CHAPTER 8

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Utilization of animal resources in Roman Iron Age Vik: Zooarchaeology at Ørland

ABSTRACT
During the archaeological excavations at Vik, Ørland in 2015 and 2016, a large assemblage of faunal remains was recovered. The assemblage of animal bones from Roman Iron Age contexts weighed altogether c. 25.4kg, and stemmed mainly from waste deposits and, to a lesser degree, from building remains from three farmsteads. The main aims of the analyses were to investigate the utilization of animal resources. Kill-off patterns of domestic animals show preferences for meat production, wool production but also dairying. Not all parts of the domestic animals were found on site, indicating that prime meat-bearing elements and possibly hides were transported or traded from Vik. Some wild mammals, both terrestrial and marine, were hunted for food and raw materials. Fishing occurred on a quite large scale in the coastal waters but also on the open sea. The fish bone material does not provide evidence for stockfish processing or trade in fish at this early stage. The osteological finds from Ørland provide a picture of a dynamic subsistence economy that must have been flexible. In view of this, it is not likely that the settlement decline in Vik from the 4th century AD onwards reflects changes in available natural and/or domestic resources.

INTRODUCTION
Ørland is situated at the mouth of the Trondheim fjord, where the sea route to the inner parts of Central Norway meets the important sea route along the Norwegian coast. Vik lies in central Ørland, and consisted of cultivated land prior to the excavations. The excavations came about as a result of the planned extension of the Ørland Main Air Station. The excavated area covered c. 117 000 m^2, and was situated along a former raised beach, forming a ridge approx. 9-11 m asl. (Figure 1). The settlement traces covered ten phases from c. 1100 BC – present. Extensive finds of bone material mainly stemmed from features dating to Phase 3 (c. 50 BC – AD 350), while some bones were also found in features dating to Phase 2 (c. 400 BC – AD 50), Phase 4 (c. AD 350 – 550), Phase 6 (c. 900 – 1250), Phase 7 (c. AD 1250 – 1850),

