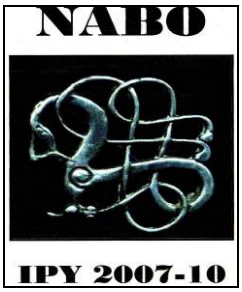

The Gásir Area A Archaeofauna: An Update of the Results from the Faunal Analysis of the High Medieval Trading Site in Eyjafjörður, N Iceland

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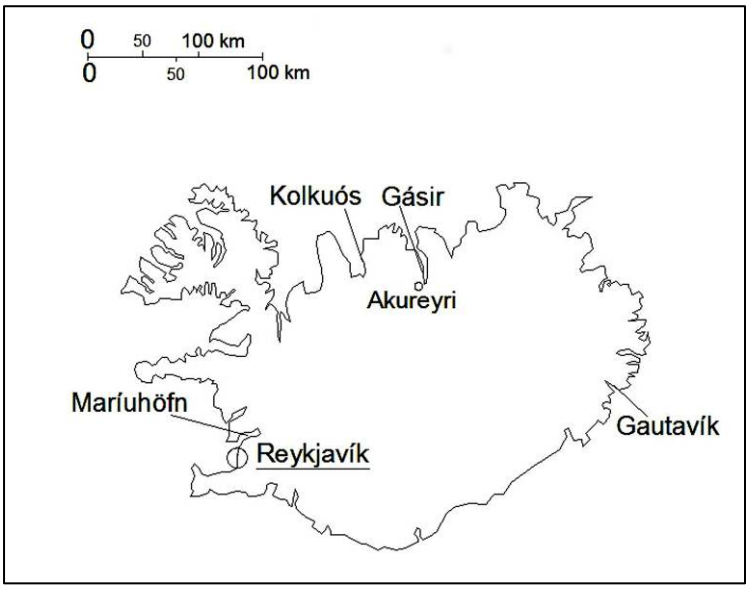

Figure 1 – Gásir Location map (map source: Harrison et al. 2008).

Introduction

This faunal report presents new information on the Gásir archaeofauna which was collected during 5 years (2002 – 2006) out of the total 6 years of Archaeological excavations at the site of Gásir near the modern city of Akureyri. Under the direction of Howell Roberts of *Fornleifastofnun Íslan*ds (Archaeological Institute Iceland, FSÍ) and on behalf of *Minjasafnið á Akureyri* (Akureyri Museum), initial investigative activities at Gásir were begun in 2001. The project resulted in a large scale, open-area archaeological excavation carried out during the summer seasons of 2002-2006. The project has produced a substantial amount of animal bones, which have been continuously analyzed at the CUNY Northern Science & Education Center laboratories as part of the North Atlantic Biocultural Organization cooperative effort, with funding provided by the UK Leverhulme Trust, and the US NSF IPY project (see acknowledgements section for specific grant numbers). The Gásir excavations were part of an ongoing larger scale, long term project which aims to place the investigation of the high medieval trading center at Gásir in a regional and historical context. At this time, the analysis of the Gásir assemblage has been virtually completed, and is the basis for the author´s PhD thesis, to be completed in the Spring of 2010.

C**urrent work** done on the Gásir faunal remains included finishing the analysis of the numerous fish remains from the midden deposit (2076) which was in-filling a sunken

feature (pit house) that had been excavated in 2005 (Pálsdóttir, Roberts et al. 2006 for more information on the specifics). Additionally, several contexts containing few faunal remains as well as several bones gathered during processing of bulk samples were among the materials processed. The radiocarbon dates and associated Carbon and Nitrogen isotopic assays carried out on mammal bone and marine shell by Dr. Gordon Cook (SUERC) provide both chronology and some N and C isotopic indication of differential grazing patterns in stock brought to Gásir. The available AMS dates calibrate to ranges between the mid 13th through the early 15th Centuries, which roughly reflects temporal evidence provided by artefacts and documentary sources (Harrison et al 2008, Roberts et al 2006). In the winter of 2008, additional terrestrial mammal elements were sampled for radiocarbon analysis. The bones providing new isotopic samples were taken from the Churchyard, Gásir Area B (Vésteinsson in Roberts et al. 2006, Harrison 2007) archaeofauna, and date the various strata associated with church re-construction and abandonment roughly between AD 1250 and 1400. The radiocarbon dates of both areas are represented together in figure 20 and indicate that while there may have been human activity at Gásir before the 13th Century AD, the central distribution of the calibrated date ranges is clearly 13th-14th century AD (Dr. Gordon Cook (SUERC), Bronk-Ramsey OxCal v. 4.0.5, 2007). Further radiocarbon analysis of both, the Gásir Area A and B remains, is still to follow, and may help establish the approximate date of the initial church construction, human activity in the area prior to the building of the church, as well as enable a more precise phasing of the market place (Area A) deposits.

Zooarchaeological data from the years 2002 through 2006 have been used for this report, offering a total NISP (Number of Identified Species) of **15,735** out of a TNF (Total Number of Fragments) of **25,754.** The species present include domestic cattle, sheep, goat, horse, and pig as well as dog, seal, whale, bird and fish remains. In 2005, a particularly large amount of **fish** remains were analyzed, and as figure 3 demonstrates, account for more than 80 % of the total archaeofauna. As will be discussed below, the fish elements that have been analyzed in their entirety are of a large enough number to indicate a certain form of gadid management.

While most of the species found in the Gásir collection reflect an Icelandic coastal site (Perdikaris et al. 2004, Krivogorskaya et al. 2005), a variety of skeletal remains could be

associated with more extraordinary animal species that are potentially indicative for the special status of the site: a trading station seeing local visitors and foreign sailors and merchants that were exchanging goods, information, and maybe signaling aspects of their social status (i.e. the expressing of wealth or status associated with specific breeds of dogs whose major function was that of companionship). The more "unusual" assortment of faunal remains includes a walrus tusk fragment (context 101 (unstratified)); bones from both average (contexts 655, 662, 1476, 1573, 2078, 2452) and lap-dog sized dogs., (contexts 101 (unstratified)) 1551, 2851, 2812 2851), as well as two gyrfalcon bones (context 756 and 1632). While a total of more than 15 skeletal fragments of dog have been recovered, the likely number of dogs (MNI) is actually **11** (for MNI vs. NISP information see Reitz & Wing, 1999).

Special attention was given to the individual from (2812) whose remains included most of the calvarium (including the upper jaw, or maxilla), the mandible (both sides, incl. most of the teeth) and further articulated elements that make up a good deal of the upper forelimbs. At the American Museum of Natural History (AMNH), these dog remains were compared to that of an arctic fox and several different races of small dogs.

While the Gásir **dog remains** from context (2812) can be speciated to *Canis familiaris* vs. *Alopex lagopus* (arctic fox), it was not possible to match the individual to a specific modern dog race. It is quite clear (size reconstruction will be discussed below), however, that the dog was of lap dog size, whose purpose – beyond that of status symbol (Prilloff 2000) – was possibly to relieve its owner temporarily of his or her parasites. Although dogs have can be used for food purposes (Harcourt 1974), there is no evidence of such at Gásir. Further evidence for the presence of dogs is given by traces of dog gnawing on several bones.

C**attle bone** is very abundant, with a caprine/cattle ratio of 2 (2.07) caprine bone for every cattle bone (vs. ca 20 caprine per cattle bone in contemporary small rural sites). The high percentage of cattle bone is similar to very high status late medieval sites in S Iceland (Viðey and Bessastaðir being most similar), with a majority of the faunal remains butchered at an age suggesting consumption of high quality "prime age" meat.

The presence of **pig** remains should be mentioned, since by late medieval times, Icelandic pigs are in general no longer present in the faunal assemblages. A small amount

of skull remains may indicate that some pigs were brought on site alive and then butchered and consumed there. The proportion of meat-bearing bones is higher than that of the less meaty elements (Wigh 20001). These meat-elements could have traveled to Gásir in a processed state; about 70 % of the elements have chop marks; no articulation of skeletal or butchery remains that would further indicate on-site slaughter have been found.

The **fish remains** analyzed from the entire site were largely postcranial, with not enough skull and thoracic fragments available to indicate definite procurement of fresh fish at the site. The pattern of predominantly postcranial minus thoracic elements suggested that the occupants were consuming some form of processed fish, but the 'other' end of the fresh fish, the head bones including premaxiallae, was not visible in the Gásir archaeofauna until 2005, when a particularly large amount of fish remains was excavated. The fish remains (see table 1, context 2076) were part of a midden dump which served as infill for a sunken feature in the NW of the Area A excavation. With virtually the entire fish remains analyzed, the previously emerging story (Harrison et al 2008) of on-site fresh gadid management (for a discussion on fish processing contexts see Perdikaris & McGovern 2008) by a fish monger can now be confirmed (see discussion of figures 16 and 17 below).

Salmonid elements were found in a few contexts (1142, 1188, 1947, 1948, 2076) and amount to a total of only 25 elements. Almost all of the elements (24 of 25) were vertebral and most of them could be speciated as Trout (*Salmo trutta*).

Butchery patterns include typical late medieval Icelandic patterns, except for a puzzling shortage of characteristic bi-perforated sheep metapodials, which may indicate the presence of non-Icelandic consumers. Further research questions center on the nature of provisioning of the site, context-specific bone associations and activity areas, bone and horn craft working, possible indicators of multiethnic foodways, and indicators of social status system. There are a total of 23 cattle corn horn cores (see picture) and many of them exhibit chop marks that indicate horn core working (Harrison in Roberts, 2006).

Materials and Methods

All the midden materials were dry-sieved through 4mm mesh and where applicable (i.e. context 2076, etc), 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, 2004, see www.nabohome.org for downloadable version 8). 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 (1989) fish identifications follow FISHBONE 3.1 (2003, also at www.nabohome.org), and sheep/goat distinctions follow Boessneck, (1969) and Halstead and Mainland (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).

The Gásir Area A archaeofauna

Several areas have been of interest to the archaeological research conducted on the site: Area A, the booth-like sunken features with associated trackways that make up the main trading area (Roberts et al. 2006); Area B, the church and churchyard built most likely by and for the merchants at Gásir (Vésteinsson in Roberts et al. 2006). All of the different areas, including areas A and B, are highlighted in figure 2. This faunal report will be concerned with the results from the bone assemblage present at Area A.

