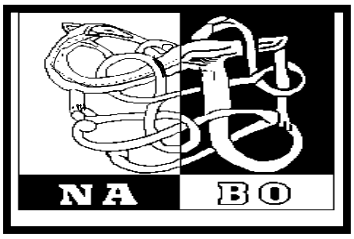

Interim Report of faunal analysis from the 2005 Excavations at Gásir, Eyjafjörður, N Iceland

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Summary

Archaeological excavations at the site of Gásir near the modern city of Akureyri were started in 2002 and directed by Howell Roberts of *Fornleifastofnun Íslan*ds (Archaeological Institute Iceland, FSÍ) for *Minjasafnið á Akureyri* (Akureyri Museum). The ongoing 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. Analysis of the 2005 zooarchaeological remains was carried out by Ramona Harrison. The 2005 excavations were part of a larger scale, long term project which aims to investigate the remains of the early trading center at Gásir, and to place the site in a regional and historical context. Excavation work at Gásir is to be continued and this report is thus only a working paper to be updated and replaced as more material becomes available for study. The 2005 archaeofauna continues patterns in mammal bone distribution observed in previous years, and the addition of a context bearing large amounts of marine fish bone allows an expansion of our understanding of provisioning and possible fishing activities at Gásir. Radiocarbon dates and associated Carbon and Nitrogen isotopic assays carried out on mammal bone and marine shell by Dr. Gordon Cook (Scottish Universities Reactor Center) provide both chronology and some indication of differential grazing patterns in stock brought to Gásir.

Zooarchaeological data from the years 2002 through 2005 have been used for this report, offering a total NISP (Number of Identified Species) of **8,484** out of a TNF (Total Number of Fragments) of **16,292.** The species present include domestic cattle, sheep, goat, horse, and pig as well as seal, whale, bird and fish remains. The 2003 collection contained a walrus tooth (context 101), dog bones (contexts 655, 617, 684,730,756), and one gyrfalcon bone (context 756). The array of "unusual" bone has been increased with **2004**'s **gyrfalcon** femur (context 1632) and a very small and extremely curved tibia (1551) most likely belonging to a dog of **lap dog size**. Dog gnawing is visible on bones, and the 2004 excavation added 4 more dog elements (total of 7) as further evidence for

the presence of the species (additional 2004 dog elements were found in contexts 1573 and 1476).

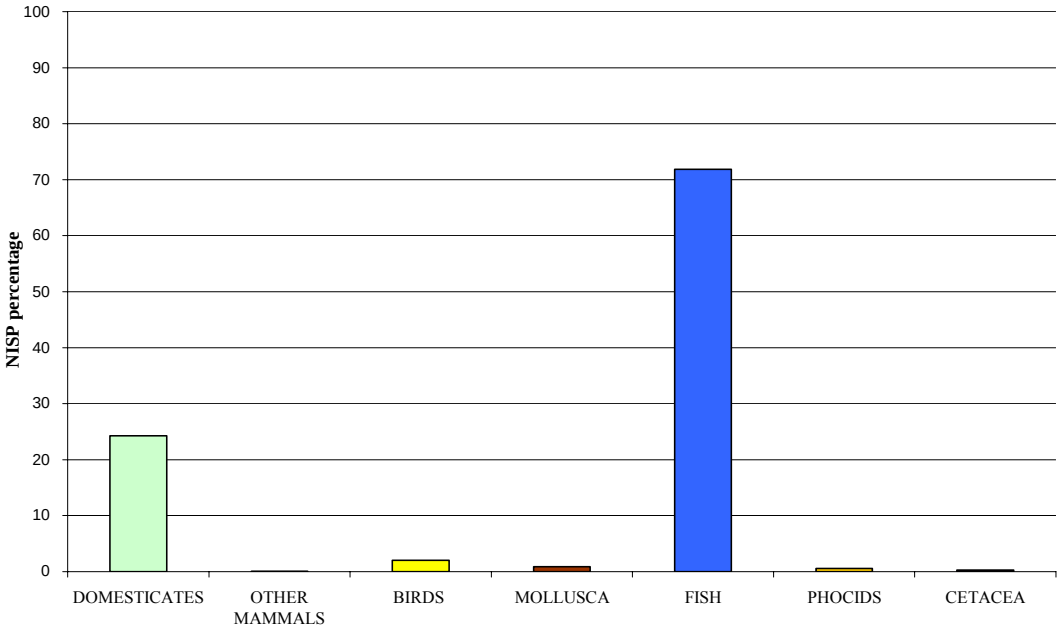
Cattle bone is very abundant, with a caprine/cattle ratio of about 1.97 (2) caprine bone for every cattle bone (vs. ca 20 caprine per cattle bone in contemporary small rural sites). The high percentage of cattle bone is similar to very high status late medieval sites in S Iceland (Viðey and Bessastaðir 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. In 2005, a particularly large amount of fish remains were analyzed, and as Fig. 1 demonstrates, account for more than 70 % of the total archaeofauna. While more analysis is required and likely to increase the number of identified fish species in relationship to domesticates, the analyzed fish elements are of a large enough number to indicate a certain form of gadid management.

The **fish remains** analyzed in 2003 were almost completely postcranial, with hardly any thoracic vertebrae present. In 2004, the number of skull and thoracic fragments was somewhat increased, but not enough 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 preserved fish rather than whole fresh fish. Marine fishbone analysis from 2005 deposits (especially context 2076) shows a different pattern: a large proportion of cranial elements vs. axial elements, thus indicating a consumption of fresh marine fish on site. The dense fishbone deposit (2076) may be an area of preparation of freshly caught fish for preservation (Fig 14).