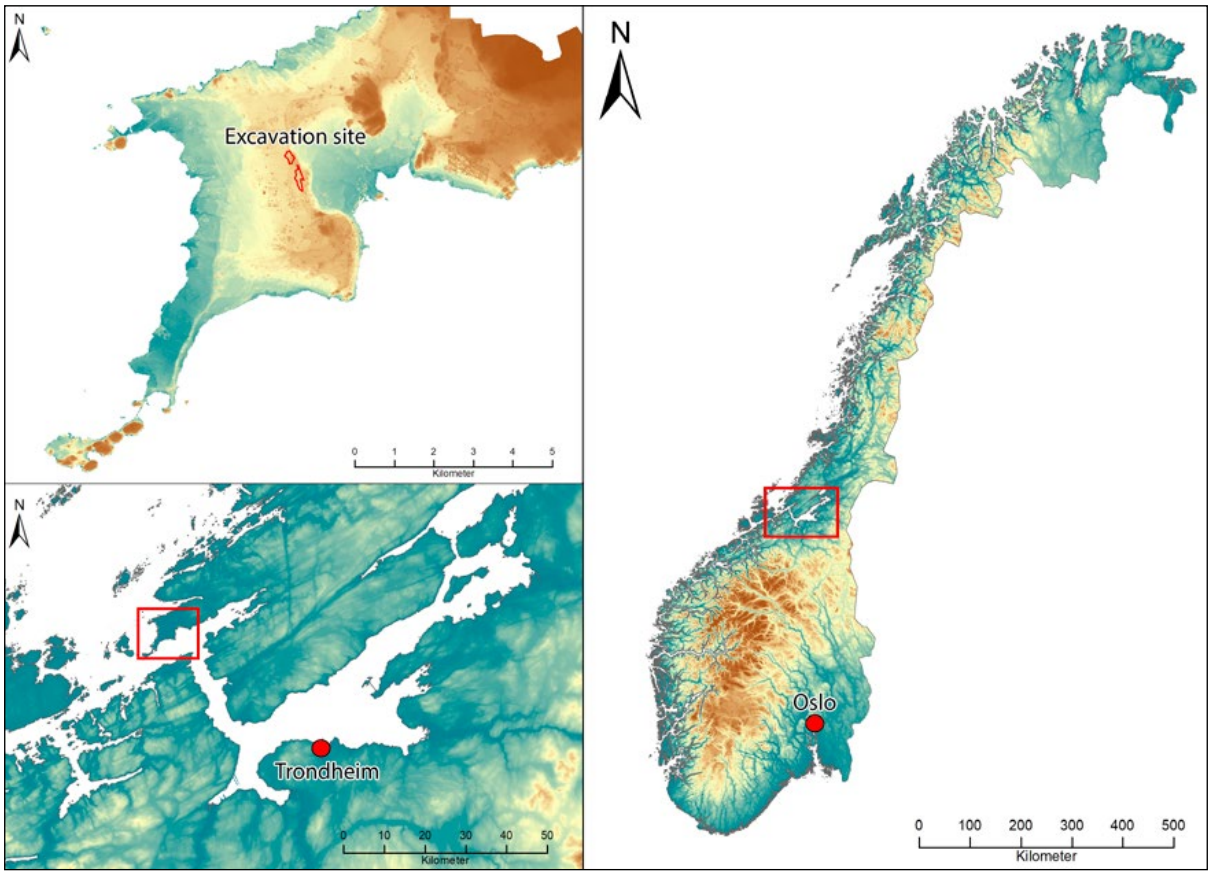

Figure 1. The location of the excavation area. Illustration: Magnar Mojaren Gran, NTNU University Museum.

and Phase 8 (c. AD 1850 – 1940, Figure 2, cf. Ystgaard et al. Ch.1).

The assemblage is the largest in Norway hitherto recovered from an open-air site using mechanical top soil stripping. Earlier zooarchaeological finds from similar contexts are limited in size and/or most often burnt (e.g. Lie 1993, Berglund 1996:75-81; Perdikaris 1999, Macheridis 2013, Wickler & Narmo 2014, Hufthammer 2015, Hufthammer & Mjærum 2016).

The analysis in this paper focuses on animal bones from the Roman Iron Age (Phase 3) contexts. The main aim of the osteoarchaeological analyses, apart from identifying animal classes and species, was to investigate the utilization of animal resources in this phase. Kill-off patterns for cattle and sheep/goats were examined in order to assess the extent and importance of meat, milk and wool production at Roman Iron Age Vik. The representation of wild mammals in the assemblage was examined in order to assess the utilization of wild mammals versus domestic animals. The large assembly of fish bones was assessed with the aim of characterizing the fisheries and establishing whether fishing was directed towards local consumption or for a larger market at this early stage.