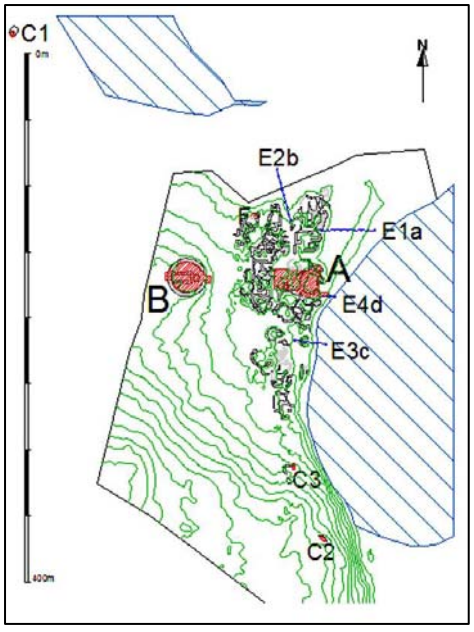

Figure 2 - Gásir site layout (Roberts et al. 2006).

Overview of Species Present

Table 1 presents the Gásir archaeofauna as a Total Count. **NISP** (number of identified specimens) refers to all fragments that could be identified to a useful level. **TNF** is a count of all bone fragments (identifiable or not), **MTM** is "medium terrestrial mammal" (sheep-dog-pig sized), **LTM** is "large terrestrial mammal" (cattle-horse sized), **UNIM** or unidentified mammal are small fragments that cannot be identified beyond this broad category. The dog bones found in the collections coincide with characteristic canine tooth marks that are present on a number of bone fragments in the collection.

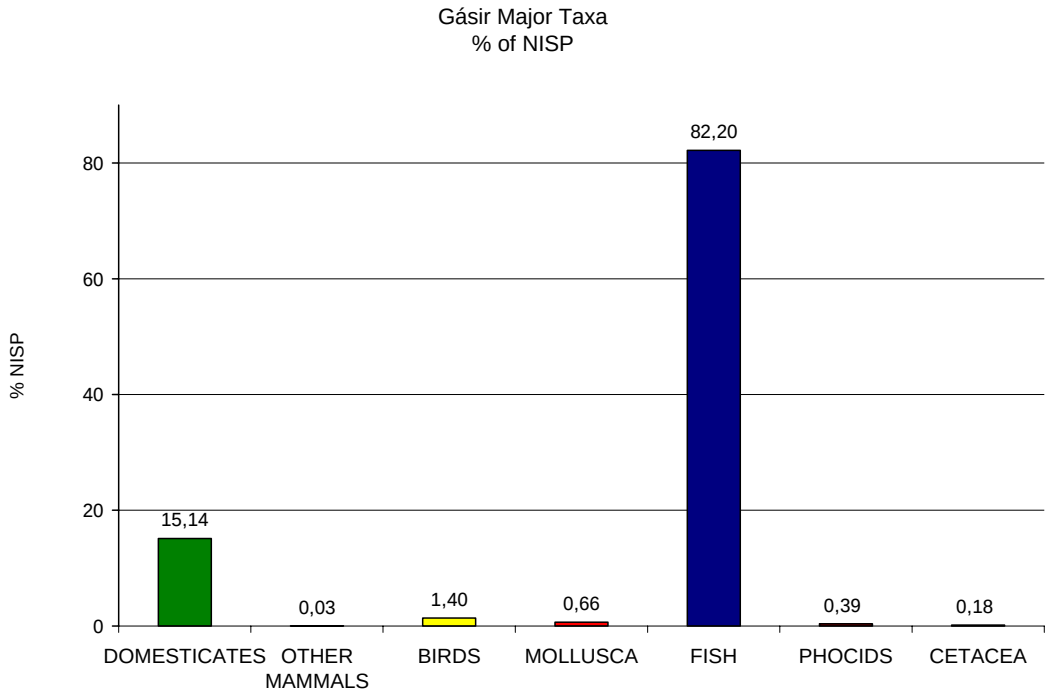

Figure 3 – Gásir Area A total archaeofauna

The site's total archaeofauna is presented in more detail in table 1. The column ´2009 total´ shows the final NISP counts and the one labeled ´context 2076´ represents only data from that particular context.

Gásir Area A - Aggregated bone fragment count.

	Fragment number			
Taxon	2007 total	2009 total		context 2076
Domestic mammals				
Cow (*Bos taurus* (L.))	720	756		3
Horse (*Equus caballus* (L.))	14	15		0
Pig (*Sus scrofa* (L.))	28	34		0
Dog (*Canis lupus familiaris* (L.))	12	15		0
Goat (*Capra hircus* (L.))	16	18		0
Sheep (*Ovis aries* (L.))	245	261		1
Unidentified caprine	1152	1283		60
Total caprine	1413	1562		61
Total domestic	2186	2381		64
Wild Mammals				
Harp Seal (*Pagophilus groenlandicus* (Erxleben))	5	5		0
Harbor Seal (*Phoca vitulina* L.)	0	1		0
Small seal	11	15		0
Large seal	0	1		0
Unidentified seal species	34	39		3
Total seal	50	61		3
Small cetacean	11	13		0
Large cetacean	3	3		0
Unidentified whale species	15	13		0
Total whale	29	29		0
Arctic fox (*Vulpes lagopus* L.)	4	4		1
Walrus (*Odobenus rosmarus (*L.))	1	1		0
Total wild mammal	85	96		4
Birds				
Gyrfalcon (*Falco rusticolus* (L.))	2	2		0

Mallard (*Anas platyrhynchos* (L.))	1	1		0
Common eider (*Somateria mollissima* (L.))	33	35		1
Guillemot family (Uria spp.)	16	24		0
Atlantic puffin (*Fratercula arctica (*L.))	5	8		3
Fulmar boreal (*Fulmarus glacialis* (L.))	0	0		0
Common gull (*Larus canus* L.)	0	1		1
Gull species (Larus spp.)	4	4		0
Razorbill (*Alca torda* (L.))	5	5		0
Mute swan (*Cygnus olor* (Gmelin))	2	2		0
Red-throated diver (*Gavia stellata* (Pontoppidan))	0	1		0
Duck species (Anas spp.)	0	3		1
Sea bird non-speciated	0	1		0
Unidentified bird species	112	133		12
Total bird	180	220		18
Fish				
Cod (*Gadus morhua* (L.))	427	1086		980
Haddock (*Melanogrammus aeglefinus* (L.))	216	602		500
Pollack (*Pollachius pollachius* (L.))	11	109		99
Ling (*Molva molva* (L.))	0	3		2
Atlantic Halibut (*Hippoglossus hippoglossus* (L.))	3	5		2
Gadid species	1066	2754		2231
Brown trout (*Salmo trutta* (L.))	19	20		1
Salmonid species	2	5		0
Atlantic Wolffish (*Anarhichas lupus* (L.))	0	1		1
Pleuronectiformes	1	1		1
Total fish species identified	1745	4586		3817
Marine fish non-speciated	0	5187		5037
Unidentified fish species	4365	3163		0
Total fish	6110	12936		8854
Mollusca				
Periwinkle (Littorina spp.)	2	2		0
Clam (Mya spp.)	46	55		0
Unidentified mollusc species	38	47		4
Total mollusca	86	104		4
Total Number of Identified Species	**8655**	**15737**		**8944**
Large terrestrial mammal	770	822		9
Medium terrestrial mammal	1820	2036		86

Small terrestrial mammal	19	20		0
Unidentified terrestrial mammal fragments	6369	7139		218
Unidentified marine mammal fragments	0	2		0
Total number of fragments	17633	25756		9257

Table 1 – Gásir Area A – Aggregated bone fragment count. The left and middle columns show the site's total archaeofauna at different stages of analysis; the right column shows the archaeofauna collected from the midden deposit, context 2076.

While the species break-down in Table 1 reflects the amount of analysis that has occurred since the last Gásir faunal report (Harrison in Pálsdóttir & Roberts et al. 2007) was written, it also demonstrates the nature of the faunal deposit that had accumulated in context 2076, the fill of the pit/sunken feature excavated in 2005 (Pálsdóttir & Roberts et al. 2007). The faunal assemblage from this context consists of 99 % fish remains, with a few domesticate remains and occasional other species present. This context is very valuable as it offers insight into the site's gadid management, as discussed in the fish section of this faunal report. While not the entire fish skeletal assemblage could be associated with species or placed into the gadid family with a large enough confidence level, these unidentified remains are beyond any doubt from marine fish and thus indicative of the coastal site's fish procurement: marine fish were much focused upon and salmonids and other fresh water fishes available from nearby rivers, i.e. the Hörgá, were not favored by the people from Gásir. The location of the site makes this preference of ocean fishes no great surprise, as the market place was situated in a coastal inlet at the southwestern end of a very long fjord.

Gásir archaeofauna in comparison

Major Taxa

In figure 4, the Gásir bone assemblage is compared to roughly contemporary collections from Svalbarð in the NE (SVB5, medium-high status farm with church), the elite manor at Bessastaðir (BES L) near Reykjavik (McGovern 1990, Amorosi et al 1992, 1996, Ólafsson 1991a, b), the monastery on Víðey in Reykjavík (VID LM) (Amorosi 1996), and two phases (Akurvík 24, Akurvík 22; 13th and 15th centuries respectively) of a seasonally occupied fishing station in the Westfjords of Iceland (Amundsen et al 2005, Krivogorskaya et al 2005).