Salmonids, most determined to be Trout, were found in a number of contexts (1142, 1188, 1948), excavated in 2004 (Floatation results) and 2005. There is at least one river close to the trading station that is currently used for trout fishing (Gásir is located at the southern edge of the Hörgá River Delta), and the presence of these species is not a great surprise (Roberts, 2002 & (a). The Salmonids account for only .25 % of the total NISP, and consist of only vertebrae.

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. Four large cattle horn cores from very large were found in 2005, and may indicate horn craft working (McGovern, personal communication, May 2006).

Fig 1- NISP Categories



Overview of Species Present

Table 1 presents the 2002-2005 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. As opposed to the 2002 and 2005 yield, dog bones are present in the 2003 and 2004 collection, coinciding with characteristic canine tooth marks that are present on a number of bone fragments in the collection.

Table 1 Gásir 2002-2004	Aggregated Fragment Count				
Taxon	2002	2003	2004	2005	total
Domestic Mammals					
Cattle (*Bos taurus dom L*)	255	296	66	61	678
Horse (*Equus cab. dom L.*)	5	5	2	1	13
Pig (*Sus scrofa dom L.*)	2	12	8	2	24
Dog (*Canis fam. L*)	present	3	4	no evid.	7
Goat (*Capra hircus dom* L)	2	9	1	1	13
Sheep (*Ovis aries dom* L)	45	166	13	14	238
Caprine	296	487	163	141	1088
total Caprine	343	662	177	156	1338
total Domestic	605	978	257	220	2061
Wild Mammals					
Harp Seal (*Pagophilus groenl.*)	0	4	1	0	5
Small seal	4	6	0	1	11
Seal species	5	2	8	16	31
total Seal	9	12	9	17	47
Small Cetacean	1	7	2	0	10
Large Cetacean	1	1	1	0	3
Whale species	0	8	4	1	13
total Whale	2	16	7	1	26
Arctic fox (*Alopex lagopus*)	0	4	0	1	5
Walrus (*Odobenus rosmarus*)	0	1	0	0	1
Birds					
Gyrfalcon (*Falco rusticolus*)	0	1	1	0	2
Mallard (*Anas platyr.*)	0	1	0	0	1
Eider duck (*Somateria moll.*)	0	26	3	3	32
Guillemot family (*Uria* sp.)	1	8	5	0	14

Puffin (*Fratercula arctica*)	0	2	3	0	5
Fulmar (*F. glacialis*)	0	0	0	0	0
Gull species (*Larus* sp.)	0	1	0	3	4
Razorbill *(Alca torda*)	0	2	1	2	5
Swan (*Cygnus olor*)	0	1	0	0	1
Bird species indeterminate	23	41	7	36	107
total Bird species	24	83	20	44	171
Fish					
Cod (*Gadus morhua*)	9	2	75	341	427
Haddock (*Melanogr. aeglef.*)	10	30	36	138	214
Pollack *(Pollachius virens*)	0	2	0	9	11
Atl. Halibut (*Hippoglossus. hipp*)	0	3	0	0	3
Gadid sp	14	8	250	792	1064
Trout (*Salmo trutta*)	0	0	3	16	19
Pleuronectiformes	0	0	0	1	1
Salmonid species	0	0	2	0	2
total Fish species identified	33	45	366	1297	1741
Fish species indeterminate	278	1010	804	2262	4354
Total Fish species	311	1055	1170	3559	6095
Mollusca					
Periwinkle (*Litt*. l.)	0	1	1	0	2
Clam (*Mya* sp.)	0	36	3	0	39
Moll. Species	0	0	28	9	37
total Moll. Species	0	37	32	9	78
total NISP	951	2186	1495	3852	8484
Large Terrestr. Mammal	188	354	108	82	732
Medium Terrestr. Mammal	493	592	353	282	1720
Small Terrestr. Mammal	0	8	4	1	13
Unidentified Mammal Frag.	580	185	2199	2379	5343
total TNF	2212	3325	4159	6596	16292

