The Siglunes Archaeofauna, I. Report of the Viking Age and Medieval Faunal Remains.

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Introduction

The Siglunes site encompasses a Settlement Era (ca. AD 871) farm mound located on mainland and a series of eroding fishing structures found along the southern and western coasts of the peninsula protruding to the west from the mainland area. The site may have been occupied continuously through the post-medieval period and the last permanent Siglunes inhabitants moved away from the site in the 1970s.

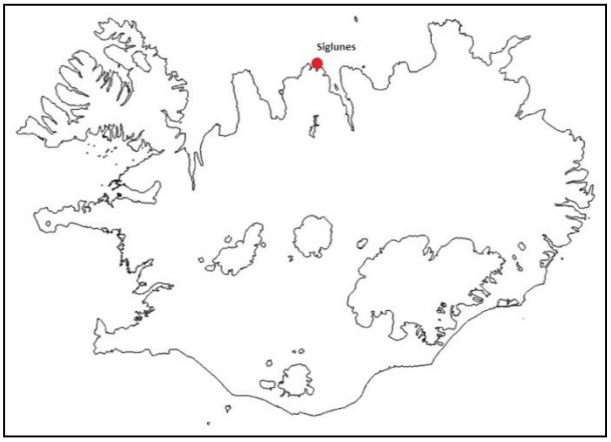

Figure 1: Map of Iceland, indicating the Siglunes location at the very mouth of Eyjafjörður´s western coast (Lárusdóttir & Roberts 2012:4.

The Siglunes rescue and excavation project in the far North of Eyjafjörður is a NABO collaboration with currently four team members from the Archaeological Institute Iceland and the CUNY Graduate School and University Center. The first two seasons in 2011 and 2012 were small team site investigations in preparation for larger projects in the future. The archaeological project builds on survey work done in the whole Siglufjörður district in 2004 and 2006 when the poor preservation state of some of the remaining Siglunes structures due to coastal erosion was detected, resulting in the currently ongoing rescue and research excavation project (http://northatlanticherc.gc.cuny.edu/?page_id=20).

Figure 2: Siglunes map showing eroding sites surveyed in 2004 and 2006 (Landmælingar Íslands in Lárusdóttir & Roberts 2012:6).

Materials and Methods

All the midden materials were dry-sieved through 4mm mesh and where, materials were targeted for whole-soil sampling for post-excavation analysis in accordance with NABO recommendations to study plant remains, industrial activities, and other aspects of the site formation process.

The faunal materials were processed at the CUNY Northern Science & Education Center (NORSEC) laboratories in New York City and Brooklyn. Recording and data curation followed the NABONE protocols followed for other archaeofauna from Iceland, Faroes, Greenland, and northern Norway (NABONE, 2006, see www.nabohome.org for downloadable version 9). Following widespread North Atlantic tradition, bone fragment quantification makes use of the Number of Identified Specimens (NISP) method (Grayson 1984). Mammal measurements follow von den Driesch, (1976) and von den Driesch & Boessneck (1974), fish metrics follow Wheeler & Jones (2005) fish identifications follow FISHBONE 3.1 (Perdikaris et al 2004b, also at www.nabohome.org), and sheep/goat distinctions follow Boessneck, (1969) and Mainland and Halstead (2005). Tooth-wear stage studies follow Grant (1982) and long-bone fusion stage calibrations follow Reitz and Wing (1999), with overall presentation of age reconstruction following Enghoff (2003).

Site Chronology

Rescue excavations at a few of the Siglunes structures associated with fishing activity has predominantly focused on the collection of a representative archaeofauna, especially from midden materials deposited in Mounds B and E. A stratigraphic excavation of Mound B deposits sampled midden materials that came from three distinct occupation phases: the earliest deposits were underneath in-situ H1104 tephra. The subsequent phase of midden deposits was found between the H1104 an H1300 tephra bands, the latter also in situ. The most recent midden layers were deposited later than H1300 tephra, in both Mound B and Mound E. The Mound B midden materials deposited later in time than the H1300 tephra were very fragmentary, but those from Mound E resulted in a substantial collection of well-preserved animal bones. Initially, the three phases were put into the following chronological groups: pre-1104, between 1104 and 1300, and

post-1300. Radiocarbon dating provided absolute dates for the earliest and latest deposits. From the present faunal remains dated through Radiocarbon and Tephra analysis, the Siglunes archaeofaunal remains can be divided into three activity periods.

10th-12th c. Archaeofaunal remains from Mound B excavated from contexts under the H1104 tephra layer. A terrestrial mammal bone from context [102], one of the basal midden contexts, was Radiocarbon dated to the 10th c. Bones analyzed from context [101] fall into this phase, but deposited above the small collection from context [102] and date between the 10th and 12th c.

12th – 14th c. Archaeofaunal remains from Mound B collected from contexts situated between the H1104 and H1300 tephra layers. Context [152], producing the largest faunal collection from Siglunes to date, was Radiocarbon dated to the 13th c. The bones utilized for the Phase 2 discussion here are from this 13th c. context.

14th c. Archaeofaunal remains from Mound E (context [187/184]) and Mound B (context 147) deposited above the H1300 tephra layer and Radiocarbon Dated to the 14th c. The Mound archaeofauna thus represents the 14th c.

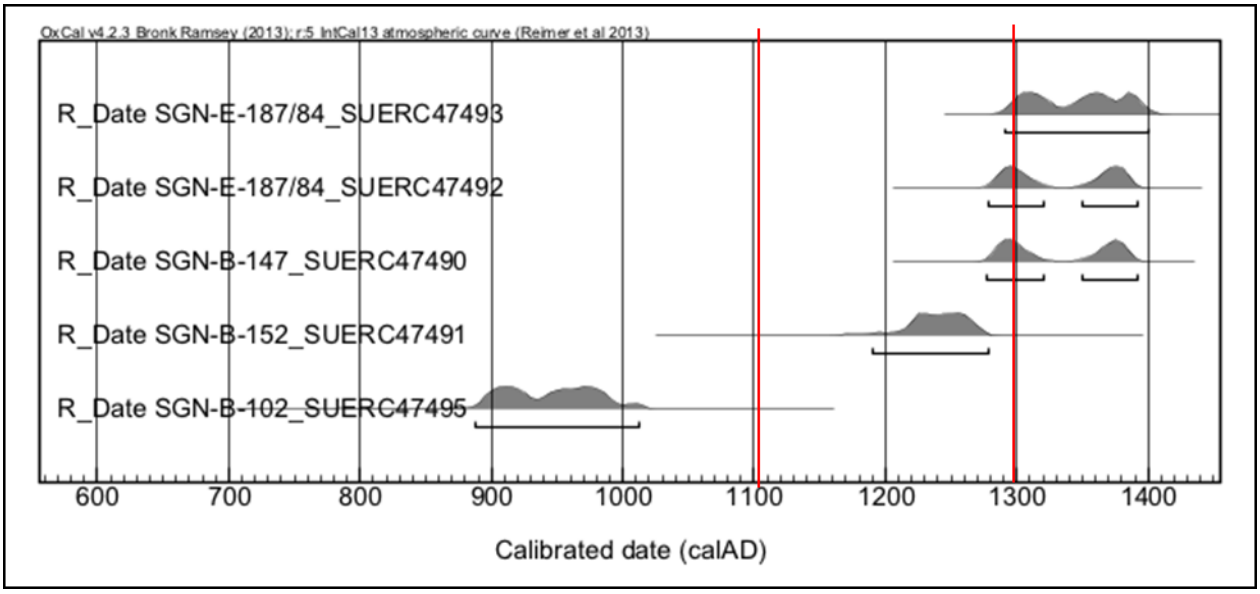

Figure 3. Siglunes, assembled Radiocarbon dates combined with H1104 and H1300 tephras (c14.arch.ox.ac.uk/oxcal/OxCal.html, v. 1.6, Bronk Ramsey 2010, Atmospheric data from Reimer et al. 2009). Mound E data followed by Mound B data.

The calibrated radiocarbon dates displayed in figure 3 show the Mound E (187/84) dates first and Mound B (147, 152, 102) dates second. The red lines indicate the two in situ tephra layers (H1104 and H1300) confirmed for the two archaeological mounds (Sigurgeirsson in Lárusdóttir et al. 2012).