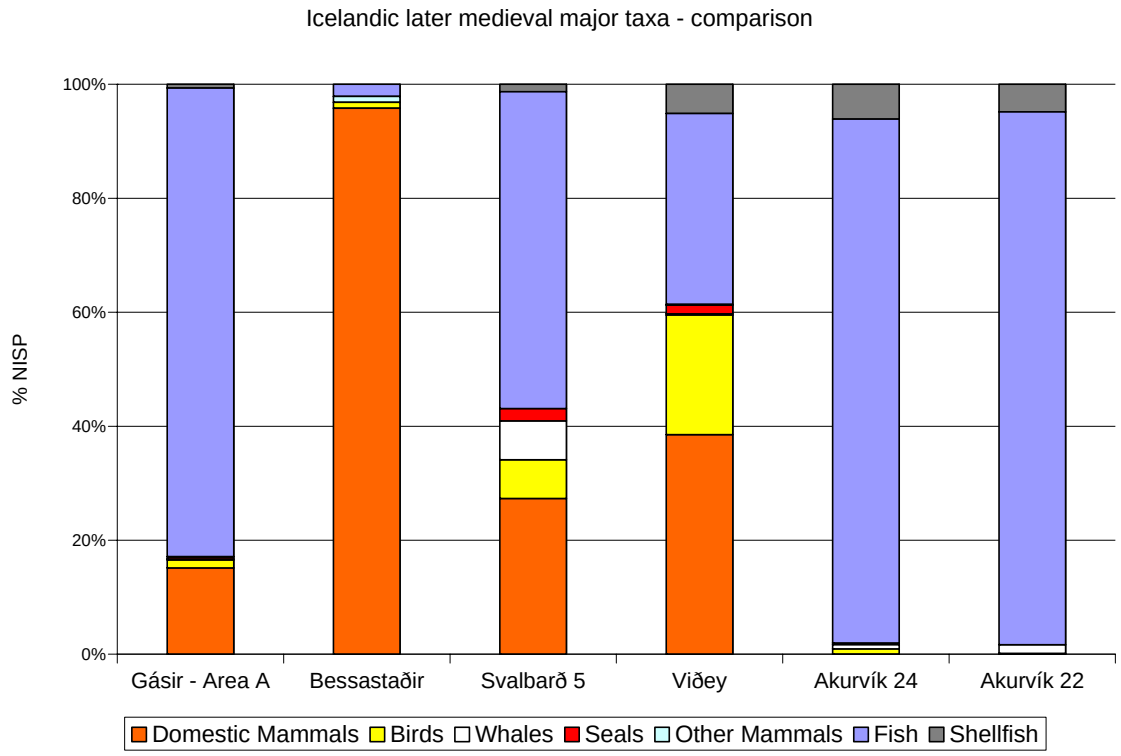

Figure 4 – The Gásir archaeofauna as compared to other later medieval faunal collections. Sources: Svalbarð 5 (Amorosi 1996); Víðey (Amorosi 1996); Bessastaðir (Amorosi et al 1992, McGovern 1990. Ólafsson 1991a, b, Amorosi 1996), Steinbogi (Brewington et al 2004)

From the major taxa comparison, it is evident that the faunal collections from the church farm at Svalbarð (data from medieval layers) in NE Iceland, and Viðey, the rich monastic site on an island just outside the modern Reykjavik harbor, best resemble the one at Gásir´s trading station.

The high status farm at Bessastaðir with its high domestic mammal proportion, and the seasonally occupied fishing station in Akureyri containing almost only fish, present stark contrasts to the faunal assemblage found at the trading site.

Domestic Mammals

Table 2 presents the relative Percentage of the domestic mammals for the entire Area A contexts excavated at Gásir. There is an overall decrease in cattle bone vs. caprine bone. The total ratio emerging from five years of faunal analysis: caprine/cattle = 2,07 which can be reasonably rounded to a ca. 2:1 ratio of caprine to cattle. The latest goat/sheep

ratio is 14,50. Goats thus do not make up a large portion of the collective caprine category.

Table 2 - Gásir Relative % of Domesticates		
	NISP 2009	% NISP
Taxon		
Bos taurus (L.)	756	31,74
Equus caballus (L.)	15	0,63
Canis familiaris (L.)	15	0,63
Sus scrofa (L.)	34	1,43
Ovis aries (L.)	261	10,96
Capra hircus (L.)	18	0,76
Ovis/Capra sp.	1283	53,86

Table 2 – Domesticates profile at Gásir, Area A.

The data presented in table 2 is used for Figure 5 below: here it is compared to several other domestic mammal patterns from medieval Icelandic sites.

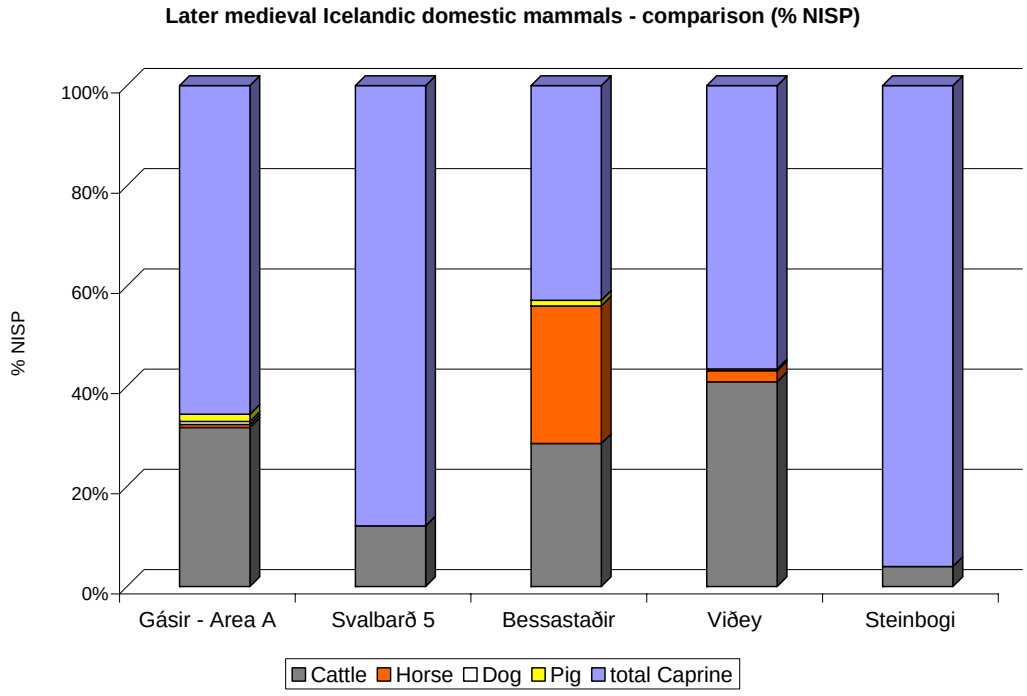

Figure 5 – Domestic Mammal Proportions from selected Icelandic sites.
Sources: Svalbarð 5 (Amorosi 1996); Víðey (Amorosi 1996); Bessastaðir (Amorosi et al 1992, McGovern 1990. Ólafsson 1991a, b, Amorosi 1996), Steinbogi (Brewington et al 2004)

The small medieval farm of Steinbogi in the Mývatn area and the church farm at Svalbarð in the NE of Iceland display a domesticate profile that is much different from

the one at Gásir. Rather, the market site's domesticates assemblage resembles that form Bessastaðir and Viðey, two higher status sites close to Reykjavík. The pattern can be understood as one reflecting a later medieval site within close proximity to important religious and political institutions, such as Reykjavik for the SW located sites, or Möðruvellir, the important monastic farm, located less than 5 km from the trading site at Gásir (for a discussion on central places, see Vésteinsson 2006.

Reconstructing Domesticate Mortality Patterns

Cattle

Figure 6 illustrates the relative percentage of bones of neonatal (newborn) calves in a range of Viking-Medieval Icelandic sites, illustrating the normal range of variation from ca 20-50% of the total cattle bone count.

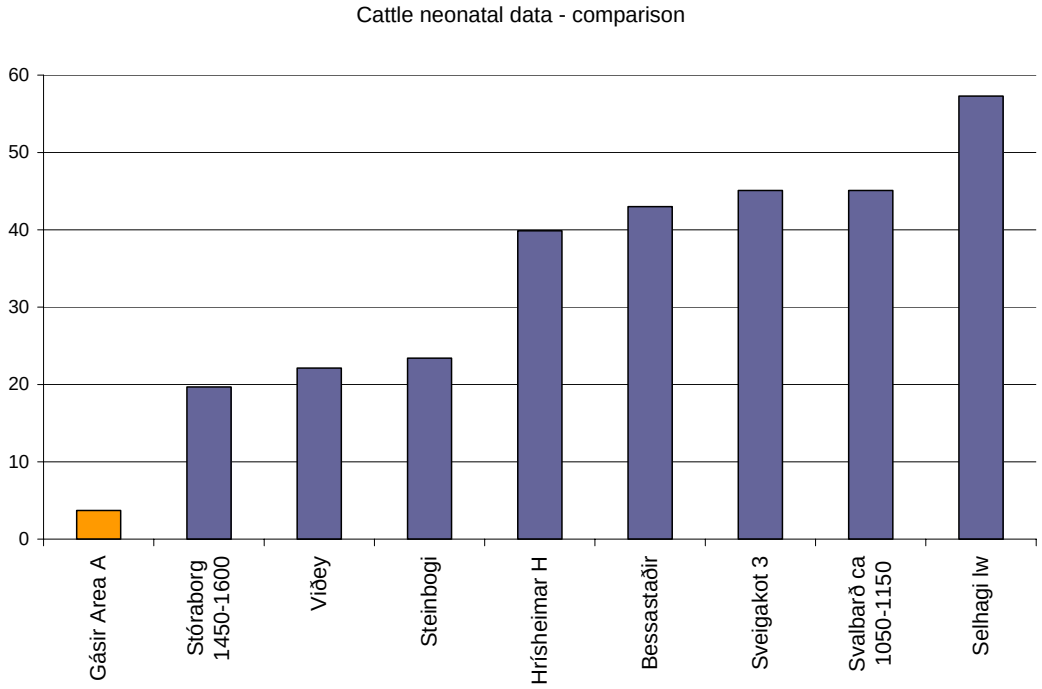

Figure 6 - Late Medieval Gásir neonatal cattle percentages compared to earlier Medieval medium status farmsteads in Sveigakot (McGovern 2004), Hrísheimar (McGovern 2002), Selhagi (McGovern & Perdikaris 2007, Draft) and Steinbogi (Brewington et al 2004) in Mývatnssveit; the Late Medieval church farm at Svalbarð in northeastern Iceland (Amorosi 1996, 397), the Late Medieval monastic center at Viðey in Reykjavík (Amorosi 1996, 403), the he Late Medieval middle to high status farm at Stóraborg in the Southwest (Amorosi 1996, 373), and the Late Medieval period of the high status mansion at Bessastaðir (Amorosi 1996, 335) close to Reykjavík.