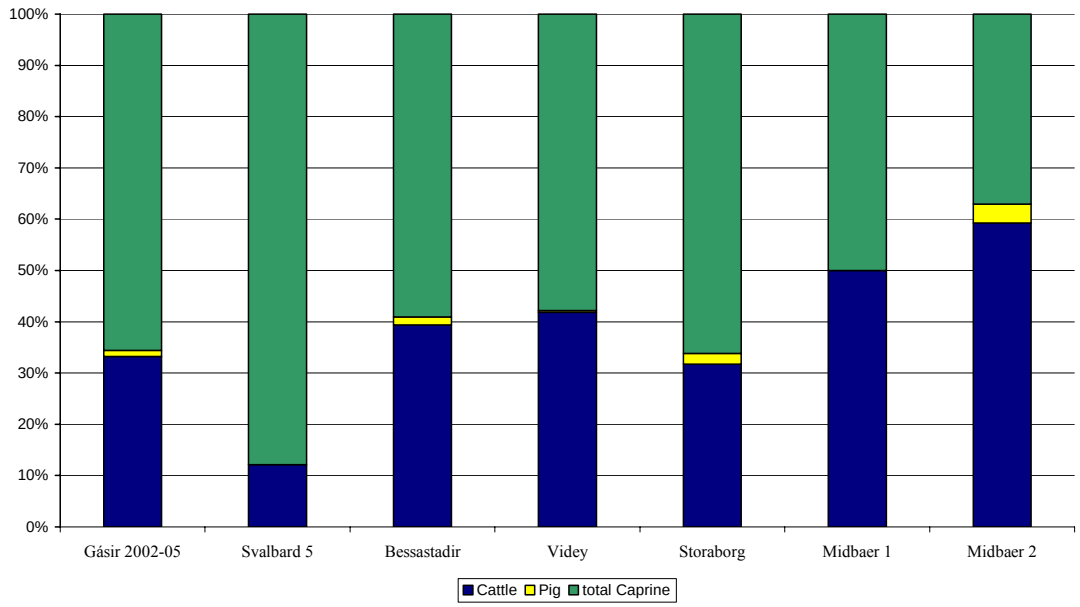
Domestic Mammals

Table 2 presents the relative Percentage of the domestic mammals for 2002-2005 contexts. There is an overall decrease in cattle bone vs. caprine bone. The total ratio emerging from four years of excavation: caprine/cattle = 1.97 (1.82 in 2003) which can be reasonably rounded to a ca. 2:1 ratio of caprine to cattle. The latest sheep/goat ratio is now 18.31, consistently indicating that goats were a minor portion of the collective caprine category.

Table 2 Gásir 2002 - 2005 Relative %					
Taxon	2002	2003	2004	2005	2002-2005
Bos taurus	42,15	30,27	25,68	32,91	32,91
Equus caballus	0,83	0,51	0,78	0,63	0,63
Canis familiaris	0,00	0,31	1,56	0,34	0,34
Sus scrofa	0,33	1,23	3,11	1,17	1,17
Ovis aries	7,44	16,97	5,06	11,55	11,55
Capra hircus	0,33	0,92	0,39	0,63	0,63
Ovis/Capra sp.	48,93	49,80	63,42	52,77	52,77

The high ratio of cattle to caprines (1:2) can be compared to other late medieval (14th – early 16th Century (Icelandic archaeofauna (Figure 3).

Fig. 3 - Late Medieval Iceland Major Domesticates (%)



In figure 3, Gásir 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, the monastery on Víðey in Reykjavík (VID LM), a middle ranking S coastal farm Storaborg (STB E) and two phases of a midden deposit associated with the small farm Miðbaer on the island of Flatey in Breidafjorð in the NW (Amundsen in press). The high cattle percentages for this small farm on Flatey are somewhat deceptive, as they reflect the extremely limited pasturage available on the island and a clear decision to use most available pasture for cattle raising (thus the graph actually reflects fewer sheep rather than more cattle). In general, higher percentages of cattle on most late medieval sites reflect availability of high quality pasture, high social status, or both. The closest matches with the Gásir domestic mammal pattern are in fact with the very high status manor of Bessastaðir in the SW, and the middle ranking S coastal farm Storaborg (STB E).

Figure 4 - Late Medieval Major Taxa NISP (%)

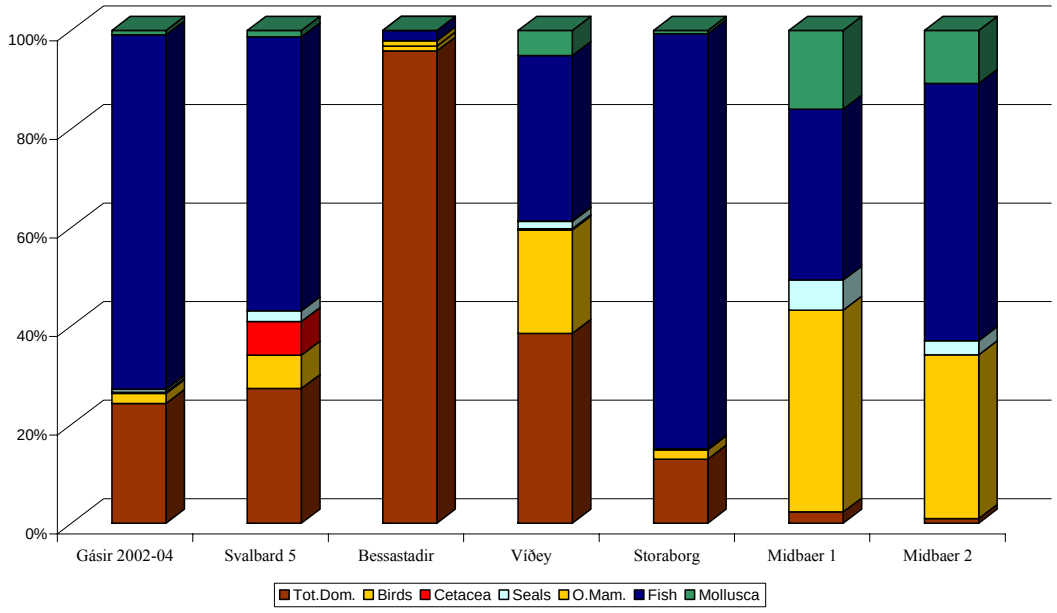


Figure 4 makes use of the same comparative archaeofauna to present the larger picture of the whole collection, regionally comparing wild species and domesticates. From the complete NISP collection, it seems that the middle ranking S coastal farm Storaborg (STB E) offers the most resemblance in total distribution of faunal remains recovered.