SUERC #	GU #	Phase	Area	Context	Age % Modern	Age error	2 SIGMA (95.4 %) probability	1 SIGMA (68.2%) probability	δ13 C (‰)	δ15 N (‰)
47490	31009	14th c.	Mound B	147	664	29	1277(49.4%)1320calAD; 1350(46.0%)1392calAD	1283(35.3%)1305calAD; 1364(32.9%)1385calAD	-19.6	3.3
47491	31010	13th c.	Mound B	152	793	29	1188(2.3%)1199calAD; 1206(93.1%)1279calAD	1223(68.2%) 1262calAD	-22.0	7.2
47495	31014	10th c.	Mound B	102	1098	29	889(93.2%)997calAD; 1004(2.2%)1013calAD	898(25.3%)921calAD; 944(42.9%)985calAD	-21.2	2.7
47492	31011	14th c.	Mound E	187/184	660	29	1278(47.5%)1321calAD; 1350(47.9%)1392calAD	1285(33.1%)1306calAD; 1363(35.1%)1385calAD	-21.2	1.8
47493	31012	14th c.	Mound E	187/184	622	29	1291(95.4%)1400calAD	1299(27.9%)1322calAD; 1348(26.3%)1371calAD; 1379(14.1%)1392calAD	-21.0	n/a

Table 1. List of Results from Isotopic Analysis; Mound B data followed by Mound E data (courtesy: SUERC)

Table 1 combines the Radiocarbon results from Figure 3 with stable Carbon (delta C13) and Nitrogen (delta N15) isotopes. Delta C13 values provide information on whether the organisms were part of the terrestrial or marine food web, delta N15 values provide information on nitrogen contents in potential fodder resources (Ascough et al. 2006). A comparison between the Nitrogen levels from the fishing area animal bones and those from the farm mound would be of great interest. Sampling of the Siglunes farm mound is suggested for future archaeological activities on this complex site.

The Archaeofauna

This report provides initial analysis of the Siglunes faunal collections rescued in 2011 and 2012.

Currently, there are limited data sets available, mainly a breakdown of the major taxa, and selected fish elements, all gadids or members of the codfish family, and a majority thereof cod (*Gadus morhua*). One context from Mound E, 187/184, has been analyzed in its entirety. Radiocarbon Analysis places this context into the 14th c. Analysis of the marine fish remains from this context's provides a direct comparative to the one from Gásir in Eyjafjörður.

Brief Summary of the results from initial faunal analysis

The Siglunes faunal samples collected and analyzed to date stem from the fishing site on the peninsula, reflected in the overall faunal distribution and making the **marine fish** category the dominant one among the faunal remains. Current results indicate that almost all of the fish remains are from the gadid family, most fall into the Atlantic Cod (Gadus morhua) species category. The Haddock (*Melanogrammus aeglefinus*) species a distant second, and Saithe (*Pollachius virens*), Ling (*Molva molva*), and Cusk (*Brosme brosme*) are mixed in.

The 14th c. archaeofauna from Mound E further contains occasional Atlantic Halibut (*Hippoglossus hippoglossus* (L.)) and Atlantic Wolffish (*Anarhichas lupus* (L.)).

The marine mammal proportion is dominated by seals of unidentifiable species, save for a few individual skeletal elements that could be associated with Harbor Seal (*Phoca vitulina*) and Harp Seal (*Phoca groenlandica*). Other marine mammal elements are from cetaeceans, ranging from Propoise/Dolphin sized specimens to remains of large-sized whale species. The latter are often found in form of heavily butchered vertebral elements or the debris of craft working.

A small sample of these unidentifiable craft working fragments are currently analyzed by Swedish aDNA specialist, Cecilia Anderung. For a pilot project, one of the whale elements was speciated to *Phocoena pohcoena*, Harbor porpoise. The fragment came from context [103], dating before AD1104, and possibly as early as the 10th c.

With exception of the 14th c. archaeofauna, the Number of Identified Specimens (NISP) is very low per occupation period: 247 NISP for the 10th – 12th phase, and 278 NISP for the 13th c. collection. Results for these low numbers are due to a time effective sampling strategy employed to address the issue of changes over time in the size of Cod fish – the predominant fish species at

Siglunes. Contexts were therefore sub-sampled for specific skeletal elements: premaxilla, dentary, and cleithrum (see Fish section for a discussion).

Bones belonging to taxa other than fish were fully analyzed and will be displayed in comparisons listing wild and domestic mammal, and bird species.

The 14th c. faunal collection (youngest phase) from context [187/184] in Midden E was completely analyzed, with a total **NISP of 5,258.** The gadid remains from this context will be compared to 14th c. gadid remains from the coastal trading site at Gásir, in Eyjafjörður for a discussion on potential fish supply of the trading site from specialized coastal fishing sites.

Major Taxa

The Siglunes fish remains outnumber all other taxa remains by the thousands. Since only selected fish elements have been analyzed from the pre-1300 deposits (context [101] from the earliest activities and context [152] from the 13th c. ones), only the Major Taxa graph for the Phase 3 deposit (context 187/184) from the 14th c. is displayed here.

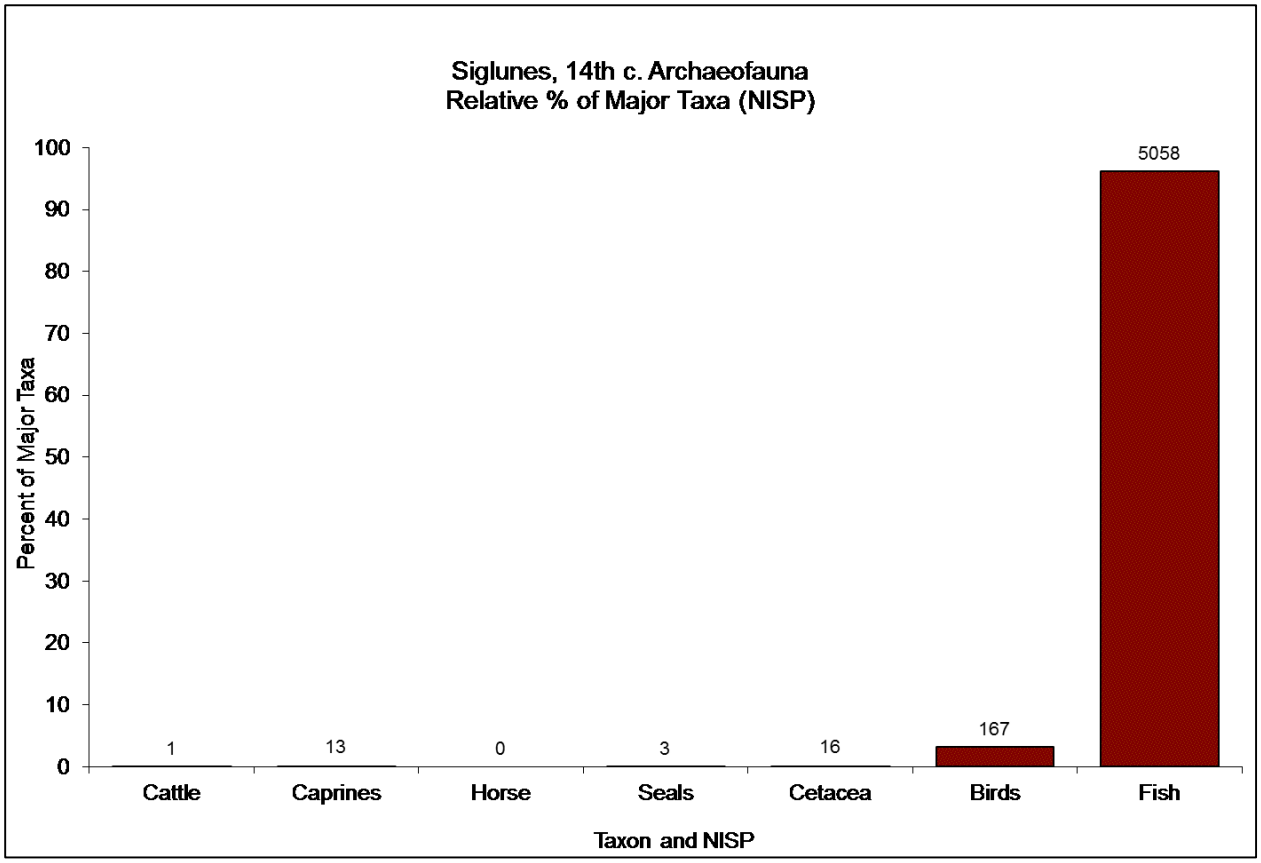

Figure 4. Major Taxa Graph, context [187/184].