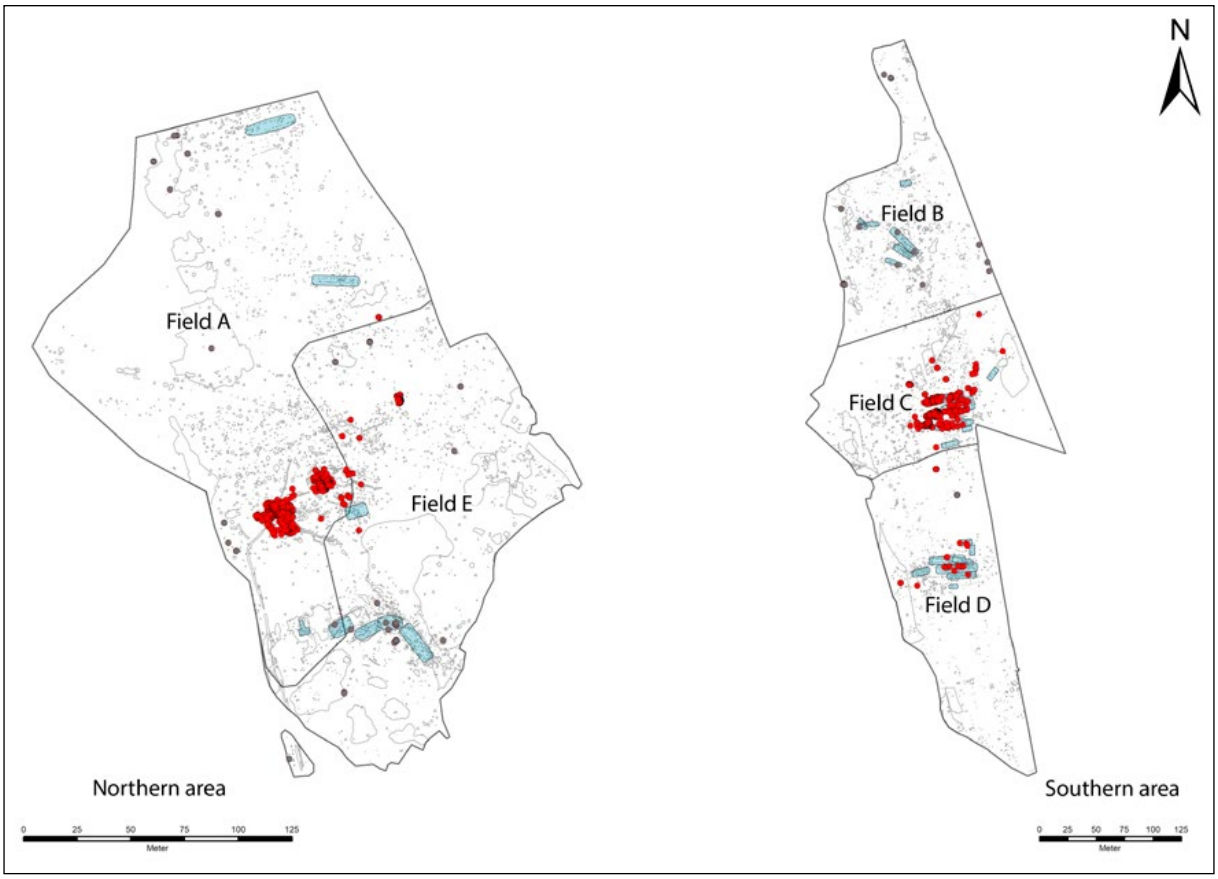

Figure 2. Spatial distribution of the faunal remains at Vik. Illustration: Magnar Mojaren Gran, NTNU University Museum

Finally, patterns in waste deposition and building remains were examined.

MATERIAL AND METHODS

Contexts with bones

The subsoil of the flat landscape at Vik was dominated by shell sand, but this alternated with gravel and silt (Linderholm et al., Ch. 4, Figure 2). In areas dominated by shell sand, preservation conditions for bones were good. In areas dominated by silt and gravel, preservation conditions for bones were comparably poor, although in some areas waterlogged gravel and silt also secured good preservation conditions for bone material.

Features dating to Phase 3 were concentrated on settlement remains in the central parts of Fields A/E in the northern area, and in the central parts of Fields C and D in the southern area. These areas represented three Roman Iron Age farmsteads. The central part of Fields A/E was situated in an area with a mixture of shell sand and gravel. The subsoil in the western part of Field A was partially waterlogged. Most of the bones were found in two large waste deposits, 110297 and 106581. They were surrounded by a range of smaller features such as cooking pits, hearths and