This is generally interpreted as evidence of dairy herd management, with most milk being reserved for humans (Halstead 1998). The very low percentage of neonatal cattle bones at Gásir (indicated in gold) is thus very uncharacteristic of most Icelandic cattle collections, suggesting a different pattern of management or consumption. The fusion data below may offer a better age-at-death range in this case.

The cattle long bone fusion proportions (figure 7) indicates that at later medieval Gásir, most of the young cattle survived the stage of distal epiphysis fusion of the humerus, which occurs at around 1-1.5 years of age. There would appear to be considerable cattle mortality between 1-1.5 years and 2.5-3 years at Gásir, again suggesting kill off of large but not fully mature juvenile cattle as well as the presence of adults (note the different fall-off of survivorship at Hofstaðir and Sveigakot).

The graph further indicates that there were several adult individuals that survived at least until 3.5 – 4 years, as the distal radius fusion data demonstrates.

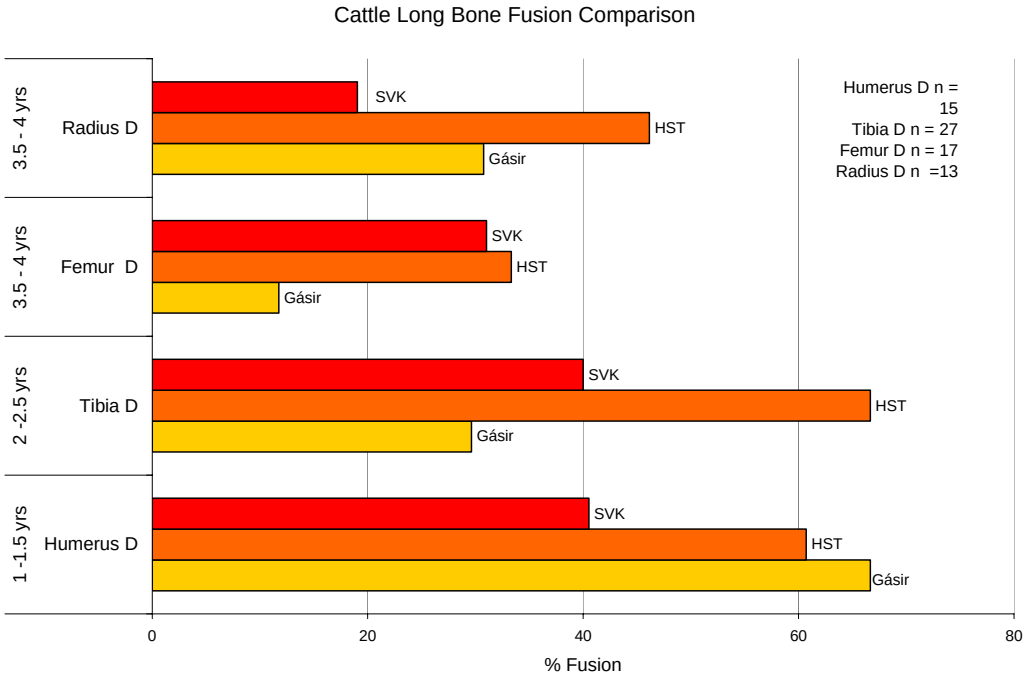

Figure 7 – Cattle long bone comparison
SVK – Sveigakot í Mývatnssveit, HST – Hofstaðir í Mývatnssveit

While a total of 29 cattle tooth rows were excavated from the Gásir market station, only 17 lower jaws can offer some insight into the site's food provisioning strategy. The reason fro eliminating 8 tooth rows from this eruption analysis is mostly post-

depositional factors, such as loss of diagnostic teeth that would make this eruption study too much based on speculation. As can be seen in Figure 8, in the majority of the excavated cattle tooth remains, the animals' death occurred either in the second or third year of life or as an adult. The shortage of jaws of usually common newborn or less than 3 month old calves is notable, and supports the impression provided by the overall low percentage of neonatal or very young juvenile cattle bones. If these old juvenile or young adult cattle are males, they have been raised at considerable expense in fodder (esp. winter feeding). If they are females, they also have lived long enough to consume much fodder, but are only beginning their potential service as dairy cattle. In either case, in the context of a diary herd, these are very expensive animals to raise and slaughter at this stage in their lives.

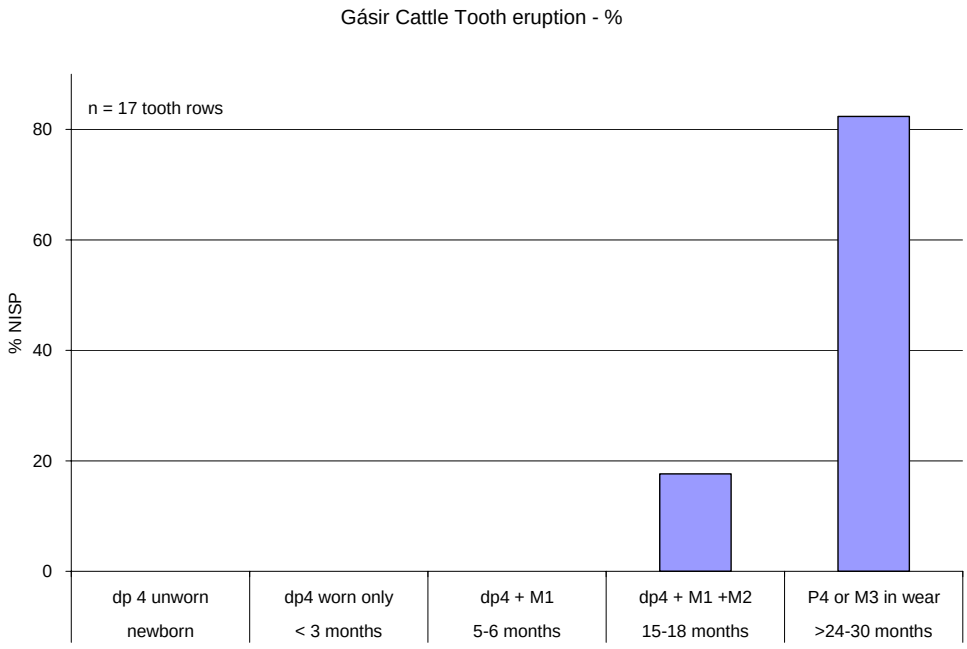

Figure 8 – Gásir Cattle tooth eruption

These mortality patterns indicate not only that Gásir was not itself a dairy farm, but that it was not being provisioned with the most readily available surplus age classes generated by a normal Icelandic dairying economy: very young calves and elderly worn out milk cows. The Gásir cattle bone collection indicates that the site was instead provisioned with high quality young adult cattle meat by nearby farms. Since the farms were not sending their cast-offs to Gásir, but instead made major adjustments to their cattle herding strategy necessary to raise surplus animals to adult or near adult meat weight, it seems

likely that the market at Gásir had a significant impact on agricultural practice in the surrounding district.

Caprines

Figure 9 displays a comparison of tooth wear stages on caprine mandibles with wear stage scores used from Grant (Grant 1982). It is clear from the Gásir sheep mandibles that few show. Wear rates on caprine third molars (M3) suggest that few of these adult sheep were in fact old adults. Rather, the mandibular wear patterns indicate the presence of substantial numbers of young to middle aged adults, without the higher proportion of highly worn teeth characteristic of old ewes or wethers (probably maintained primarily for wool production) characteristic of most larger Icelandic sheep mandible collections, i.e. HST and SVK used for comparison from the NE Icelandic inland sites mentioned already earlier in this report (McGovern 1999, 2002). There were 17 mandibles available for study.

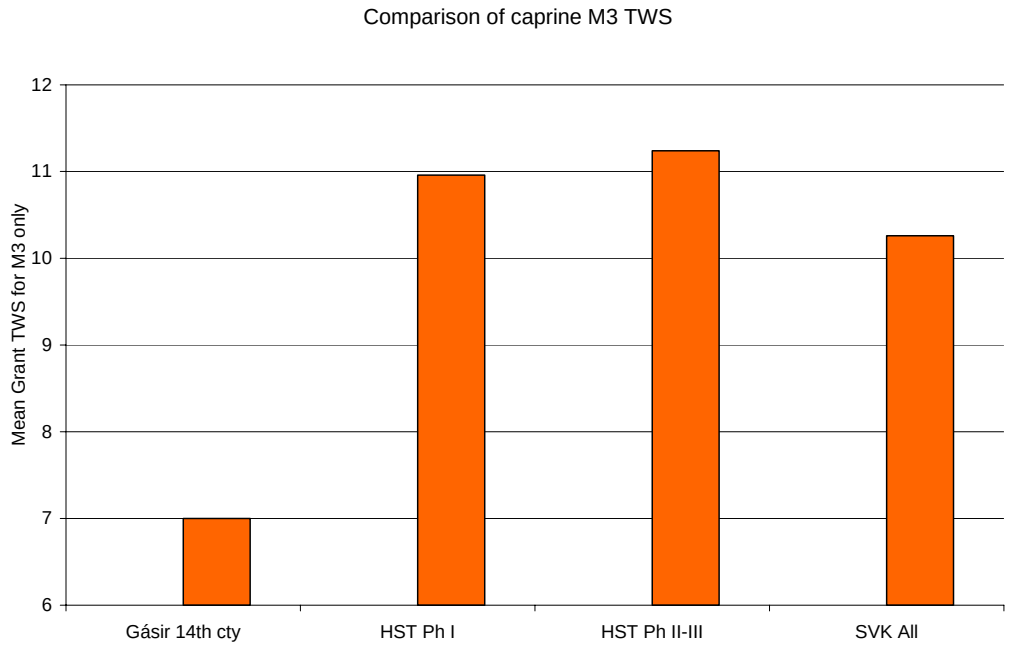

Figure 9 – Comparison of M3 TWS (tooth wear stages)
SVK – Sveigakot í Mývatnssveit, HST – Hofstaðir í Mývatnssveit

The caprine (sheep/goat) long bone fusion comparison (fig. 10, below) shows that the majority of caprines at Gásir were killed between 2 and 3.5 years of age, placing them

into a young adult and thus high quality meat stage. In comparison, caprines at HST (Hofstaðir) and SVK (Sveigakot) saw a slightly different mortality pattern, with higher culling in the first year at and a generally higher proportion of older adults at HST. Tooth wear and long bone fusion patterns suggest that most animals died as younger adults or mature adults. Gásir was not being provisioned with worn out milking ewes or tough old wethers, but with sheep in their prime. Again, the implications for animal production strategies in nearby farms suggest some sort of specialized production.