At 96.20 %, fish bones clearly dominate the rest of the major animal taxa. Birds are the second most frequently used taxon, accounting for 3.18 % of the total 14th % archaeofauna. The Cetacea category represents 0.30 %, all Caprines 0.25 %, Seals 0.06 %, and one single Cattle bone equals 0.02% of the total.

Figure 5 below omits the fish remains the present a relative percentage of taxa analyzed from all three phases. This is comparative profile of the site economy other than fish resource management.

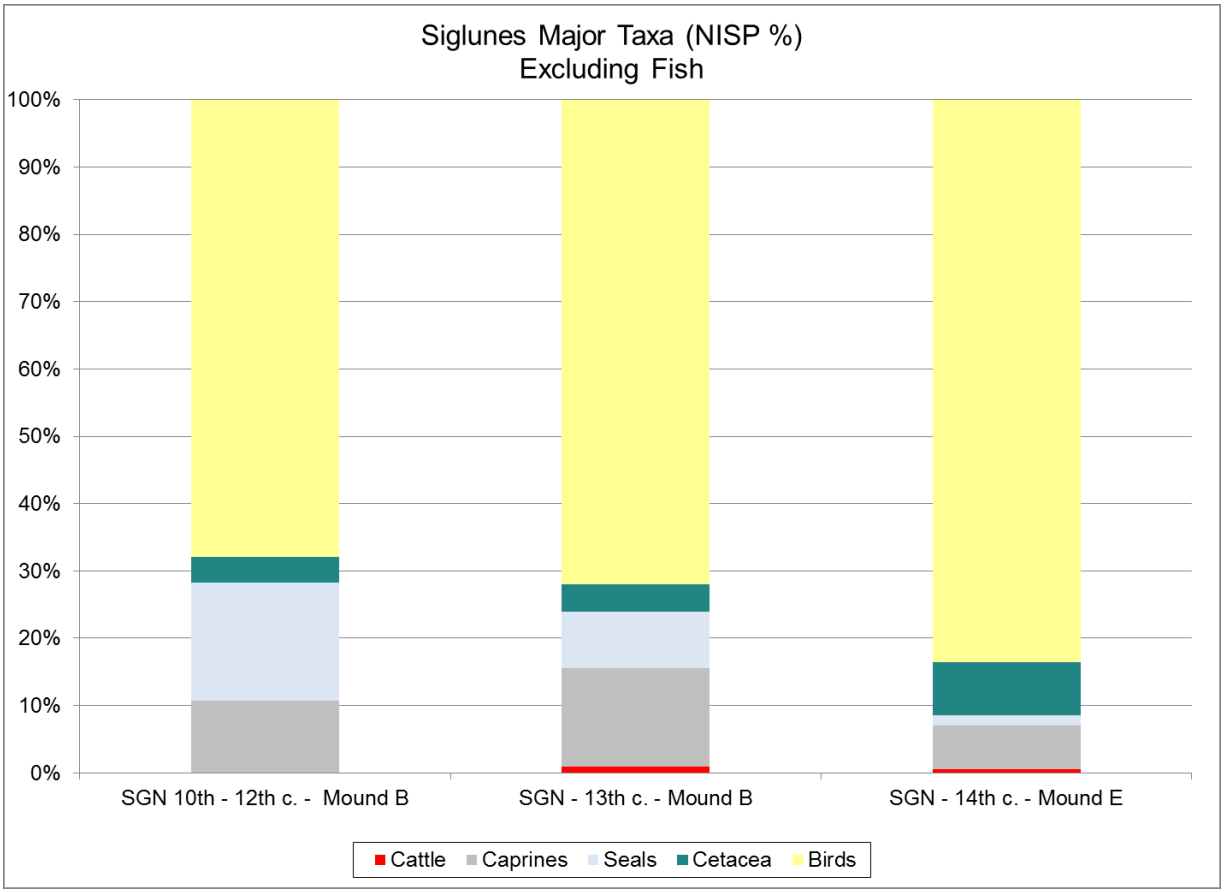

Figure 5. Major Taxa Graph (NISP %), excluding Fish taxon.

All three occupation phases contained very small amounts of domestic mammal remains. The bird bone category increases in the 14th c., totaling 83.5 % of the major taxa category, when excluding fish elements. The caprine category is somewhat higher in the 13th and 10th-12th c. deposits. Seal proportions decline over time, with cetacea proportions increasing in turn.

Mammals

The Siglunes mammal graph indicates a rise in domesticates from the 10th-12th c. to the 13th c., with a decline in the 14th c.

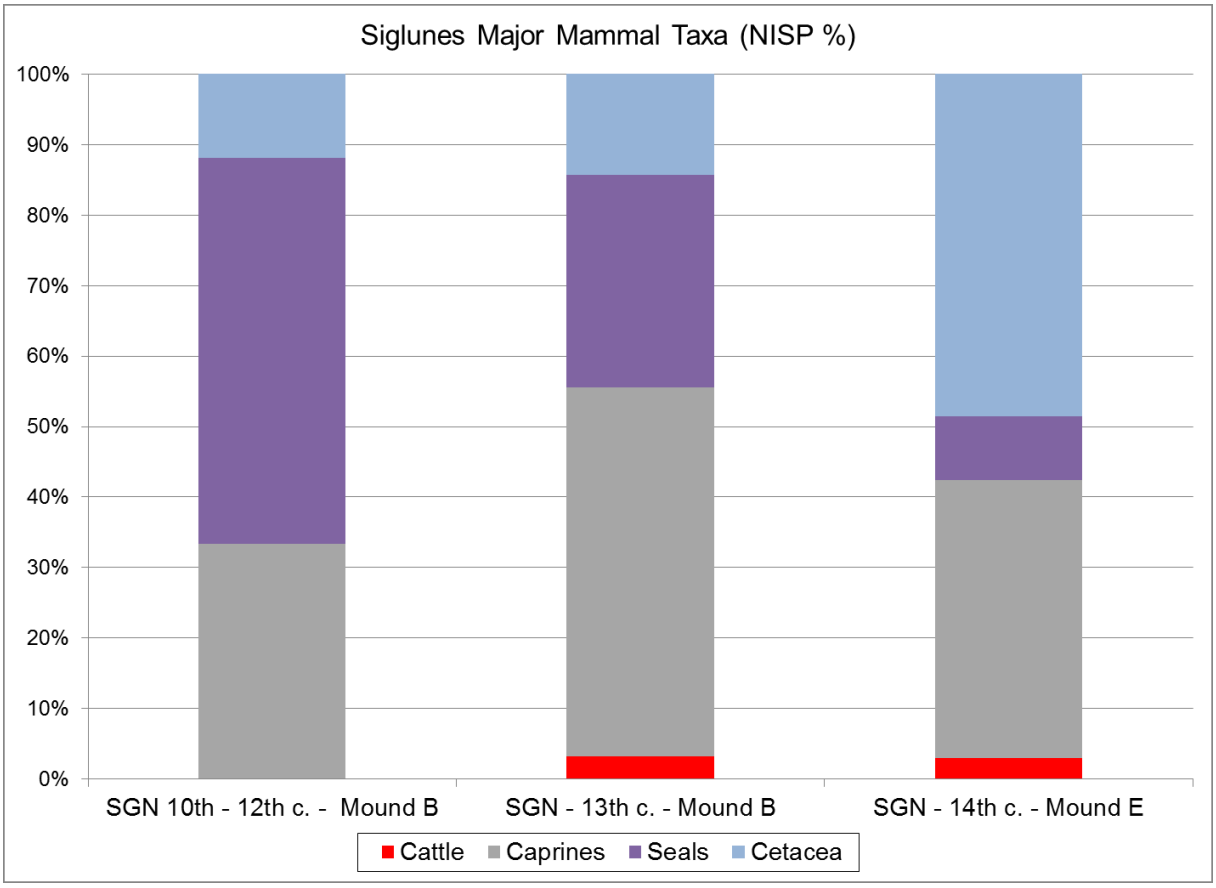

Figure 6. Major Mammal Taxa.