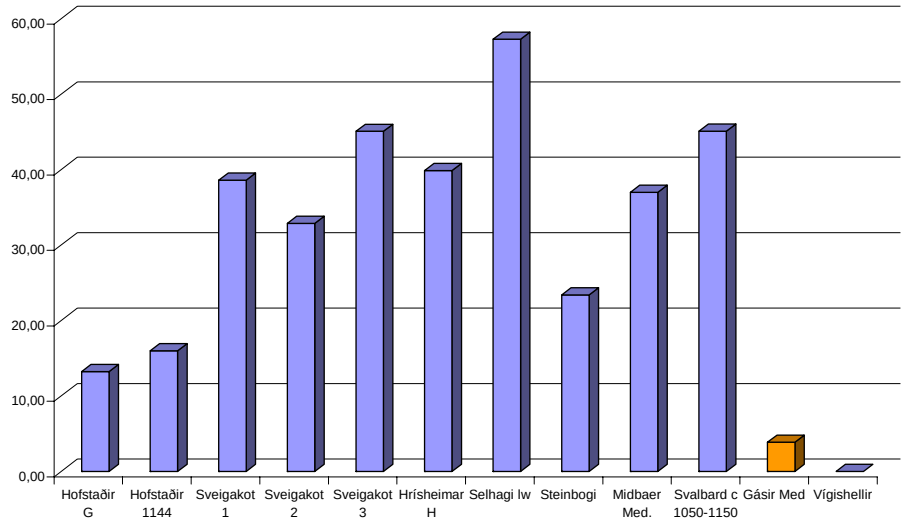
The total archaeofauna in 2004 was more likened to the monastery on Víðey in Reykjavík (VID LM), which in 2005 still shows similarities, but not to the same extent as STB E.

Reconstructing Domesticate Mortality Patterns

Cattle

Figure 5 illustrates the relative percentage of neonatal (newborn) calf bones in a range of Viking-Medieval Icelandic sites, illustrating the normal range of variation from ca 15-50% of the total cattle bone count. 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 is thus very uncharacteristic of most Icelandic cattle collections, suggesting a different pattern of management or consumption.

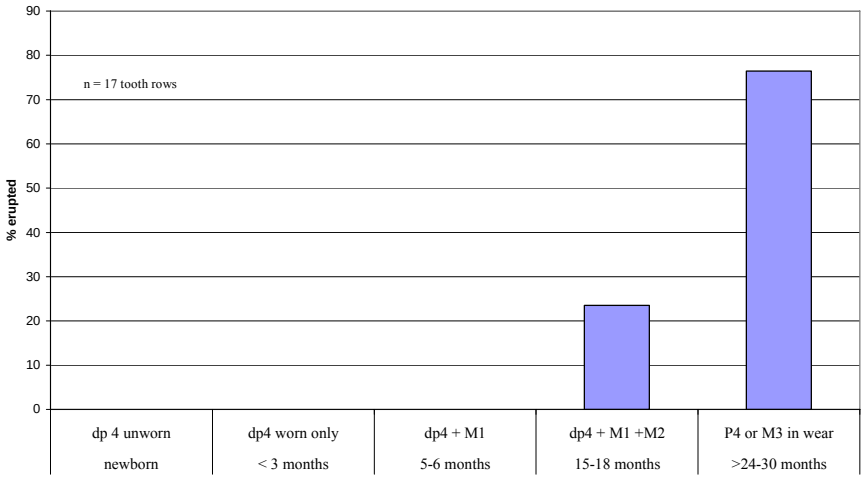
Figure 5 - Medieval Iceland - NN comparison (%)



The Gásir excavation has produced a total of 17 cattle tooth rows that offer some insight into the site's food provisioning strategy. As can be seen in Figure 6, in the majority of the excavated cattle tooth remains, the animals' death occurred either in the second year of life or as an adult. The shortage of jaws of usually common newborn or less than 3

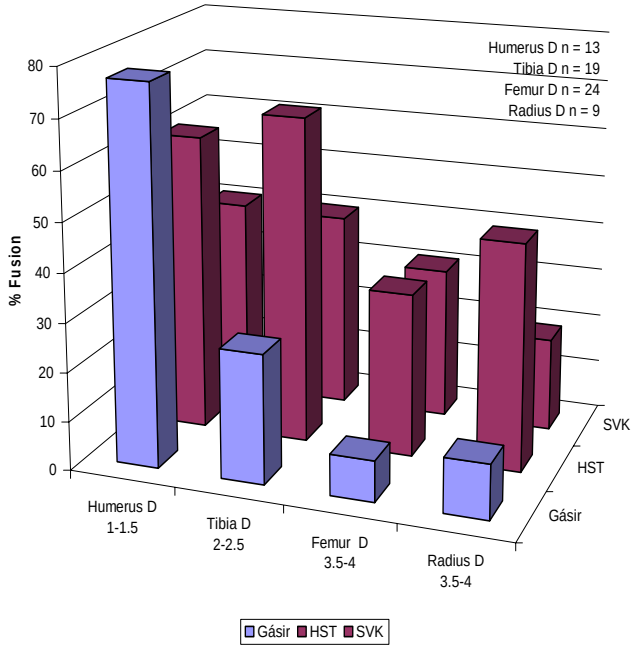
month old calves is notable, and supports the impression provided by the overall low percentage of neonatal or very young juvenile cattle bones. If these old juvenile or young adult cattle are males, they have been raised at considerable expense in fodder (esp. winter feeding). If they are females, they 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.

Fig 6. Gásir Cattle Tooth eruption (%)



The cattle long bone fusion proportions (figure 7) indicates that at late 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 yrs 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).