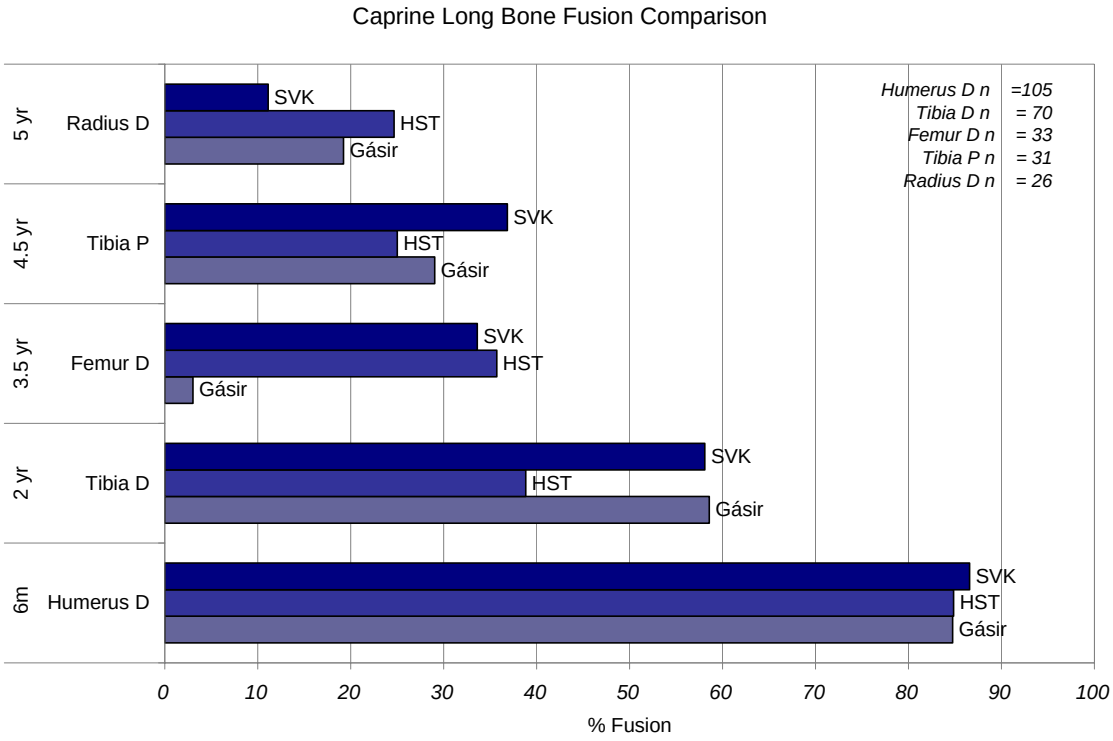

Figure 10 – Caprine Long Bone Fusion Comparison
SVK – Sveigakot í Mývatnssveit, HST – Hofstaðir í Mývatnssveit

Pigs

A considerable number of pig remains are present in the Gásir faunal collection. This is very atypical of late medieval Icelandic and also European (Reichstein 2000) sites. By the 14th Century, the pigs had either disappeared from the Icelandic landscape or become very rare (McGovern in Edvardsson 2006). Some of the bone fragments present could have formed portions of smoked or salted pork shoulder or hams (Perdikaris et al 2002), but some cranial fragments suggest that live pigs (native or imported) were present at

Gásir. The Leverhulme Project is involved in a nitrogen isotope project and has yielded so far mostly data that may indicate the areas of origin of the animals. It is possible that some of the individuals were brought from overseas; a number of cranial (see figure 12) remains indicate that they reached the trading site alive. Further isotopic studies may provide better evidence on the origins of the pigs consumed at Gásir, as well as on their diet.

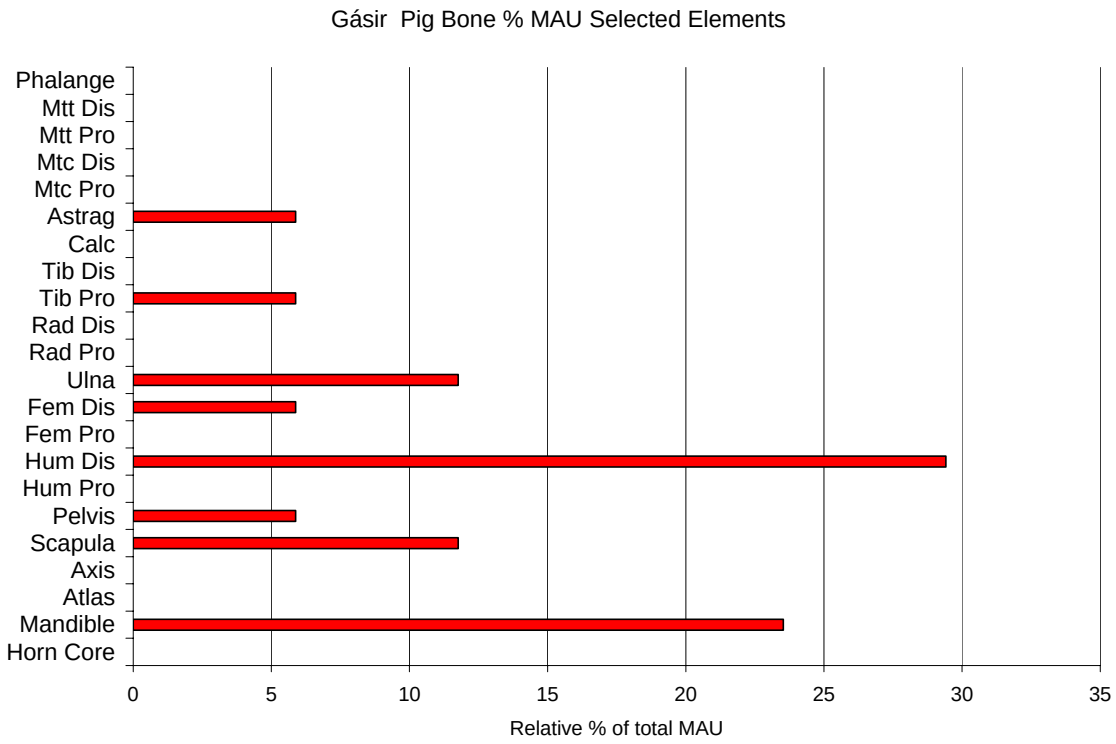

Figure 12 – Breakdown of Gásir meat-bearing elements, MAU % (NISP/frequency in skeleton %).

Figure 12 displays the percentage of the various elements in relation to their frequency in the skeleton. Long bones, and especially femur (80 %) and humerus (>65%) elements were found to have butchery marks on them. The chop marks together with the lack of articulated elements could mean that some pigs were brought to site already proportioned (see Wigh 2002). There were two elements found in contexts 2783 and 637: a chopped femur (have to side it) and the maxialla/calvarium in the first, and a femur shaft element and scapula proximal end in the latter. The elements from context 637 do not display any butchery marks.

Potentially, pig elements from both these contexts could be understood as butchery units (for discussion of pig butchery methods see Prilloff 2000).

Figure 12 - Context 2783
Sus scrofa, adult – maxilla, left side, occlusal view

Dogs

As already mentioned in the summary, there are a total of 15 dog elements present in the Gásir faunal remains. These elements belong to most likely only 11 individuals, as some elements were found in the same context, highly suggestive of one formerly articulated skeleton rather than two individuals.

Reconstructed shoulder heights of small Gásir dogs

Species	Context	Skeletal Element (bone)	Greatest Length (GL) of bone	Size-reconstruction factor (von den Driesch & Boessneck 1974)	Recon-structed shoulder height	Size-Reconstruction Measurement (Harcourt 1974)	Recon-structed shoulder height
Canis familiaris	1551	tibia	90 mm	2,92	26,3cm	(2,92xtl)+9,41	27,2cm
Canis familiaris	2812	humerus	98 mm	3,37	33 cm	(3,43xtl)-26,54	31cm
Canis familiaris	2851	humerus	98,55mm	3,37	33,2cm	(3,43xtl)-26,54	31,2cm

Table 3 – Reconstructed shoulder heights of small Gásir dogs

The discovery of five very small dogs at Gásir is subject to further investigation, but such small "lap" dogs were status items in high medieval Europe (Prilloff 2000) and have been found elsewhere in late medieval Icelandic archaeofauna (Pálsdóttir 2005). As indicated by table 3, these dogs were of lap dog size, slightly larger than a Pomeranian. The small dog from context 2812 is one articulated individual and it is unclear how it was deposited

in a dump-area. The most likely scenario is that it was deposited of after its death. The burnt, regular-sized dog element from context 2452 could be in fact be a sick dog that was thrown onto a midden and the whole dump then burnt to prevent any spreading of disease. Figure 13 demonstrates the small size of the dog's skull which is compared to a specimen at AMNH. It was not clear to which dog race that skeleton belonged to, but it was smaller than medium-sized.

Figure 13 - *Canis familiaris*, context 2812 (left), compared to AMNH dog specimen (right).

Wild Mammals

Apart from a few additional whale and seal elements that could not further speciated, the Gásir Wild Mammal story has not changed from the last few years. The NISP table (Table 1) gives a basic idea of the numbers in wild mammals found at Gásir.

As a reminder, there was a worked **Walrus** (*Odobenus rosmarus*) (fig. 14) tusk that is most likely a remnant of ivory extraction (Harrison et al, 2008).

Figure 14 – Walrus tusk remain.

Whale remains of smaller sized individuals such as pilot whales, narwhal, beluga or porpoise were analyzed and may have constituted food debris. Some larger-sized whale remains that were most likely used for artifact working were also present in the collection. Late medieval cook books include many receipts for young porpoise to be served as high-status dishes, but porpoise and small whales have been consumed in most parts of the N Atlantic since prehistory (Harrison et al in Roberts, 2004).