The 14th c. deposit from Mound E displays the highest proportion of cetacean remains, whereas the 10th -12th c. deposit displays the highest seal proportion. The relatively highest proportion of domesticate remains is observed in the 13th c. deposit. Whether this accounts for a true trend in the site's consumption patterns changing over time or a possible indicator for seasonality remains to be determined by additional faunal analysis. As demonstrated from the sections presented from here on, the NISPs are currently not high enough for such statements.

Domesticates

Domesticates Table	pre-1104 NISP	pre-1104 NISP %	1104-1300 NISP	1104-1300 NISP %	14th c. NISP	14th c. NISP %
Cattle (*Bos taurus*)		0	2	5.71	1	3.85
Sheep (*Ovis aries*)	1	7.14	3	8.57	1	3.85
Ovis/Capra sp.	13	92.86	30	85.71	12	46.15
Total	*14*		*35*		*14*	
total Ovis/Capra	14	100	33	94.29	13	50.00

Table 1. Domesticate Proportions from Mound B and Mound E.

All three deposits contained very few domestic animal bones. As highlighted in the Major Taxa Distribution Graph (figure 4), the 14th c. deposit´s domestic mammal bones represent less than .30 % (0.27%) of the total faunal assemblage.

Wild Mammals

The whale elements included in this Wild Mammals NISP table are only those not obviously modified for artifact production. Besides these more intact whale elements, hundreds of splinters have been recovered as part of whale bone working debris. Selected elements were used for an upcoming aDNA study by Dr. Cecilia Anderung, University of Uppsala.

Scientific Names	*English Common Names*	10th-12th c. NISP	10th-12th c. NISP %	13th c. NISP	13th c. NISP %	14th c. NISP	14th c. NISP %
Phoca vitulina	*common or harbor seal*	2	7.14				
Phoca groenlandica	*harp seal*			1	3.57		
Large phocid	*large seal*	2	7.14				
Phocid species	*seal species*	19	67.86	18	64.29	3	15.79
Large cetacean	*Great whale*	1	3.57				
Small cetacean/ porpoise	*small-sized whale/porpoise*	1	3.57	2	7.14		
Cetacea species	*whale species*	3	10.71	7	25	16	84.21

Table 2. Wild Mammal Species recovered from Mounds B and E.

The seal and whale elements retrieved from the Siglunes peninsula are indicative of the site´s location in the northern waters of the Atlantic Ocean. Comparatively few seal elements were found in the 14th c. archaeofauna so far, but there were quite a few more whale remains suggestive of food consumption in the this context. The Harp Seal (Phoca groenlandica) element from the 13th c. context might be indicative of high amounts of pack ice or drift ice and could either be suggestive of a particular season, or a climatic event.

Birds

Siglunes - Bird Species	10th-12th c. NISP	10th-12th c % NISP	13th c. NISP	13th c. % NISP	14th c. NISP	14th c. % NISP
Migratory Waterfowl						
Eider Duck (Somateria mollissima)	6	15.79	13	14.29		
Anas species (Duck family)	1	2.63	1	1.1		
Sea birds						
Black Guillemot (Cepphus grylle)	1	2.63			1	2.27
Murre species (Uria species)	7	18.42	25	27.47	3	6.82
Razorbill (Alca torda)	1	2.63	11	12.09	2	4.55
Alcid species	1	2.63	2	2.2		
Common gull (Larus canus)			1	1.1		
Great black-backed gull (Larus marinus)	2	5.26	5	5.49	7	15.91
Gull species (Larus species)	2	5.26	2	2.2	4	9.09
Fulmarus glacialis (Fulmar)	14	36.84	22	24.18	26	59.09
Cormorant (Phalacrocorax carbo)	1	2.63	6	6.59		
Shag (Phalacrocorax aristotelis)	2	5.26	3	3.3		
Non-Migratory Terrestrials						
Ptarmigan (Lagopus mutus)					1	2.27
Birds analyzed to species or family	**38**	**100**	**91**	**100**	**44**	**100**
Unidentified bird species	51		71		123	
NISP total Bird	*89*		*162*		*167*	

Table 3. Siglunes, analyzed bird species.

Alcids (Murre, Razorbill, Black Guillemot), Great black-backed gulls, ducks (mainly Eider), and Cormorant and Shag species (both adult and juvenile remains were analyzed) found in the earlier two phases (both Mound B), and the alcids and gulls found in deposits (Mound E) dating from the youngest phase reflect the local avian fauna. The presence of Common gull in the 13th c. archaeofauna is somewhat controversial, as this species was not supposed to have bred in Iceland until the 1950s (Ævar Peterson, personal communication, 2013).

The potentially most controversial find in the Siglunes avian assemblage are the fulmar elements retrieved from all three phases. Traditionally, the thought is that these birds were only found in nesting in northern Iceland as late as the 17th c., but this site clearly demonstrates that these birds can be found in archaeological records and Siglunes is arctic enough to harbor them from early times on, at least during the winter. Avian specialists have long suspected and argued that this species was found in Iceland as early on as the Viking Age (Fisher 2008, Ævar Peterson, personal communication 2013). The absence of shag and cormorant elements from the 14th c. collection could indicate different resource preferences or seasonality.

Marine Fish

The fish discussion is presented in two parts here, as analysis occurred at two different stages.

Sub-sample analysis: All three contexts were sub-sampled for analysis of only certain skull elements – Premaxillae and Dentaries - allowing for reconstruction of Cod life-sizes to identify size ranges over time. Further, the cleithrum – a bone found in the pectoral region and often traveling with a processed fish filet - were singled out as they, together with premaxillae - often found on processing sites - are useful proxy indicators of fish body portions. Both analytical methods will be discussed in more detail below.

Complete analysis: Fish bone analysis is very time consuming and only one context has been analyzed completely to date. The results from this analysis can be used for comparison with other fishing sites and especially with the 14th c. fish remains from the medieval trading site at Gásir.

<u>Sub-sample analysis</u>

The well preserved faunal collection contains thousands of marine fish, with the great majority of them placed into the gadid or Cod fish family.

Siglunes Analyzed Fish		Sub-Sample SGN 10th-12th c.	Sub-Sample SGN 10th-12th c.	Sub-Sample SGN 13th c.	Sub-Sample SGN 13th c.	Whole SGN 14th c.	Whole SGN 14th c.
Scientific Names	English Common Names	NISP Count	NISP %	NISP Count	NISP %	NISP Count	NISP %
Gadus morhua	Atlantic cod	64	55.17	123	55.91	1538	42.32
Pollachius virens	Saithe	2	1.72	21	9.55	197	5.42
Melanogramus	Haddock	10	8.62	21	9.55	443	12.19
Molva molva	Ling			1	0.45	1	0.03
Brosme brosme	Torsk	2	1.72	1	0.45	131	3.60
Gadidae, sp. Indet.	Gadid family	38	32.76	53	24.09	1314	36.16
Hippoglossus hippoglossus	Halibut					7	0.19
Pleuronectidae sp.						1	0.03
Anarchichas lupus	Wolfish					2	0.06
Total analyzed fish		116		220		3634	
Fish, sp. & family	Fish species					1424	
Total Fish		116		220		5058	

Table 4. Analyzed Fish NISP breakdown. Faunal collections from the earlier two phases were sub-sampled, the later one analyzed in full.

The table above presents a gadid species breakdown from all three periods, but with only selected elements (premaxilla, dentary, cleithrum) included from the 10th to 12th c. and 13th c. deposits. The premaxillary and dentary elements were analyzed and measured Cod life-size reconstructions. Cleithra and Premaxillae were further used for proxies of fish body proportions (see figure 7 below). Cod (Gadus morhua) is the predominant species in all three phases, with Haddock (Melanogrammus aeglefinus) a very distant second. Occasional Saithe (Pollachius virens) elements are higher in the 13th c. and 14th c. collection, Torsk (Brosme brosme) was found in the 14th c. collection, and Ling (Molva molva) only in the earliest and most recent deposits. The initial analysis of the two early faunal collections suggests that the focus was

always placed on a cod fish product, with haddock the second most important species caught and utilized. Saithe and Torsk were utilized more later one, but Ling was never of great importance.

For an initial idea of the gadid and especially cod fish economy in place during the different occupation stages, certain elements were targeted for presence and absence of either the cranial or post-cranial portion of the cod skeleton.