Figure 7 - Cattle Long Bone Fusion comparison



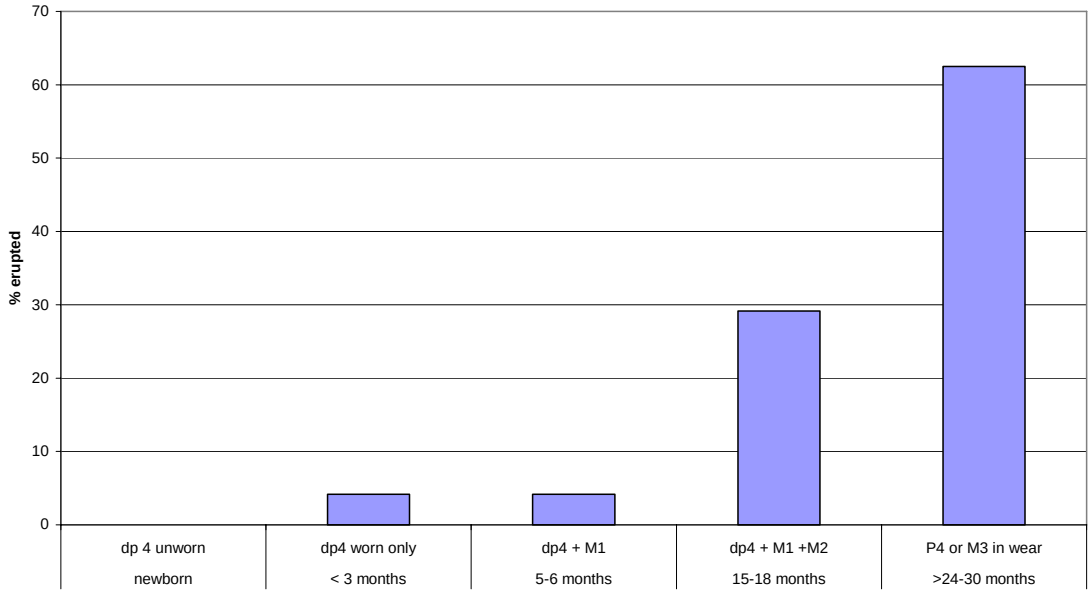
These mortality patterns indicate not only that Gásir was not itself a dairy farm, but that it was not being provisioned with the most readily available surplus age classes generated by a normal Icelandic dairying economy: very young calves and elderly worn out milk cows. The Gásir cattle bone collection 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. The nature of this impact and the linkage of Gásir with its sustaining rural hinterland are potential research questions for wider investigation.

Caprines

Figure 8 shows the pattern of tooth eruption in the caprine tooth rows (mandible and maxilla) from the Gásir excavation. Almost 60 % of the caprines were killed at an age of > 34 months, with full adult dentition in wear. Wear rates on caprine third molars suggest that few of these adult sheep were in fact old adults. The current tooth eruption and wear

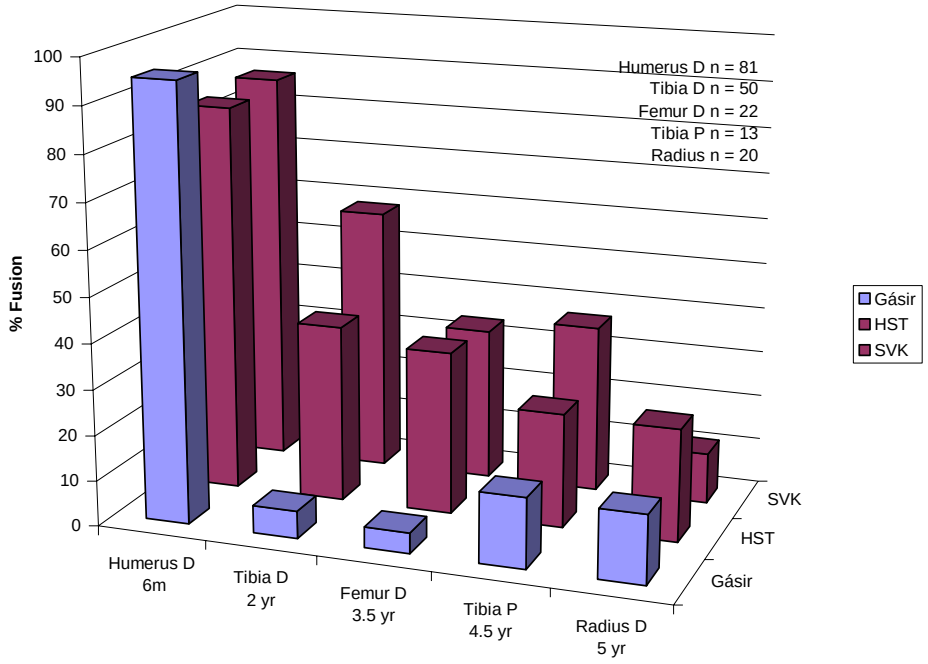
data for the Gásir caprines suggests provisioning with animals ranging from older adolescents to younger adults. Mandibular wear patterns thus far indicate the presence of substantial numbers of young to middle aged adults, without the higher proportion of highly worn teeth characteristic of old ewes or wethers (probably maintained primarily for wool production) characteristic of most larger Icelandic sheep mandible collections. Further analysis of caprine tooth eruption and wear will be carried out as sample size increases. Currently, there are 24 maxillae/mandibles available for study.

Fig. 8 - Gásir Caprine Tooth Eruption



The caprine (sheep/goat) long bone fusion comparison (figure 9) shows that the majority of caprines at Gásir were killed between 4.5 and 5 years of age, placing them into a fully adult stage. In comparison, caprines at HST (Hofstaðir) and SVK (Sveigakot) saw a slightly different mortality pattern, with higher culling in the first year and a generally higher proportion of older adults. Tooth eruption and 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 9 - Caprine Long Bone Fusion Comparison



Pigs

A considerable number of pig remains are present in the 2002-05 faunal collection. This is very atypical of late medieval Icelandic sites. By the 14th Century, the pigs had either disappeared from the Icelandic landscape or become very rare. Some of the bone fragments present could have formed portions of smoked or salted pork shoulder or hams, but some cranial fragments suggest that live pigs (native or imported) were present at Gásir. A collaborative pig DNA project now underway with the University Museum, U. of Pennsylvania Ancient Biomolecules laboratory, comparing ancient DNA from pigs across the N. Atlantic may help determine the origins of the Gásir medieval pigs.