Seals

Five of the six bones that could be identified to species level (contexts 617, 684, 730, 756, 1622 - mandible) came not from the local harbor seals (*Phoca vitulina*) still plentiful in Eyjafjord but from the ice-riding harp seal (*Phoca groenlandica).* Harp seals are common in Icelandic waters only during periods of heavy drift ice, and have been associated with "little ice age" conditions in the NE (Amorosi 1992, Woollett 2004, Oglivie 1991). While widely consumed in most coastal communities in the N Atlantic, by late medieval times seal meat was usually distained in court cook books as "fit only for sailors". It is possible that the distribution of seal bones at Gásir may provide some hints at class and ethnicity. The one other element analyzed was part of the auditory system (Petrous Bulla) of an indigenous Harbor seal (context 2187).

Birds

Table 4 presents the total number of birds identified to species, grouped by family. The majority of bones come from eider ducks, common along the shore of Eyjafjord today.

Guillemot and Puffin were regularly eaten in Iceland and much of Atlantic Europe, and may have been used seasonally in dried form, prepared similarly to their medieval Atlantic European counterparts (Bond and O'Connor 1999:418). Two swan elements *(Cygnus olor*) were analyzed, found in context 674 and 2871. The two gyrfalcon (*Falco rusticolus*) elements from contexts 756 and 1632 have been discussed in previous reports, but their presence in the high-medieval archaeofauna at Gásir and impact on trade related issues is significant (for more in-depth discussion on the Gásir birds, see Harrison et al 2008).

Identified Bird Species	NISP	% NISP
Raptor	2	2,30
Gyrfalcon (Falco rusticolus)		
Migratory Waterfowl		
Mallard Duck (*Anas platyrhynchos*)	1	1,15
Eider Duck (*Somateria mollissima*)	35	40,23
Mute Swan (*Cygnus olor*)	2	2,30
Red throated diver (*Gavia stellata*)	1	1,15
Anas species (Duck family)	3	3,45
Sea birds		
Murre species (Uria species)	24	27,59
Atlantic puffin (Fratercula arctica)	8	9,20
Razorbill (Alca torda)	5	5,75
Common gull (Larus canus)	1	1,15
Gull species (Larus species)	4	4,60
Unidentified sea bird species	1	1,15
Total	87	100

Table 4 – Identified Bird Species

Fish

As mentioned above, the large majority of the Gásir fish remains can be understood to consist of marine fish species; due to the close proximity with the ocean, but also because the entire collection of fish elements only contained few fresh water species.

Freshwater Fish

As mentioned above, almost all salmonids were speciated as Trout (*Salmo trutta*), and only amount to 25 elements, 24 of which are vertebral. Because several of these contexts were bulk-sampled and then water sieved through 1 mm mesh, it is very safe to assume that the low amount of freshwater fish is a true reflection of presence, or, more accurately, absence of this fish category.

Marine Fish

As indicated by the high number of indeterminate fish bone elements, a large amount of the Gásir fish remains is fragmented beyond speciation. One possible explanation could be application of stone cod hammers used to tenderize dried fish in medieval times. The coastal Gásir gadid distribution no longer demonstrates a pure "consumer" profile (see Harrison in Roberts, 2005). The total Gásir element distribution and especially the premaxilla vs. cleithrum ratio better reflect the site's location within a coastal inlet and indicate that at least a part of the fish remains stem from locally caught gadids.

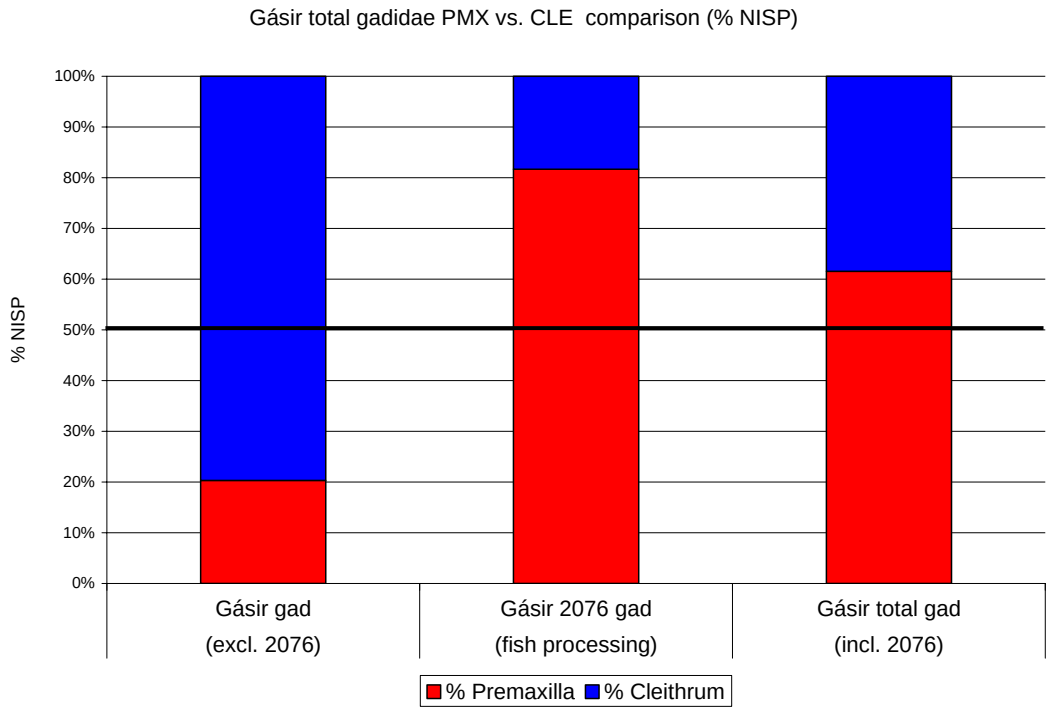

Figure 15 – Gásir gadid comparison of premaxilla (PMX) vs. cleithrum (CLE) proportions

Figure 15 displays the percentages of Premaxillae vs. Cleithra ratios when related to the total amount of analyzed gadid elements. Context 2076 can be understood as fish-

processing deposit, with the fish product not traveling considerably beyond the trading site area, to be consumed relatively soon after the whole fish has been turned into a fillet. The fish processing pattern typically reflects a large amount of skull and cranial fragments, including the premaxilla, while the axial part of the body, including the cleithrum (pectoral region), is absent. The cleithrum travels with the preserved fish and is found at consumer sites, such as HST, HRH and SVK in the Mývatn region (Perdikaris & McGovern, 2003). The first bar in Figure 15 reflects such a Consumer Profile.

The proportion of Premaxiallae vs. Cleithra for the total Gásir site reflects the presence of whole gadid skeletons on site and indicates that fish may have been caught locally and used for consumption. It may not be too far-fetched to assume that at least some of the fresh fish at Gásir only traveled within the market place. The black bar in figure 15 indicates a ratio of 1:1 PMX to CLE ratio reflecting an entire fish/gadid skeleton. Each fish has two premaxilla and two cleithrum fragments. At Gásir, the total gadid PMX vs. CLE ratio indicates the presence of several whole fish skeletons on site.

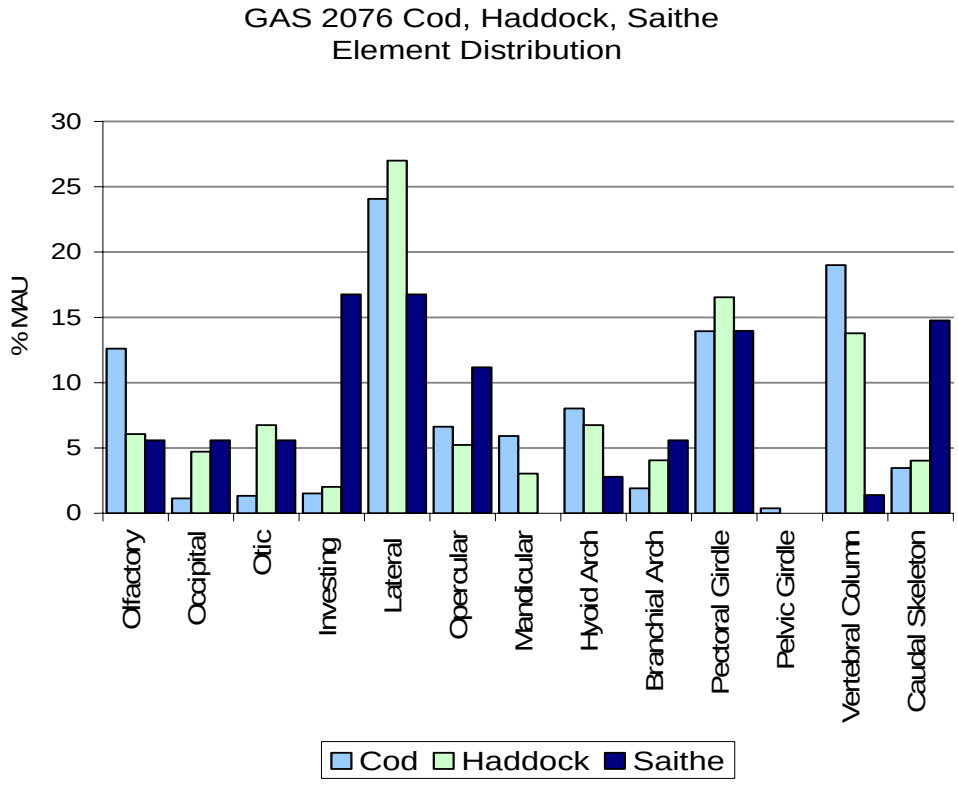

Figure 16 – Element Distribution comparison.
Cod (*Gadus morhua*), Haddock (*Melanogrammus aeglefinus*), Saithe (*Pollachius virens*).

The cod and haddock skeletal element distribution and size reconstruction from the fish midden (context 2076) (figures 16 and 17, respectively) point toward a fresh fish processing at Gásir. Since a large amount of the skull elements from the total archaeofauna were found in one specific location, that context can be viewed as a fish monger's refuse. The cod, haddock, and saithe element distributions from the fish deposit slightly to the NW of the main trading area indicate that there was not really a preference for one gadid species only and that the fish were most likely used for on-site consumption

Since there were only about 100 saithe elements present in the collection, a thorough discussion of this species beyond its skeletal element distribution is not feasible.