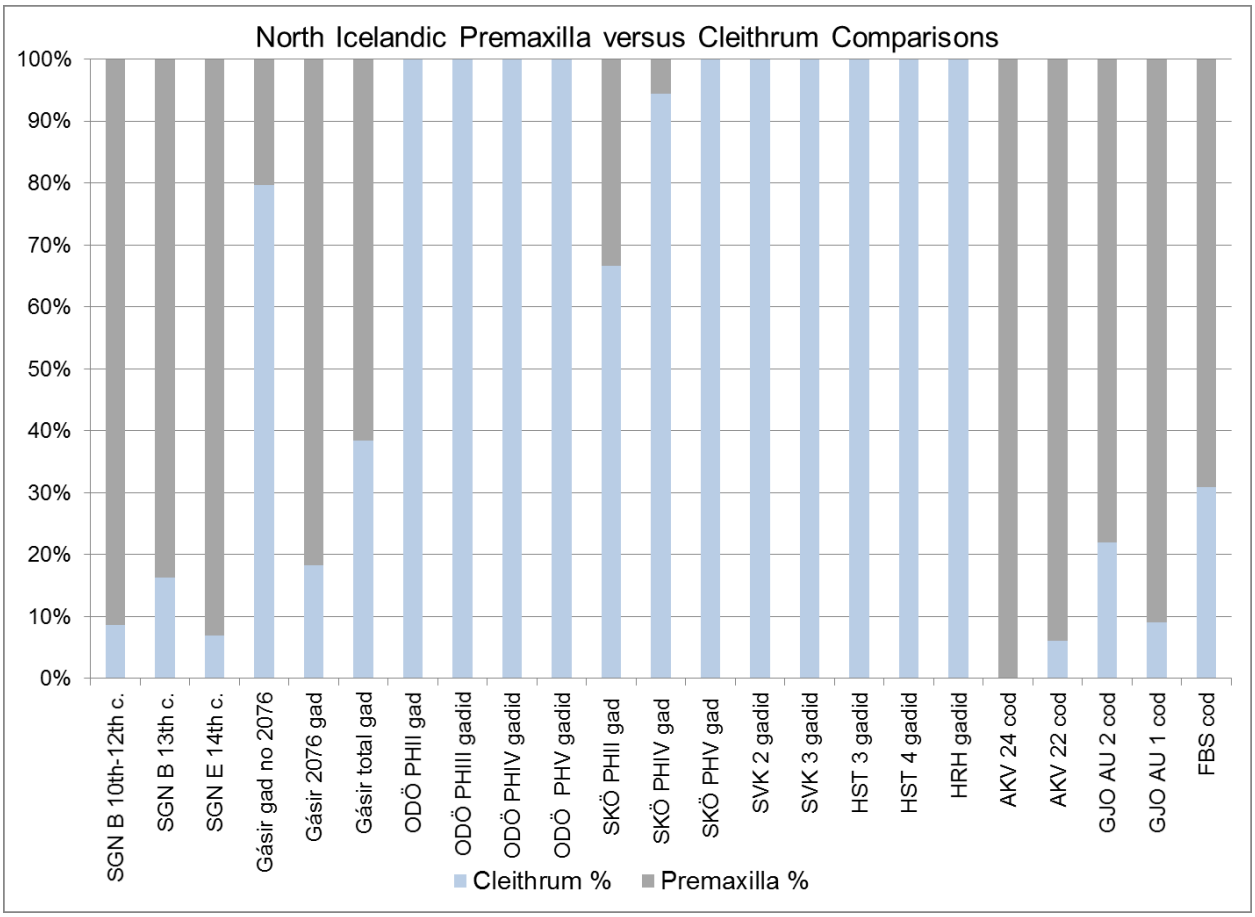

Figure 7. Premaxilla vs Cleithrum comparisons from Icelandic sites. SGN – Siglunes, ODÖ – Oddstaðir, SKÖ-Skuggi, SVK – Sveigakot, HST – Hofstaðir, HRH – Hrísheimar, AKV – Akurvík (13th & 15th c.), GJO – Gjögur (15th and 17th c.), FBS – Finnbogastaðir (18th & 19th c.).

Figure 7 displays the percentages of premaxilla (one of the jaw bones) vs. cleithrum (large bone found in the pectoral region) bone element ratios for the Siglunes cod elements. The cleithrum

travels with the preserved fish along with varied amounts of the vertebral column, and tends to accumulate in disproportionally higher amounts (than premaxillary fragments) at consumer sites, such as the ones from the Eyjafjörður inland sites Skuggi and Oddstaðir (Harrison et al 2010, Harrison 2010, 2011, 2012, 2013) and Sveigakot, Hofstaðir, and Hrísheimar in Mývatnssveit (Perdikaris and McGovern 2007, 2008). The jaw bone called premaxilla is normally discarded at the point of fish cleaning and preparation for drying or consumption, and thus tends to accumulate differentially at dried-fish-producing sites such as Akurvík whose 13th (24) and 15th c. (22) cod remains are listed here. (Amundsen et al. 2005). The Siglunes premaxilla vs. cleithrum proportions clearly support that Siglunes was indeed a fishing site and the remains from Mound E and B display on-site fish cleaning and processing.

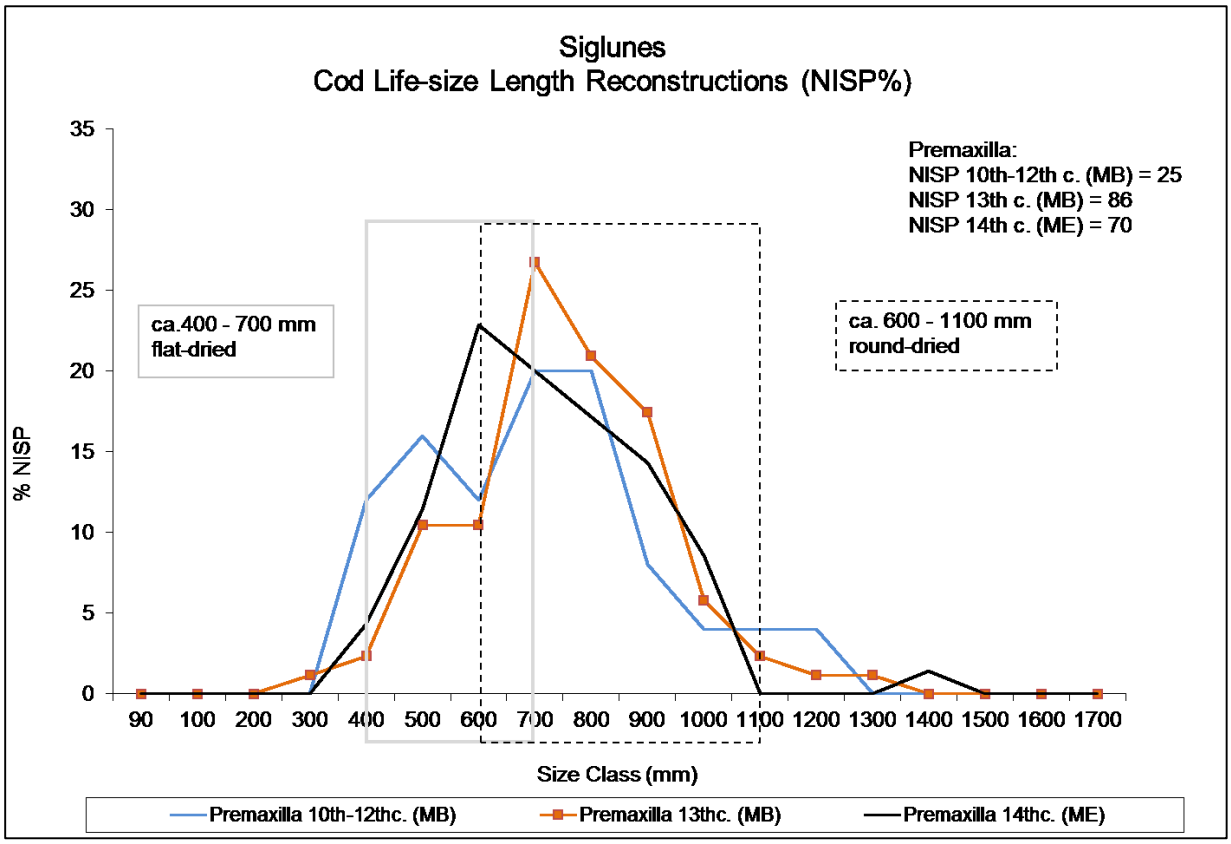

Figure 8. Cod life-size reconstructions based on Premaxilla Measurements; Siglunes, MB = Mound B; ME = Mound E.

