.18
2	SFS4-2690	p	px	2.36	184.70
2	SFS4-592	p	px	3.3	266.18

2	SFS4-595	p	px	1.82	139.15
2	SFS4-598	p	px	2.04	157.58

Table 23. Estimated total length of saithe, pollack and *Pollachius* based on premaxilla measurement 1 from context 2 (see appendices viii and ix for definition of species and element abbreviations)

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