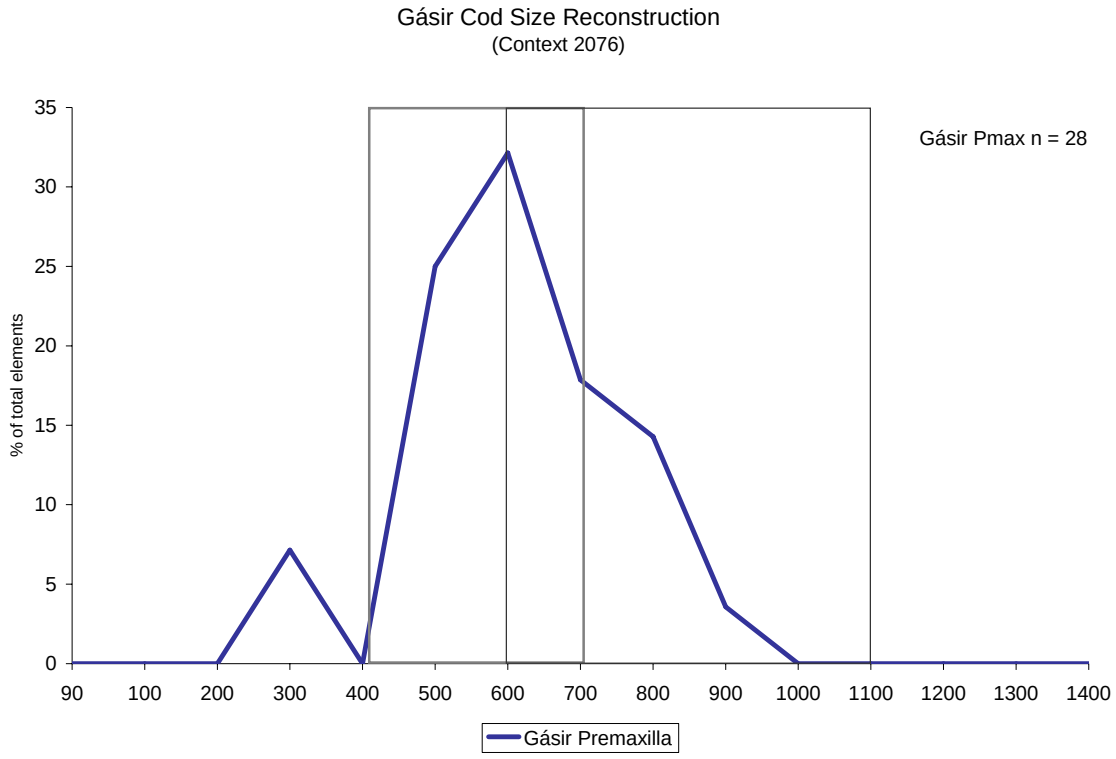

Figure 17 – Gásir Cod Size Reconstruction

Figure 17 displays the cod size reconstruction, and places the measured individuals within a wide size range that cannot indicate specific fish processing for export purposes as it can be demonstrated for other Icelandic coastal sites, i.e. Gjögur and Akurvík in the Westfjords (Perdikaris & McGovern 2008:80). Rather, randomly sized gadids were caught for on-site butchery and consumption within a short period of time.

Craft working

The horse remains are mostly comprised of loose teeth and foot/lower leg fragments. It should be noted that context 220 and context 101 yielded more than 50% (8/15) of the horse bone assemblage present at the site. The nature of preserved horse bone fragments indicates craft working activities rather than horse meat consumption, since the elements found were mandibular, maxillary, or lower limbs. Whale bone: except for the porpoise-size whales, the majority of whale bones found at Gásir bear marks that derive from bone working. The one large whale element collected in 2003 represents a particularly good example for craft working, since it has been drilled.

Figure 18 displays one of the whale bone artifacts that were identified during the final stage of faunal analysis in 2008; two of these pieces (context 1783. 1569) may have been used as clamps and one artifact (context 1806) shows a perforation on its wider end for textile work, either for nets or wool processing (McGovern, CUNY Hunter, NORSEC Bioarchaeology laboratory director, personal communication, February 2009).

Figure 18 – Whale bone artifact – possible clamp (context 1783).

The total number of cattle Horn cores is 25; these rather large cattle horn cores (see figure 19) can indicate on-site horn craft working, however, no clustering of areas with a high frequency of elements could be observed.

Figure 19 – Cattle horn core, cranial view (context 2684)

Foodways and Ethnicity

Beginning around AD 1150-1200, a technique for extracting the marrow from the metapodials (lower leg bones) of sheep and goats spread into several N Atlantic communities, including the Shetlands, Faroes and Iceland (but not Greenland). The bi-perforation technique involves opening two circular holes at each end of the long bone and sucking out the rich marrow (Bigelow 1985). This marrow extraction technique avoids bone splinters in the marrow produced by the earlier Viking age pattern of longitudinal splitting, and has the advantage of retaining a very usefully shaped bone nearly intact for tool use. By the later medieval period, nearly all sheep metapodials in all Icelandic archaeofauna were bi-perforated, and split metapodials are exceedingly rare (by early modern times a folk belief held that splitting metapodials at meals would cause live sheep to break legs in the same place). In England and Continental Europe, this technique remained unknown, and late medieval diners continued to split sheep and goat metapodials in the old fashion. Table 5 presents the proportions of split vs. bi-perforated caprine metapodials from the Gásir collection (including drilling to err on the safe side), documenting the overwhelming use of splitting rather than bi-perforation in marrow extraction. In an Icelandic farm site of the 14th-15th century one would expect to see these proportions reversed. Does this low frequency of bi-perforation reflect non-Icelandic ethnic origins of the residents of Gásir?

Caprine Metapodials				
	Bi-perforated	Split	Other	total
count	8	53	18	7955
%	10,13	67,09	22,78	100

Table 5 – Caprine Metapodials; split vs. bi-perforated.

One caprine metatarsal from context 2943 was at least mono-perforated, which was put in the 'other' category rather than the 'bi-perforated' one.

Radiocarbon Dates and Isotopic Analysis

The Gásir project has collaborated with a large scale international geophysical/archaeological project (Ascough et al 2006) aimed at better understanding variations in Marine Reservoir Effect (MRE) which affect age estimates based on organisms wholly or partly within the marine food web (shellfish, sea weed, marine mammals, sea birds, fish). This large scale project is based at the Scottish Universities Reactor Center in East Kilbride Scotland, and is directed by Dr. Gordon Cook, who kindly provided the data and analysis. The MRE project provided 8 radiocarbon assays on cattle bone, seal bone, and clam shell (Mya sp) from a single context [528]. C13/C14 assays were also carried out at the same time (delta C13%) and N15 assay was carried out on the mammal bone.

Table 6 presents these data, displaying the laboratory code, source material, radiocarbon years BP, one standard deviation, and the Carbon and Nitrogen isotopic assay results.

Gásir Radiocarbon Results March 7 2006 (courtesy Gordon Cook)						
SUERC #	Context	material	Radiocarbon years BP	sd	delta C13	delta N15
8635	Context 528	cattle bone	795	35	-22,5	2,8
8634	Context 528	cattle bone	595	35	-22,1	2,2
8629	Context 528	cattle bone	645	40	-21,8	7,3
8633	Context 528	seal bone	1145	35	-12,7	14,4
8638	Context	clam	1165	35	0,5	

	528	shell				
8639	Context 528	clam shell	1305	35	1,9	
8637	Context 528	clam shell	1175	35	2,5	
8636	Context 528	clam shell	1200	35	2,8	

Table 6 – Carbon and Nitrogen isotopic study results.

As expected, the marine shell fish and the seal bone show high delta C13 values (values above -15/-16% indicate marine food web participation) and radiocarbon dates far too old for the medieval site. The three cattle bones (SUERC 8635, 8634, and 8629) produce fully terrestrial delta C13 values, and radiocarbon dates that are plausible given the documentary and artefactual dating evidence. Figure 20 graphs the calibration curves for these three cattle bone samples and the five calibration curves from the churchyard samples (SUERC 22079, context 2003; SUERC 22080, context 5126; SUERC 22081, context 5192, SUERC 22082, context 5224; and SUERC 22083, context 5146;).

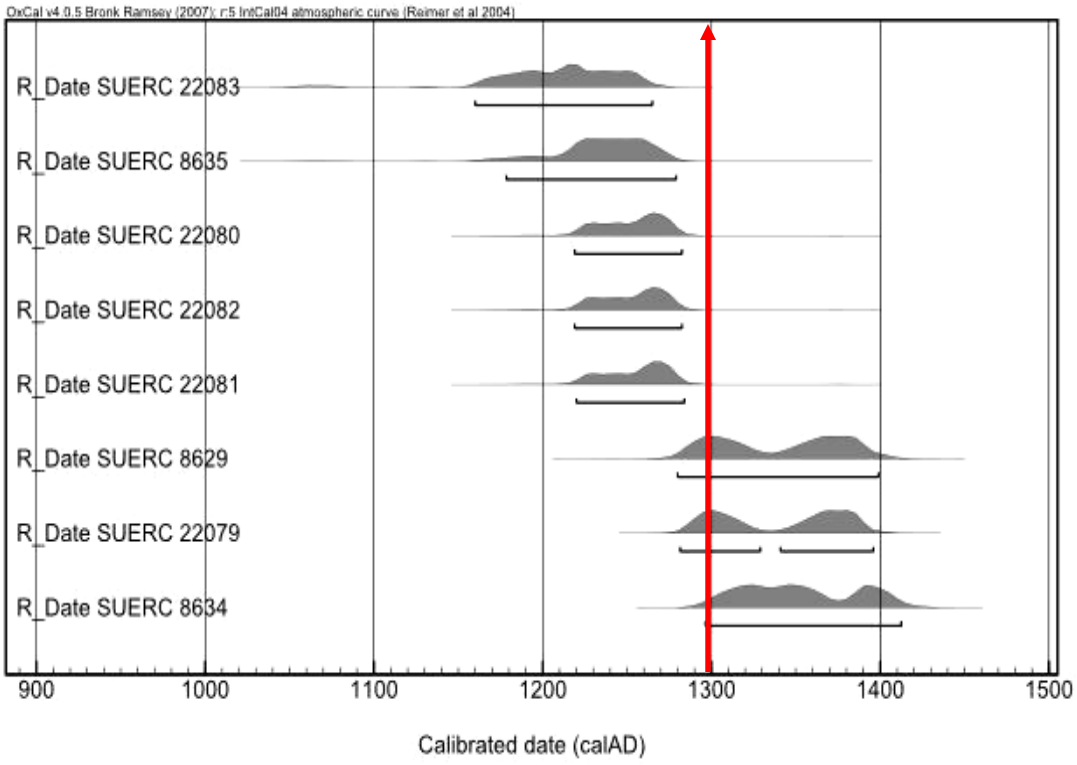

Figure 20 - Radiocarbon calibration, displaying data from Area A (SUERC 8629, 8634, 8635) and Area B (SUERC 22079, 22080, 22081, 22082, 22083).
(OxCal v. 4.0.5 Bronk-Ramsey 2007) (r.5 IncCal04 atmospheric curve (Reimer et al. 2004))