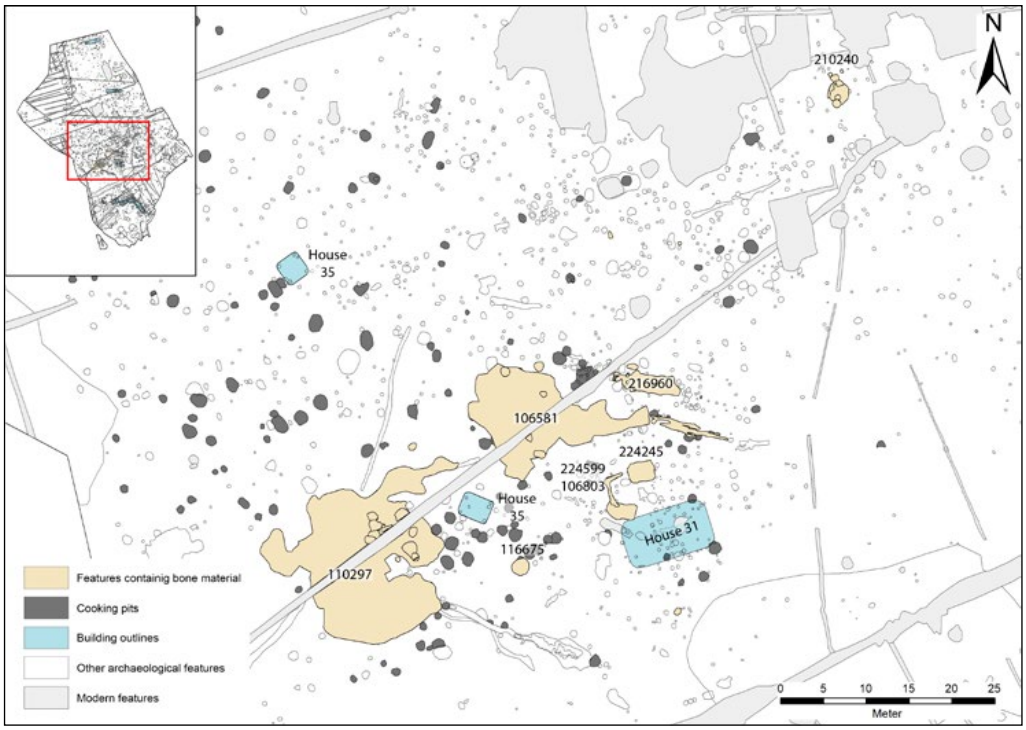

Figure 3. Central part of Fields A/E (Phase 3 settlement area) with features containing animal bones. Illustration: Magnar Mojaren Gran, NTNU University Museum.

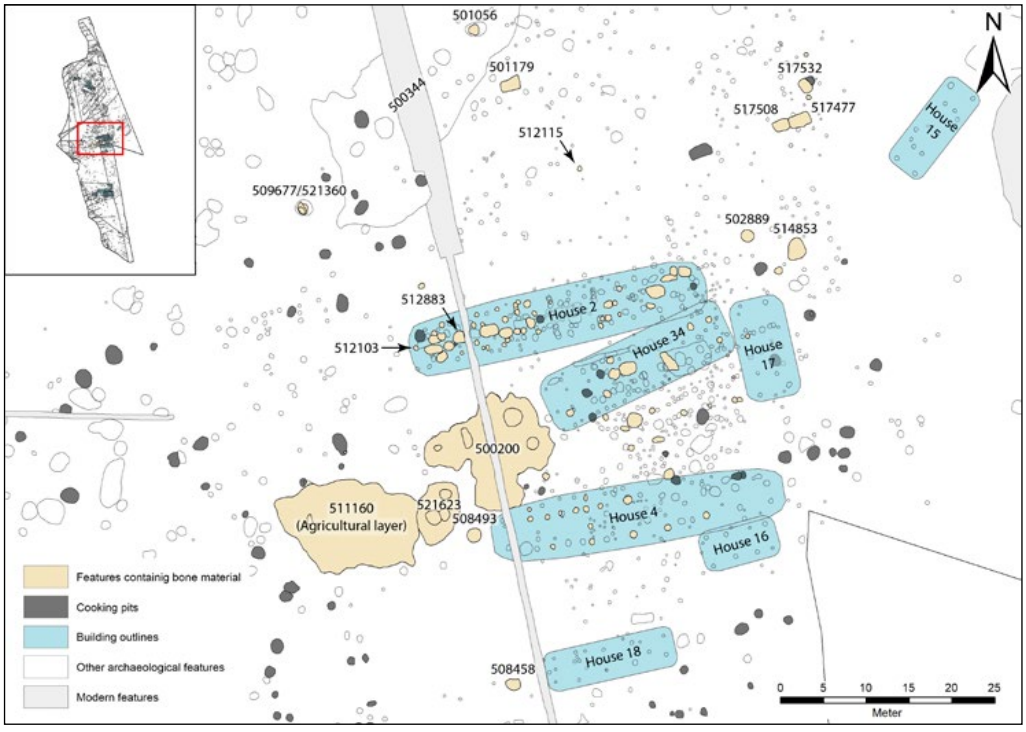

Figure 4. Central part of Field C (Phase 3 settlement area) with features containing animal bones. Illustration: Magnar Mojaren Gran, NTNU University Museum.

also possible building remains, although no buildings were preserved, due to modern-day activity. Another waste pit, 210240 in Field E, was located c. 45 m to the northeast of the two large waste deposits, and contained c.8.5kg of fish bones and a large number of cockles (Figure 3, Mokkelbost, Ch. 7).