The traditionally set size ranges for a split fish product is 400 to 700 mm, smaller than the so-called stock fish filet dried in the round (size range of 600 to 1100 mm) (Perdikaris & McGovern 2008).

While the 13th c. cod elements can be placed right into the "stock-fish window", those from the 10th – 12th c. fit into a wider size range that seems to be almost evenly split into flat-dried fish ('klipp-fisk' like) and dried in the round ('stock-fish' like), maybe suggesting not yet fully commercial cod fish preparation. The 14th c. cod life sizes suggest a true 'combination' of the two processing methods, possibly indicating that both of these products were part of the commercial exchange – at least during the 14th c. in Eyjafjörður? This issue will be discussed further in the section of complete analysis, where the 14th c. Siglunes fish analysis will be presented in detail and compared to the contemporaneous data from Gásir.

Complete Analysis of context [187/184], Mound B

The 14th c. cod size reconstruction is compared with that from 14th c. Gásir cod remains that were excavated from a specialized fish cleaning processing feature, context [2076] (Harrison et al 2008, Harrison 2009, Harrison 2013).

Aggregated bone fragment counts from 14th c. Siglunes and Gásir fish processing deposits.

Taxon	Siglunes NISP context 187/84		Gásir NISP context 2076
Domestic mammals			
Cow (*Bos taurus* (L.))	1		3
Sheep (*Ovis aries* (L.))	1		1
Unidentified caprine	12		60

Total caprine	13		61
Total domestic	14		64
Wild Mammals			
Unidentified seal species	3		3
Total seal	3		3
Unidentified whale species	16		0
Total whale	16		0
Arctic fox (*Vulpes lagopus* L.)	0		1
Total wild mammal	19		4
Birds			
Common eider (*Somateria mollissima* (L.))	0		1
Guillemot family (Uria spp.)	3		0
Atlantic puffin (*Fratercula arctica (*L.))	0		3
Black Guillemot (Cepphus grylle (L.))	1		0
Razorbill (*Alca torda* (L.))	2		0
Common gull (*Larus canus* L.)	0		1
Great black-backed gull (*Larus marinus* (L.))	7		0
Gull species (Larus spp.)	4		0
Fulmar (Fulmarus glacialis (L.))	26		0
Duck species (Anas spp.)	0		1
Ptarmigan (*Lagopus muta (Montin)*)	1		0
Unidentified bird species	123		12
Total bird	167		18
Fish			
Cod (*Gadus morhua* (L.))	1538		980
Haddock (*Melanogrammus aeglefinus* (L.))	443		500
Saithe (*Pollachius pollachius* (L.))	197		99
Ling (*Molva molva* (L.))	1		2
Torsk (*Brosme brosme* (Ascanius))	131		0
Atlantic Halibut (*Hippoglossus hippoglossus* (L.))	7		2
Gadid species	1314		2231
Brown trout (*Salmo trutta* (L.))	0		1

Atlantic Wolffish (*Anarhichas lupus* (L.))	2		1
Pleuronectiformes	1		1
Total fish species identified	3634		3817
Marine fish non-speciated	1424		5037
Total fish	5058		8854
Mollusca			
Unidentified mollusk species	0		4
Total Mollusca	0		4
Total number of identified species	**5,258**		**8,944**
Large terrestrial mammal	1		9
Medium terrestrial mammal	18		86
Unidentified terrestrial mammal fragments	17		218
Unidentified marine mammal fragments	19		0
Total number of fragments	5294		9257

Table 5. NISP table of the 14th c. Siglunes archaeofauna compared to 14th c. Gásir archaeofauna from the fish processing pit, context [2076].

The general NISP distributions for both sites' 14th c. midden deposits are very similar. The Siglunes archaeofauna contains far less terrestrial mammal bones (see domesticates and unidentified terrestrial mammal fragments).

The Siglunes avian distribution shows more concentration on marine birds as well as more bird bones present in total than at Gásir. The wild mammal category at Siglunes is dominated by whale elements, with only few seal bones recovered from both sites' contexts. The overall faunal preservation at Siglunes is better than the one from Gásir, although the fish remains from the Gásir fish cleaning and processing midden were those best preserved from the whole Gásir faunal collection (Harrison 2009). Despite the smaller number of total fish bone recovered from the present sample of 187/84 midden materials, the Cod fish number is far higher there than at Siglunes. NISP numbers listed in the Siglunes, Gásir, and Akurvík cod size comparison below

(figure 10), demonstrate that many more fish heads were deposited at Siglunes than at Gásir and even 13th c. Akurvík, indicating a larger-scale fish production establishment at Siglunes, as was likely true for the 13th c. (figure 8 above).

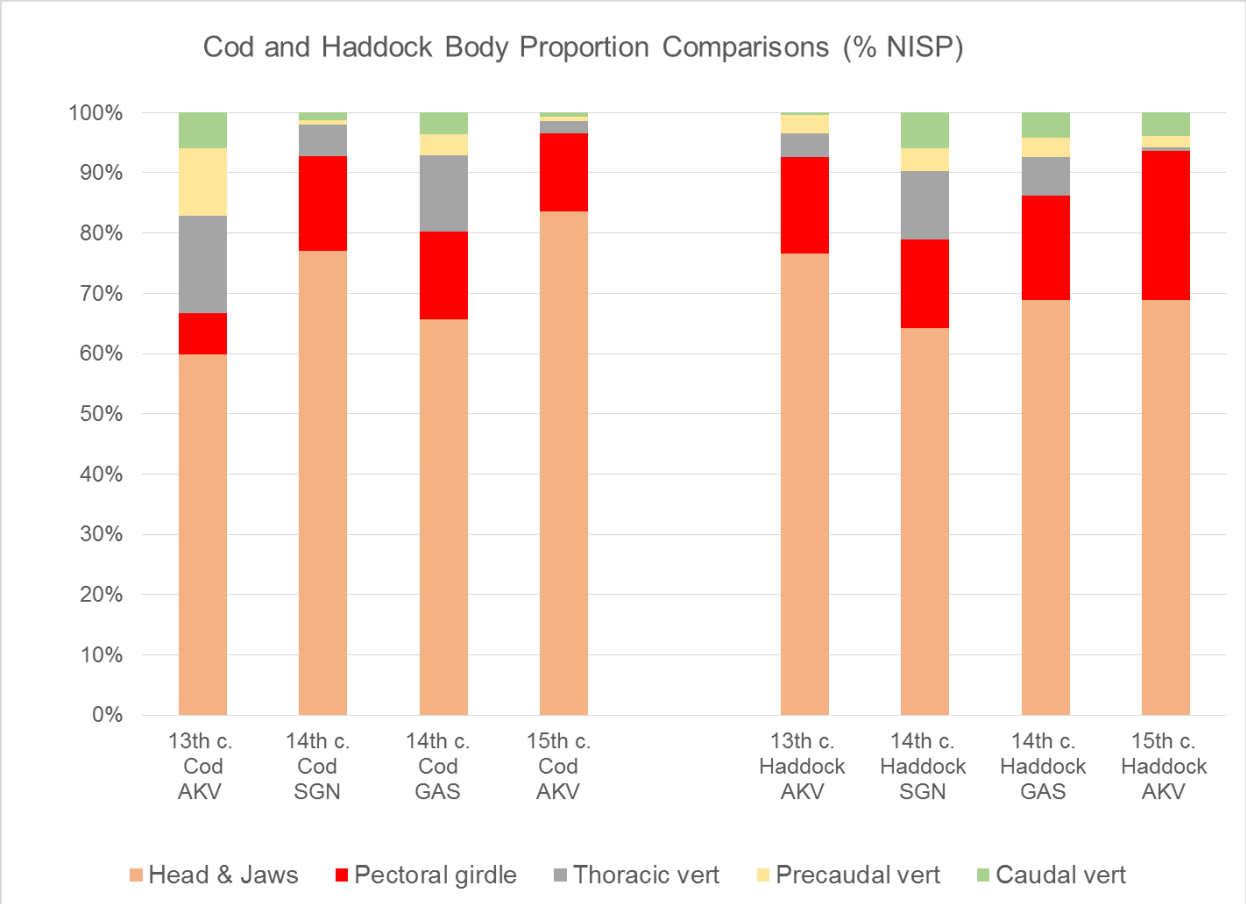

Figure 9. Element Distribution comparison from the 14th c. Siglunes (Mound E) collection and Gásir fish processing pit (context 2076), the 13th c. Akurvik (24) and 15th c. Akurvik (22) midden deposits. Cod (Gadus morhua), Haddock (Melanogrammus aeglefinus).