Dogs

As already mentioned in the summary, there are a total of 7 dog elements present in the Gásir faunal remains. Context 1551 offered a canine tibia most likely belonging to an individual of **lap dog size**. Size reconstruction according to van den Dreisch (GL * a factor of 2.92) the dog's shoulder height should be at around 262.8 mm or 26.3 cm. The presence of this very small dog at Gásir is subject to further investigation, but such small

“lap” dogs were status items in high medieval Europe and have been found elsewhere in late medieval Icelandic archaeofauna (Pálsdóttir, 2005). The Gásir 2005 archaeofauna has not yielded any canine elements or canine-chewed elements. One reason could be that the excavated areas were not accessed by dogs.

Fig.10 Lap dog size Tibia found in 2004

Wild Species

Walrus

Fig. 11 Walrus tusk fragment

The walrus canine (tusk) fragment found in context 101 was most likely brought onto the site as an extracted but unworked tusk, as there is no evidence of butchered walrus post cranial remains or of the characteristic maxillary fragments remaining from tusk extraction so prevalent in Greenlandic collections (McGovern 1985). After the tusk was expertly extracted from the animal’s jaw at some distant kill site (Greenland, arctic Norway, or just possibly on the drift ice north of Iceland) the tusk was brought to Gásir and the hollow end of the tusk root was cut off with a saw (probably a typical medieval shallow bladed backed bone working saw, as the cuts come from at least two sides rather than straight across). The solid tusk ivory was then either transferred elsewhere whole or further cut up for on site craft working. The tusk came from a medium sized adult walrus.

Whales

Whale bone fragments at Gásir fall into two somewhat overlapping categories- those showing signs of working as raw material for artifacts, and those suggesting provisioning with whale meat. Most fragments are the sort of small chips and cut offs indicative of craft work, but several rib fragments from small whales (pilot whale, narwhal, beluga) or porpoise are also interpretable as food debris (contexts 101, 223, 528, 547, 577, 1694, 1284, 1856). Three of these rib bones come from immature individuals (two from context 101, one from context 571). Other whale species elements consist largely of vertebrae. The large cetacean vertebra found in context 1714 represents potential use as a butchery block, as it shows multiple chopping marks on its surface (fig 12). 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.

Fig.12. Large whale vertebra – context 1714
possibly used as butchery block

Seals

Seal bones found at Gásir include both adults and newborn young (context 282). 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 (*P vitulina*) still plentiful in Eyjafjord but from the ice-riding harp seal (*Pag. groenl.*). 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). Various young seal elements were found in context 1948, while 1978 contained the arthritic phalanges of an older individual (figure 13). This condition is fairly common in seal species.

Fig. 13 – Phalanges 1-3 (r. to l.) with signs of arthritis

Birds

Table 3 presents the 2003 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. One swan element (Cygnus olor) was analyzed, found in context 674.

Table 3: Identified Bird Species	Absolute #	%
Raptor	2	3
Gyrfalcon (*Falco rusticolus*)		
Migratory Waterfowl		
Mallard Duck (*Anas platyrh*.)	1	2
Eider Duck (*Somateria mollissima*)	32	49
Mute Swan (*Cygnus olor*)	1	2
Sea birds		
Murre species (*Uria* species)	15	23
Atlantic puffin (*Fratercula arctica*)	5	8
Razorbill (*Alca torda*)	5	8

Gull species (*Larus* species)	4	6
Total	65	100

The exceptional find of a gyrfalcon leg bone (756) in 2003 serves to confirm documentary accounts of the export of falcon via Gásir (figure 11). A second gyrfalcon element analyzed from the 2004 faunal collection (context 1632) is even further proof for such activities.

Fig. 14 Gyrfalcon (*Falco rusticolus*)

Fish

As mentioned earlier in this report, a large amount of fish elements 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 premax vs. cleithra 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.