In the southern area, most of the finds were close to a farmstead from Phase 3 in the central parts of Field C. The farmstead and the finds were found on shell sand subsoil (Figure 4). The complex consisted of one Phase 2 building (House 18), and six Phase 3 buildings (House 4, 17, 16, 34, 2 and 15) and large Phase 3 waste deposits (500200 and 521623, Figure 4. See also Heen-Pettersen & Lorentzen, Ch. 6).

The central part of Field D had a mixture of shell sand and gravel subsoil. Here, remains of eight Phase 3 buildings were identified, but no large waste deposits were preserved. Some animal bones were recovered from features within the building remains (Figure 5, Appendix B; Heen-Pettersen & Lorentzen, Ch. 6).

Thus, the largest share of the bone material from Phase 3 settlements came from waste deposits. The large waste deposits from the central parts of Fields A/E and C covered from 4.7 to 235.2 m^2 (Figures 3 and 4). The size of these waste deposits, as well as their composition of a mixture of household waste, waste from cooking pits and waste connected to

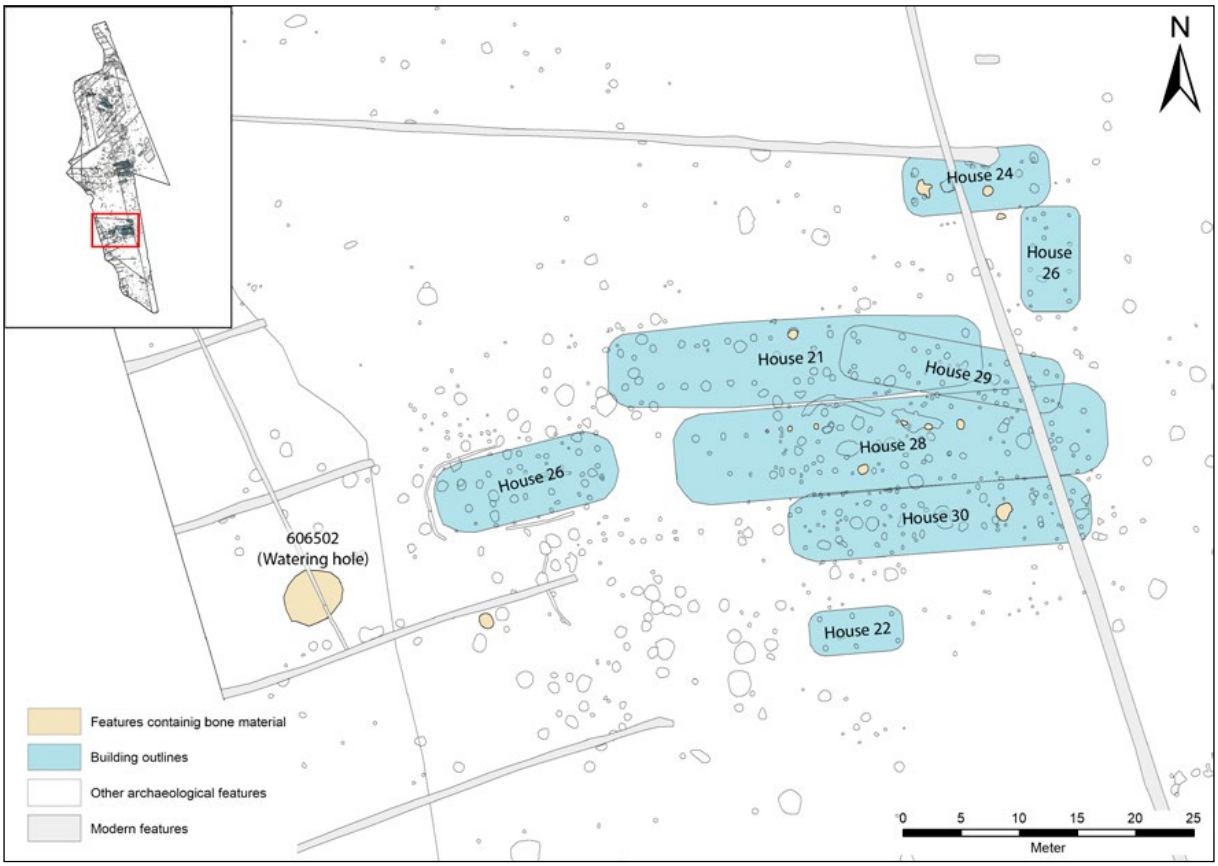

Figure 5. Central part of Field D (Phase 3 settlement area) with features containing animal bones. Illustration: Magnar Mojaren Gran, NTNU University Museum