Similar to the Premaxillary vs. Cleithra proportion graph in figure 7, the Element Distribution Graph in figure 9 analyzes which body parts of the fish are present in the collection. This time, all the skeletal elements are included for this comparison between the 14th c. Siglunes and Gásir remains that. For a good idea on what these proportions look like at Fishing Site from elsewhere

in Northern Iceland, the 13th and 15th c. data sets from Akurvík in the Westfjords are included (Amundsen et al, Krivogorskaya et al). The Gásir "fish cleaning pit" was definitely one that was used for discarding fish cleaning and processing refuse.

We see a similar body part distribution from Siglunes context 187/84 and can thus infer that this, too, was a context where fresh fish were cleaned and processed, with the skulls removed at this point and the rest of the body transported elsewhere – most likely to dry. The very low proportion of precaudal and relatively low proportion of thoracic vertebra suggest that the Siglunes cod fish were likely more often dried in the round once they had been cleaned and beheaded. At Gásir, the freshly procured fish may have been processed more or less according to their size ranges, with potentially not much attention placed on rendering the best finished product, but rather providing the most meat to the consumers. Compared to the data from Akurvík, the Siglunes cod seem to follow a trend similar to the one observed in the 15th c. Akurvík data: Head and Jaws make up close to 80 % of the cod fish proportions, and the low percentage of vertebra suggest production of a dried fish filet consisting mostly of the vertebral column. The relatively high amount of pectoral fragments may suggest a mixed product of predominantly filets dried-in-the-round, and some smaller cod fish that were split and dried-flat. The comparative life-size reconstruction graph below can further clarify this issue.

The Haddock skeletal element proportions from all sites also suggest on-site cleaning and butchery of a fresh fish. An investigation into the Siglunes farm mound might reveal whether both, Cod and Haddock filets ended up there, in what numbers, and whether or not absence of the "tails" of these gadids might have been exported further away. As suggested by the premaxilla/cleithrum comparison graph in figure 7, the fish bones collected from Gásir other than the "fish pit" suggest provisioning of the site with preserved products, i.e. gadids either

dried in the round or split open and dried flat (Harrison 2009, 2013). The fact that these fish bones from the market area were not from fresh fish is reflected in the high amount of bone fragmentation suggesting use of "fish hammers" (Harrison et al 2008) or other implements to tenderize the fish filets that were otherwise inedible.

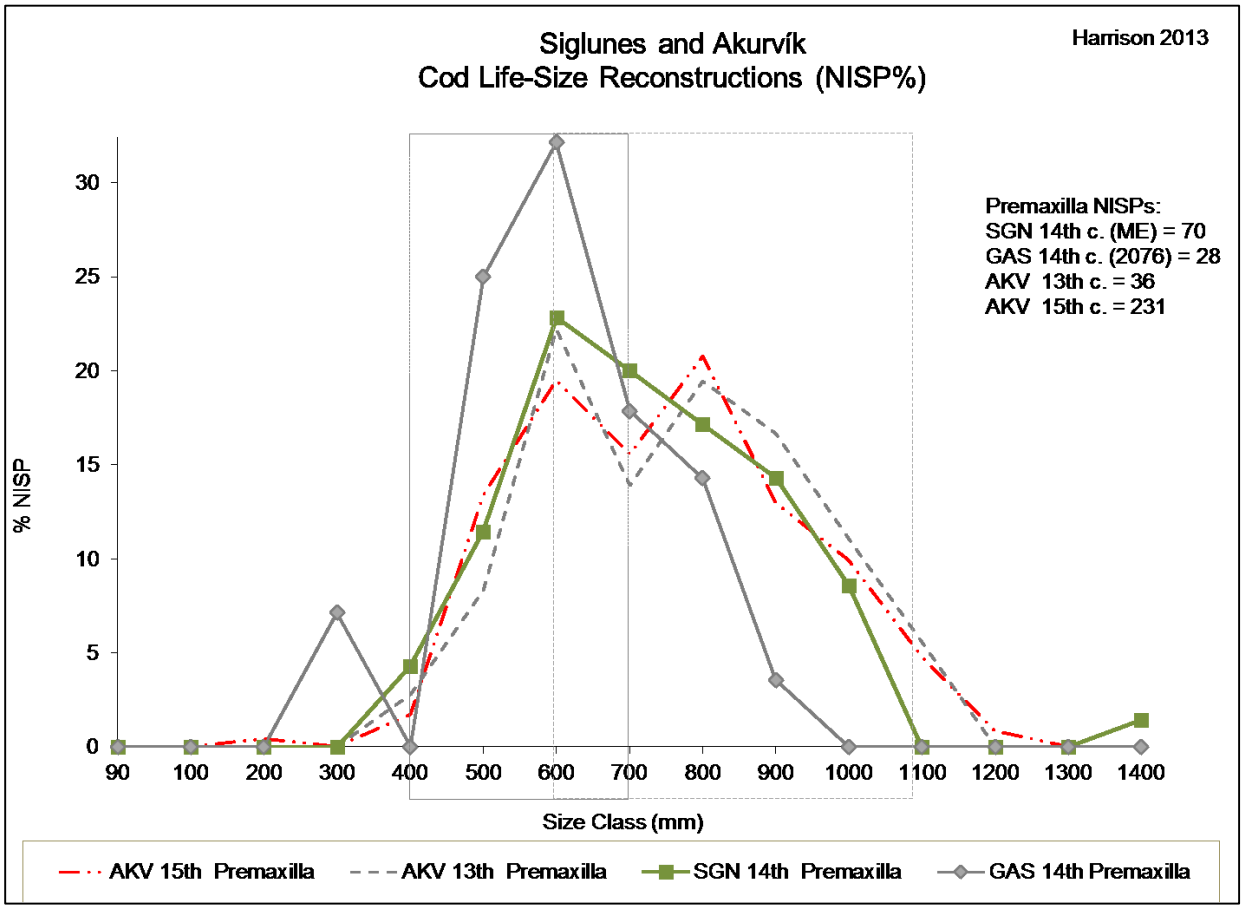

Figure 10. Siglunes and Gásir Cod Size Reconstructions compared to those from 13th and 15th c. deposits of the Akurvík fishing station in the Westfjords (Perdikaris & McGovern 2007 2008, Amundsen et al, Krivogorskaya et al).

Compared to the bimodal peaks of the Akurvík Cod life size distributions, the one from Siglunes suggests perhaps not a clean dried-round vs. split open and dried-flat profile. Rather, it seems to have one peak in the size class fitting the smaller, "klipp-fisk" like product. Rather than displaying a sharp decline in larger cod fish sizes, however, there is a very gradual and relatively

'static' proportion fitting the larger, "stock-fish" lick product. Gásir, on the other hand, seems to have predominantly focused on smaller sized cod, possibly again a sign that this site was provided by fishermen – possibly with fish not reserved for the export product, but for "domestic consumption"? Gásir, again clearly lacks the number of elements needed for a true "production site", but shows all the signs of fresh fish processing. The Siglunes archaeofaunal signature is somewhat limited by a relatively small sample numbers of the context [187/84] and will profit from a return to Siglunes and continued excavation of this layer. Further, this is only one context and more contemporary deposits need to be investigated to verify and/or negate this pattern.

Final Remarks

- New data from the Siglunes faunal collection suggest that residents of the fishing site were using both domesticate and wild resources, with marine birds, mammals, and especially fish outnumbering the domesticate species in all of the three activity phases. Meat from domestic mammals was most likely brought to site from the Siglunes farm. The questions whether the people fishing out on the peninsula were part of the farm household or migrating from elsewhere and the nature of the relationship between the farm and the fishing station over time still need to be investigated.