Fig. 15 - Premaxilla & Cleithrum comparison

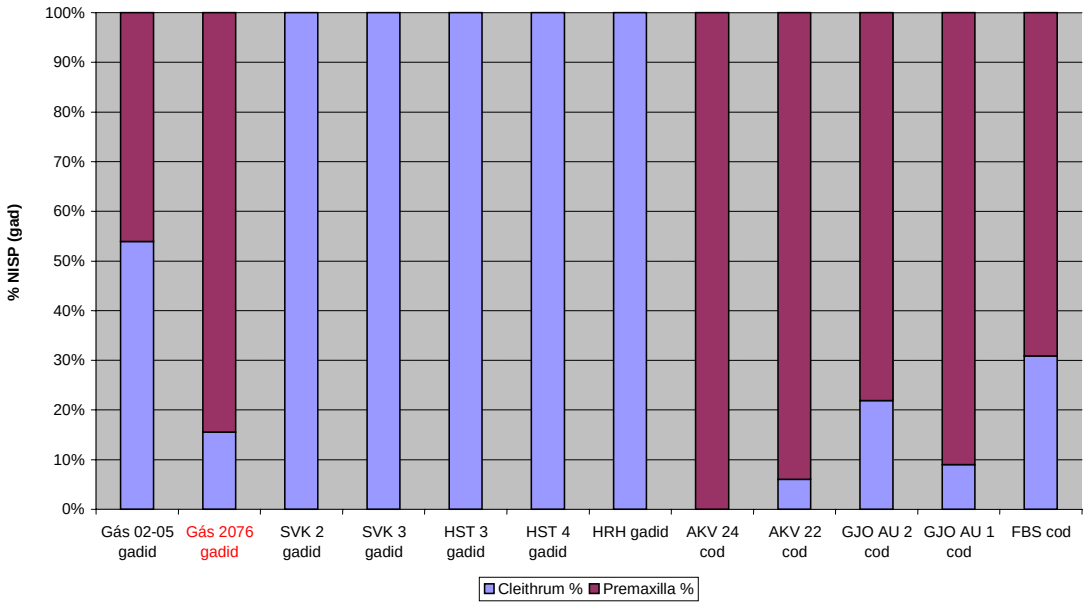


Figure 15 displays the percentages of Premaxillae vs. Cleithra ratios when related to the total amount of analyzed gadid elements. When compared with gadid elements from a typical fishing booth profile at Akurvík or that of a fishing farm at Gjögur, context 2076[1] can be understood as fish-processing deposit. A typical fish processing signature displays presence of 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 proportion of Premaxiallae vs. Cleithra for the total Gásir site (2002-05 data compiled) reflects the presence of whole gadid skeletons on site and indicates that fish may have been caught locally and used for consumption.

[1]As mentioned in the Summary, context 2076 yielded a large amount of fish remains, with 25 % analyzed by the time of this report. Even though more analysis is to take place, it is already clearly visible that this context indicates a specialized area where marine fish may be cured and even traded in form of stock fish or klipp fisk (see Perdikaris, 1999).

A Haddock/Cod comparison of elements as well as a size/age reconstruction are planned and will refine the pattern. The archaeofauna analyzed yielded a good number of gadid elements that can be measured, as well as atlas vertebrae (fig. 16) that allow for incremental analysis.

Fig. 16 Context 2184 – Haddock Atlas

Craft working

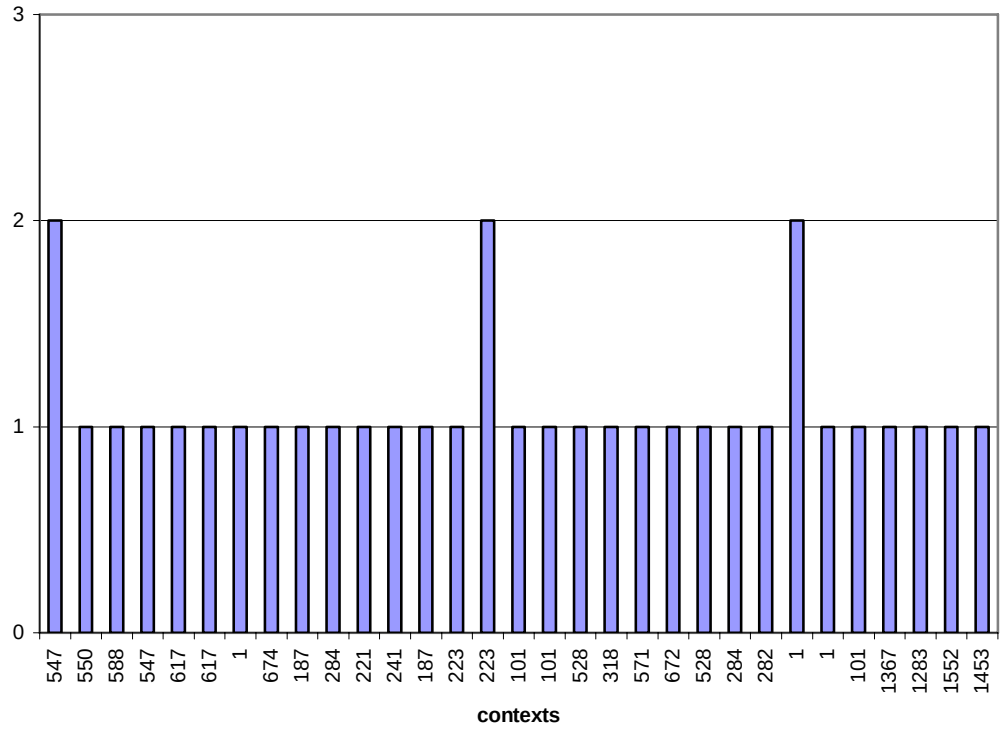
The horse remains are mostly comprised of loose teeth and foot/lower leg fragments. It should be noted that context 220 and context 101 yielded 70% (7/10) of the horse bone assemblage present at the site. The nature of preserved horse bone fragments indicates craft working activities rather than horse 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. In 2005, four large Cattle Horn cores (1916, 1808, 2076) were found, bringing the total number of cattle Horn cores to 22 and are possible indication for horn working on site.

Gnawing

Tooth marks of carnivores (almost certainly dogs in the Icelandic context), rodents, and occasionally humans are regularly found on bones in North Atlantic archaeofauna. Archaeofauna from Norse Greenland are by far the most gnawed, with up to 30 % of bones on some sites showing carnivore tooth marks (McGovern 1985). Icelandic bone collections are far less heavily marked by gnawing, though some bones from urbanizing Reykjavik show dog and rodent gnawing on the same bones (suggesting a multi-tiered scavenging hierarchy, Perdikaris et al 2001). The Gásir 2002-05 collection does show

carnivore (presumably dog) gnawing, and the distribution by context is shown in figure 17. As mentioned above, there is no evidence for canine gnawing on bone in the 2005 archaeofauna.

Fig 17 - Dog gnawing



Note that while a low number out of the total bone assemblage are gnawed, there are a good amount of contexts that show gnawing. Questions that arise are: dogs have access to some areas but not others? Are some species' bones (and some skeletal elements) more likely than others to show gnaw marks?

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 1984). 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 4 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?