storage of manure, ensured excellent preservation for bone material (Mokkelbost, Ch. 7). A fair share of bones was also recovered from building remains. Houses 2, 4, and 34 from Field C had a considerable number of bones preserved in postholes, hearths, cooking pits and other pits (Figure 4), while the building remains in Field C also had some bones preserved, mainly in postholes (Figure 5).

Scattered finds of bones were also found in pits, waste pits and agricultural layers in the northern parts of Field A, while in the southern parts of Field E, bones were recovered in pits, waste pits, wells, ditches and postholes. These contexts were mainly dated to Phase 6 (c. AD 900 – 1250), while a few were dated to Phase 4 (c. AD 350 – 550). Lastly, bones were found in archaeological features scattered in Field B, mainly dated to Phase 2 (c. 400 BC – AD 50). Finds of recent bones, comprising larger parts of animal carcasses, were found in Fields B and D, and these may be linked to historic period activities (Phase 7, c. AD 1250 – 1850, and Phase 8, c. AD 1850 – 1940, Figure 2). Bones from Phases 2, 4, 6, 7, and 8, will not be further discussed in this paper.

The bone material

The assemblage of animal bones from all phases in Vik comprised a total of 22,696 specimens weighing 34.4kg. The bones from Phase 3 contexts weighed altogether c. 25.4kg. A detailed presentation of the osteological finds dated to Phase 3, sorted by excavation area and context, is found in Appendix A-C. A majority of the bones were unburnt, c. 97% by weight, Appendix A.

Methods

The osteological and taphonomic analyses were performed using standard methods and techniques for species identification, assessment of age-at-death and sex, identification of butchery marks, and investigations of anatomical representation. Furthermore, taphonomic data on weathering, fragmentation, level of firing and fracture patterns were recorded. Standard references used were Habermehl 1961, Silver 1969, Grant 1982, Stiner et al. 1995, Vretemark 1997, Outram 2001, 2002, Storå 2001, Magnell 2006, Carter & Magnell 2007, and Lyman 2008. The osteological and the taphonomic data was evaluated in relation to contextual information in order to investigate the depositional patterns and evaluate possible preservation bias, but mostly to conduct intra-site analyses. Special focus was directed towards the depositional patterns in the features and layers and houses. We report the results of the quantifications according to the *number of identified specimens* (NISP), which for this assemblage, due to the high level of fragmentation and the high number of features with small numbers of fragments, was considered the most suitable unit. Units such as *minimum number of individuals* (MNI) or *minimum number of elements* (MNE) would not have provided more reliable estimates (see e.g. Lyman 2008). For comparisons of the age structure of the killed animals based on tooth eruption and wear we use MNE estimates for jaws. The results of the analyses from each excavation area (Fields A-E) have been summarized in separate reports where detailed information may be found (see Ystgaard et al. 2018).

RESULTS AND DISCUSSION

Identified species

The level of fragmentation was high and most mammal bone fragments were smaller than 2 cm. Due to the high level of fragmentation a large number of specimens were identified only to a group or class of animals such as mammal, large mammal, bird or fish (Tables 1-2, Appendix A-C).