From the area A analysis, two dates (SUERC 8634 and 8629) group nicely within the 14th century, which probably accurately reflects the period of deposition of the (528) context and agrees with the current tephra evidence (AD 1300 tephra indicated by arrow). The outlier (SUERC 8635) appears to be a residual bone fragment probably redeposited in later layers from an earlier context. This earlier 13th c date does provide some confirmation of an earlier occupation at Gásir below the 1300 tephra horizon suggested by some of the documentary sources. The recent C14 analysis on area B archaeofauna offers dates from a series of contexts, with one (SUERC 22079) falling into the 14th century and coinciding with terminal use of the church (Vésteinsson, personal communication, Sept. 22, 2008). SUERC 22080, 22081, and 22082 date the contexts to about 1250 – 1300 and coincide with the residual data from area A context 528 (SUERC 8635). The last date (SUERC 22083) is associated with initial church building activities, gives an earlier 13th c date. Since the N15 values from the churchyard dates are still forthcoming, this data will be presented as soon as made available and discussed together with C13 values.

The N15 values for the three cattle bones from area A indicate the animals had somewhat different grazing histories in the years prior to their slaughter and consumption. The very low N15 values are similar to the values produced from nearby Mývatnssveit sites with highland low-arctic grazing, while the higher N15 value suggests habitual grazing on richer lowland vegetation. While more assays are clearly desirable, these diverse values suggest that Gásir may have drawn upon a wide catchment area for its provisions.

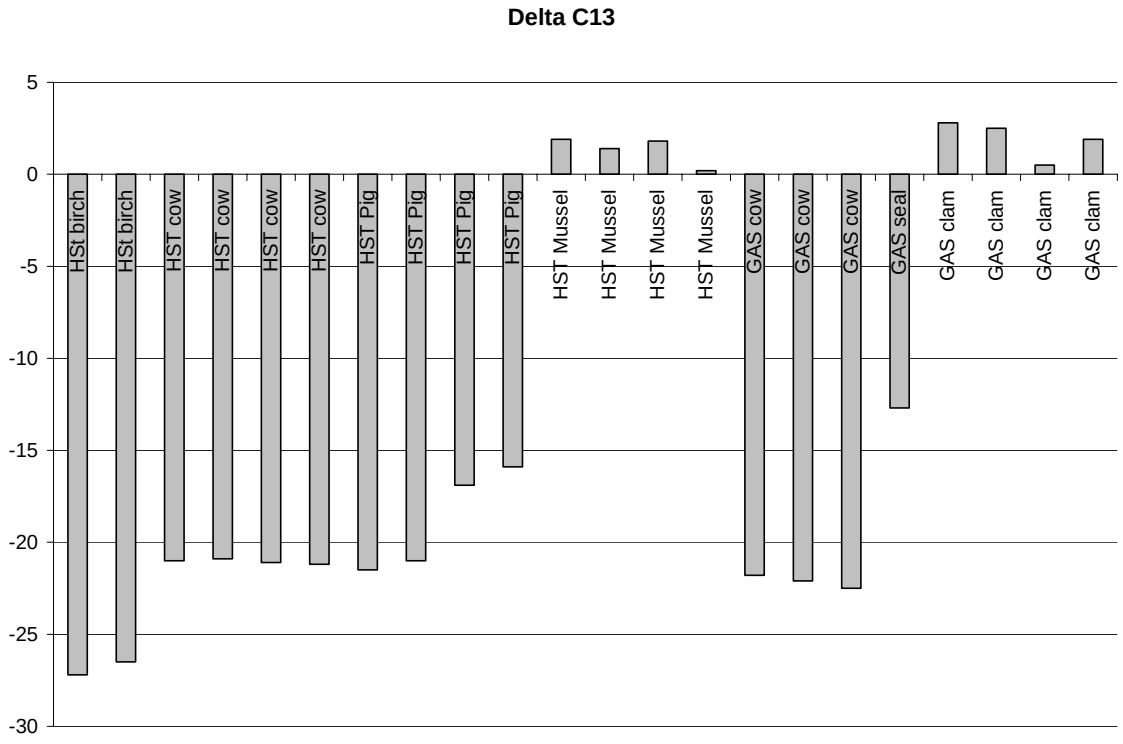

Figure 21 – Delta C13 comparison: HST (Hofstaðir) and Gásir marine vs. terrestrial food web.

Figure graphs the Gásir Delta C13 values and provides a comparison to a similar set of isotopic assays from Hofstaðir in Mývatnssveit. Note the strongest terrestrial signal (lowest delta C13 values) from birch twigs, with cattle and most (but not all) pig bones showing a terrestrial herbivore signature. The higher values for two of the Hofstaðir pigs may reflect their consumption of some marine carbon, or possibly large amounts of freshwater fish offal. The Gásir seal falls predictably within the marine food web values.

Conclusions and Further Work

The compiled archaeofauna from Gásir serves to demonstrate its considerable potential for zooarchaeological research in Iceland, and suggests a number of areas where zooarchaeology may usefully contribute to a better understanding of this complex site. The total Gásir archaeofauna has been analyzed, at least at the most basic level i.e. element representation, species present, taphonomic signatures (Harrison in Pálsdóttir & Roberts et al. 2007). For several species, a much more thorough research has taken place already; i.e. age at death reconstructions for cattle and caprines, cod size reconstruction,

presence of meat-bearing bones, isotopic studies on fauna participating in the marine and terrestrial food webs,

Beyond the basic archaeological issues associated with individual contexts and phases, Zooarchaeology can contribute to some of the larger questions concerning the role of Gásir in Iceland's history.

- **Provisioning**: How was the settlement at Gásir provided with food? As the site was definitely not primarily a farm or fishing station, it needed to be supplied from outside sources. The new data from the fish monger pit/context 2076, indicates that at least some of the processed fish products indicated by the site wide gadid element distribution pattern may have been provided directly by the Gásir market place. From historical data we can hypothesize many sources of supply, but the current bone sample suggests that dried fish, cattle and sheep meat played a major role in provisioning the settlement. While it is unclear at the moment if cuts of meat were imported to Gásir, it is now certain that at least some animals were brought to the site whole and probably slaughtered nearby. The current lack of calf and lamb bones suggests that the settlement did not in fact constitute a normal, dairy-oriented, wool producing late medieval Icelandic farm.
- **Integration with Rural Economy**: What impact did the specialized settlement at Gásir have on the rural economy of the surrounding area? How did the presence of relatively wealthy consumers affect the economic decision making of local farmers of different wealth and rank? Who might have been the owner of the typically medieval lap-dogs that somehow found their way to a very remote place? The archaeofauna suggests that the site was being mostly provisioned with older juvenile and young adult cattle and sheep, and not with cast off by-products of the normal farming economy (very young animals and very old ones). A sampling project of farm midden in the same district that has already begun (Harrison & Roberts 2007, Harrison 2006, 2008) may provide important comparative information. The isotope data mentioned above (figures 20 and 12,

Table 6) confirm the fact that a region wide survey of midden materials may be needed to trace origins of domesticates consumed at the trading site.

- **Ethnicity and Foodways**: In many respects the Gásir archaeofauna is very atypical for late medieval Iceland: cattle consumption comparable to rich manors in the SW but without the clear dairying profile characteristic of these elite farms. In the details of butchery and consumption of animals there are messages about foodways and ethnicity: does the butchery pattern of sheep at Gásir reflect the dining habits of native Icelandic or foreign consumers? Again, the small and seemingly out-of-place lap dogs should be mentioned. Did a foreign dignitary bring them into the market realm as a way of connecting Gásir with the larger international medieval community?
- **Seasonality**: The animals brought to the trading site reflect the idea of the seasonality of the market activities. The almost complete absence of new born calves and lambs (almost exclusively born in May) reflects an arrival of most of the occupants later in the summer.
- **Fish processing & Fish Consumption**: As has been demonstrated in this current report, Gásir was not a fishing station, and thus also does not bear clear traces of the market's involvement with the stock fish export prevalent in medieval Iceland (Perdikaris et al). There is, however, a fish story to be found at Gásir: that of an on-site fish monger providing people form the market and maybe the larger community with fish that has been processed on-site.
- **Status**: With still more research necessary that focuses on this part of the Gásir faunal and mostly human story, certain status indicators have already emerged that offer a place to start. The gyrfalcon and seals provide an initial idea of the socially diversified group of people present at late medieval Gásir. The small dogs may be indicative of the presence of some higher status individuals (and/or maybe their wives/daughters) during the market season. Whether these potentially important persons come from abroad or from nearby Möðruvellir or even the bishopric at Hólar (Kristjönudóttir 2005) may not be easily understood. The provisioning of Gásir with prime-meat mutton and beef does indicate that

this institution on its own is given a lot of attention and focus by the surrounding community.

- **Isotopic studies and domesticates size reconstructions:** It is suggested that more carbon and nitrogen and potentially strontium isotopic analyses (i.e. for establishment of origin of the Gásir dogs) be done on the Gásir archaeofauna to understand better the origins and lifeways of the animals and their owners as well as achieve a more refined phasing of the site. The size reconstruction may further give indication about the animal's health and breed.

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