Table 4: Caprine Metapodials				
	Bi-perforated	Split	Other	total
count	8	35	3	46
%	17,39	76,09	6,52	

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

Table 5 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 528	clam shell	1165	35	0,5	
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	

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 18 graphs the calibration curves for these three cattle bone samples (OxCal v. 3.9).

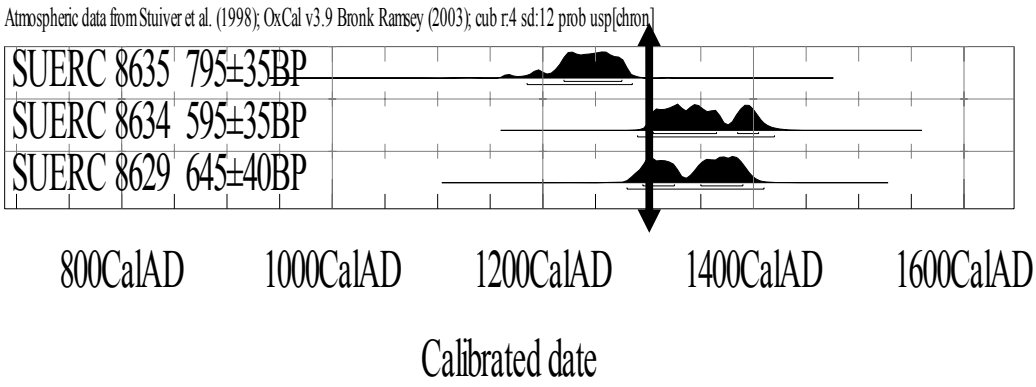


Figure18. Radiocarbon calibration

Two dates (SUERC 8634 and 8629) group nicely within the 14th c, 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 N15 values for the three cattle bones 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.

Fig. 19 - Delta C13

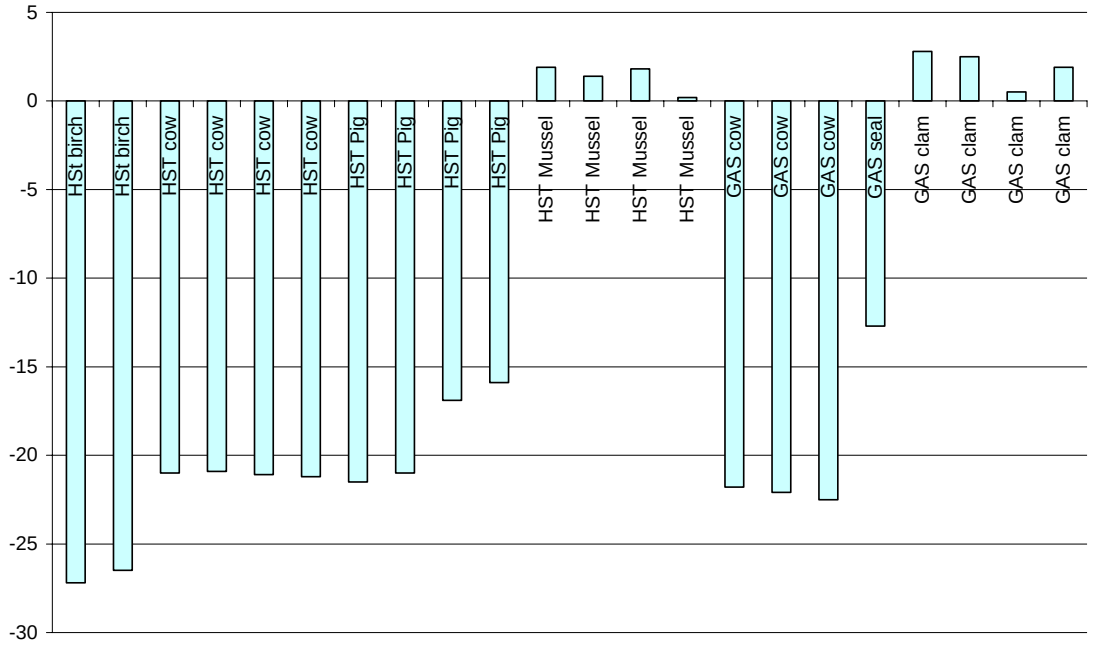


Figure 19 graphs the Gásir Delta C13 values and provides a comparison to a similar set of isotopic assays from Hofstaðir in Mývatnssveit. Note the strongest terrestrial signal (lowest delta C13values) from birch twigs, with cattle and most (but not all) pig bones showing a terrestrial herbivore signature. 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 2002-05 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. While the current sample is but a beginning, we are already able to lay out some areas for productive further collaboration and to propose some broader questions for general consideration.

As noted above, close integration of the animal bone data (element representation, species present, taphonomic signatures) with the excavation program can aid in the interpretation of specific features and in some cases may aid in establishing sequences of use and abandonment. Fortunately modern software makes such contextual integration straightforward, and this will certainly increase as the project moves ahead.

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. 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? Thus far the archaeofauna does not suggest that the site was being entirely provisioned with cast off by-products of the normal farming economy (very young animals and very old ones) but with older juvenile and young adult cattle and sheep. Further investigation of age profiles of animals brought to Gásir will be important, and the sampling of a contemporary farm midden in the same district would provide important comparative information. The isotope data mentioned above (figures 18, 19, Table 5) 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?
- **Seasonality**: If enough different seasonal indicators can be collected, it should be possible to contribute to discussions of seasonal vs. year round occupation. While the current sample is small, we may wonder if the shortage 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**:
- **Status**: Hopefully, future excavation work will produce more indicators of status and hierarchy systems present at the site. The gyrfalcon and seals provide an initial idea of the socially diversified group of people present at late medieval Gásir.

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