- The strongest signature of on-site fish processing is provided by the "premaxilla" vs. "cleithrum" graph and the comparisons to "consumer" vs. "producer" sites. The Siglunes head vs. tails signature, the skeletal element distribution graph, and the great amount of extremely well preserved fish remains attest to that as well. Analysis of the 14th c. context [187/84] from Mound E suggests a production of fish filets serving not only the local farm at Siglunes, but very likely also the farms of Siglufjörður and other Eyjafjörður areas. Icelandic medieval commercial

fishery activities (like arctic Norway) took place in winter since the production of round-dried stock fish requires near-freezing temperatures. The Gásir site was occupied in spring and summer and could therefore not have been directly involved in stock fish production (Harrison et al 2008). Much more likely, it was provided with a stock fish and also klipp-fisk product from sites like Siglunes, as suggested by one story from Sturlunga Saga (13th c.) (Vigfusson 1878).

- The reconstructed cod life-sizes suggest that the cod sizes seem to have generally increased over time, with a less specified production of likely flat dried and also dried in the round fish in the 10th – 12th c. and a more specialized focus on round dried fish in the 13th c. The 14th c. cod fish sizes display an interesting diversion from the bi-modal production signature observed in the 13th and 15th c. cod fish from Akurvík (Perdikaris & McGovern, etc.)

- Continued collection and curation of much of the endangered archaeological record is of necessity, especially concerning the archaeofaunal remains. A larger archaeofauna from especially pre- 1104 and post-1300 can fill gaps in the site chronology and track the development of commercial fishing at Siglunes. A strategic coring and test trenching exercise of all ruins on the peninsula and the homefield, including the farm mound, will allow for further investigations into the interactions of the farm and the fishing site over time. Time restraints prevented a complete collection of the remaining materials, but a proposed larger-scale intervention executed as soon as possible will allow for full retrieval of the remaining [187/84] faunal materials from Mound E. The archaeofauna from this deposit is already very promising and provides a good "base-line" of the fishing activity at this feature in the 14th c. Faunal analysis will concentrate on moving further back in time, starting with the 13th c. archaeofauna to compare that with established and known other data sets (Perdikaris and McGovern 2007, 2008). Thereupon, the Viking Age fishing activity will be investigated. In order to do so, however, gaps in the

chronological record need to be filled: While context [102] provides a few fish bone elements that can be used for analysis, a better quantifiable deposit from the earliest activities needs to be defined. Continued excavation of these features and radiocarbon dating of new and already available faunal materials will be useful here. Currently, the layers from below the 1104 tephra containing quantifiable archaeofaunal materials need more radiocarbon analysis.

- The well-stratified Siglunes archaeofauna shows enormous potential for not only adding new data to the Icelandic and North Atlantic research. It can provide us with information on Viking Age fishing strategies in the North of Iceland, and proved a case study on the origins and subsequent development from likely artisanal to larger-scale commercial fishing enterprise. What is more, the 13th and 14th c. faunal remains can provide clues on the emerging international export of a standardized cod product from Iceland, thus fueling a growing industry that would fully take off in the 15th and subsequent centuries.

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Sources

Amundsen, Colin, Sophia Perdikaris , Thomas H. McGovern , Yekaterina Krivogorskaya , Matthew Brown , Konrad Smiarowski, Shaye Storm, Salena Modugno, Malgorzata Frik, Monica Koczela 2005 'Fishing Booths and Fishing Strategies in Medieval Iceland : an Archaeofauna from the of Akurvík, North-West Iceland', Environmental Archaeology 10,2 in press

Ascough, P, G. Cook, M.J. Church, A.J. Dugmore, S.V. Arge, and T H. McGovern
2006 Variability in North Atlantic marine radiocarbon reservoir effects at c.1000 AD. In The Holocene Vol. 16, No. 1, pp131-136.

Boessneck, J. 1969. Osteological differences between sheep (Ovis aries Linne) and goats (Capra hircus Linne). Pp. 331-358, In D. Brothwell and E. Higgs (Eds.). Science in Archaeology. Thames and Hudson, London, UK.

Enghoff, I. B. 2003. Hunting, fishing, and animal husbandry at the Farm Beneath the Sand, Western Greenland: an archaeozoological analysis of a Norse farm in the Western Settlement, Meddelelser om Grønland Man & Society 28. Copenhagen

Fisher, James. 2008. A History of the Fulmar Fulmarus and its Population Problems. Ibis, Volume 94, Issue 2, pages 334–354, April 1952. Article first published online: 3 APR 2008 DOI: 10.1111/j.1474-919X.1952.tb01822.x

Grant, Annie 1982. The use of tooth wear as a guide to the age of domestic ungulates, in B. Wilson, C. Grigson, and S. Payne (eds.) Ageing and Sexing Animal Bones from Archaeological Sites, BAR British Series 109 pp 91-108. Oxford.

Grayson, D. K. 1984. Quantitative Zooarchaeology. Academic press, Orlando

Lárusdóttir, Birna & Howell M. Roberts, with contributions by Ramona Harrison & Magnús Sigurgeirsson. 2012. Siglunes: Archaeological investigations in 2011. FS447-02872, Fornleifastofnun Íslands.

Lárusdóttir, Birna (ed.). 2008. Fornleifaskráning í Hvanneyrarhreppi II: Minjar í Siglufirði (sunnan Siglufjarðarbæjar og austan fjarðar), Héðinsfirði og Hvanndölum. FS391-04042. Fornleifastofnun Íslands.

Lárusdóttir, Birna og Sigríður Þorgeirsdóttir. 2005. Fornleifaskráning í Hvanneyrarhreppi I. Minjar á Úlfsdölum og í Siglufjarðarbæ. FS284-04041. Fornleifastofnun Íslands.

Mainland, I. and Halstead, P. 2005. The economics of sheep and goat husbandry in Norse Greenland. Arctic Anthropology 42, 103-120.

Perdikaris, S. and T.H. McGovern. 2008. Viking Age Economics and the Originals of Commercial Cod Fisheries in the North Atlantic. The origins of commercial fishing: old problems and new insights. In Beyond the Catch: Fisheries of the North Atlantic, the North Sea and the Baltic, 900-1850. Sicking, Abreu-Ferreira (editors), pp 61-90. Brill Acedemic Publishers, Leiden, Netherlands.

Perdikaris, S., and T.H. McGovern. 2007. Walrus, cod fish, and chieftains: Intensification in the Norse North Atlantic. Pp.193–216, In T.L. Thurston and C.T. Fisher (Eds.). Seeking A Richer Harvest: The Archaeology of Subsistence Intensification, Innovation, and Change. Springer Science and Business Media, New York, NY, USA.

Perdikaris, S., T.H. McGovern, Y. Krivogorskaya, and M. Waxman. 2004a. Early modern fisher-farmers at Finnbogastaðir and Gjögur in northwest Iceland. Pp.139–144, In R. Gonzales (Ed.). Presence of the Archaeoichthyology in Mexico. ICAZ Fish Remains Working Group 2003, Guadalajara, Mexico.

Perdikaris, S. Krivogorskaya, Y. McGovern, T.H. Lahtiperä, P. 2004b. FISHBONE 3.1 CD Identification manual for Gadid fish in the N Atlantic. A product of the NABO cooperative available via www.nabohome.org .

Reitz E. J. & E. S. Wing. 1999. Zooarchaeology. Publisher: Cambridge, UK; New York Cambridge University Press.

Vigfusson, G. 1878 Sturlunga Saga, Including the Islendinga Saga of lawman Sturla Thordsson and Other Works. Clarendon Press, Oxford, UK.

von den Driesch, Angela. & Joachim Boessneck. 1974. Kritische anmerkungen zur Wiederristhöhenberechnung aus Längenmaßen vor- und frühgeschichtlicher Tierknochen. Säugetierkundliche Mitteilungen 22, 328-348, München´.

von den Driesch, A. 1976. A Guide to the Measurement of Animal Bones from Archaeological Sites. Peabody Museum Bulletin 1, Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, Massachusetts

Wheeler, A., & A.K.G. Jones. 2005 (2nd edition). Fishes. Cambridge University Press, Cambridge, UK.

Websites:

Information on the NABONE recording manual, the FISHBONE manual, and other reports associated with the greater Eyjafjörður Project:
www.nabohome.org

Informational blogs about the Siglunes 2012 field season:
http://northatlanticherc.gc.cuny.edu/?cat=8