Animal type	Species	Central area of Field A and E	Central parts of Field C	Central parts of Field D	Total
Large mammal	Horse	39	28		67
	Cattle	169	224	3	396
	Moose	4	2		6
	Red deer	3	1		4
	Large ungulate	22	96		118
	Large ruminant	25		1	26
	Large mammal	306	384	3	693
Middle- sized mammal	Sheep	6	6		12
	Goat	2	1		3
	Sheep/goat	270	138	2	410
	Pig	74	58		132
	Middle-sized mammal	1008	831	8	1847
	Middle-sized ruminant	27			27
	Middle-sized ungulate	1	8		9
Ruminant/ ungulate/ Indet. size	Deer	6			6
	Bovid	13	13		26
	Ungulate	7	118		125
	Middle-sized - large mammal	15	42	1	58
	Ruminant	122	99	2	223
	Middle-sized - large ungulate	1			1
Carnivore/ terrestrial	Canid	2	1		3
	Brown bear		2		2
	Otter	3			3
	Carnivore (terrestrial)	1			1
Seals	Grey seal		1		1
	Harbour seal	1			1
	Harp seal	1			1
	Seal	45	8		53
Small - middle sized mammal	Small – middle-sized mammal	4			4
Small mammal	Small mammal	5	5		10
Whale	Whale	21	3	2	26
Mammal	Mammal	1496	1530	1	3027
Bird	Chicken		1		1
	Galliformes	1			1
	Galliformes?	1			1
	Red-breasted Merganser?		1		1
	Anseriformes	3			3
	Little auk	1			1
	Great cormorant	1			1
	European herring gull?	1			1
	Falconiformes	1			1
	Passerine	6			6
	Bird	23	8		31
Total		3737	3609	23	7369

Table 1. *Identified mammals and birds (NISP) in the central areas of Field A/E, C and D at Vik, Ørland. Two human bones (and three amphibian bones) are excluded. The species are ordered according to the size of the animals in order to aid interpretations based on the categories of groups of animals.*

Species	Central area of Field A and E	Central area of Field C	Central area of Field D	Total
Atlantic cod *(Gadus morhua)*	676	424	1	1101
Haddock*(Melanogrammus m.)*	624	514		1138
Saithe *(Pollach v.)*	803	330		1133
Haddock/Saithe/Pollock *(Melanog./Pollach sp.*	9			9
Whiting/Merling (*Merlangius merlangus*)		7		7
Common ling *(Molva m.)*	175	112		287
Ling, (Lotidae*)*	44	3		47
Codfish	1252	714		1966
Codfish?		2		2
European flounder (*Platichthys flesus)*		2		2
Flatfish (Scopthalmidae 1/Soleidae 1)		2		2
Righteye flounder (Pleuronectaidae)	2	11		13
Pike? (*Esox lucius*)		1		1
Herring *(Clupea harengus)*	7	2		9
Angler? (*Lophius piscatorius)*	1			1
Fish	5150	2921		8071
Total	8743	5045	1	13789

Table 2. *Identified fish (NISP) in different areas at Vik, Ørland,*

The main waste layers 110297 and 106581 in the central area of Field A included deposits of many different items and also different ecofacts. For example, they exhibited differences in organic composition, and may have included manure that regularly would have been taken to the fields as fertilizer (Linderholm et al., Ch. 4; Mokkelbost, Ch. 7). The dates and the spatially restricted, almost static, location of the waste layers indicate that they were in use over a long time period. The activities and the depositional patterns were not static even in the areas of the waste layers, as is demonstrated by the faunal remains recovered in the features that were excavated below the layers but also in the chronologically later features, see below.

Domestic animal utilization and handling

The mammal fauna is dominated by domesticated animals, and it is clear that husbandry was an important part of the subsistence at Ørland. Of the domestic species, bones of cattle are most numerous, followed by sheep/goat and pig (Table 1 and Appendix C). It is more difficult to draw conclusions from the fact that among the fragments identified as belonging to to the general groups, middle-sized mammal, large-sized mammal or ungulate, middle-sized mammals show a much higher frequency. There may, however, be an identification bias favouring cattle, and this may have affected the identification process.

The anatomical representation for the domestic species is fairly homogeneous in the northern (Fields A and E) and southern (Fields C and D) areas. What is striking is the low number of fragments of

the peripheral parts of animals, such as phalanges, metapodia and the carpal and tarsal bones. In fact, these parts of the animals seem to be missing at both Roman Period settlement areas. It appears that the parts of the animals which are rich in meat are common in the deposited faunal assemblage, while the distal parts of the extremities are uncommon. These skeletal elements are among the hardest in the animal skeleton, so their absence is not caused by preservation bias. They are often characterized as slaughter waste, even if, for example, the metapodia of cattle and horse would be suitable for raw material. The peripheral parts of the skeletons may also have been left in the hides of the animals that might possibly have been processed elsewhere.

Not all parts of the animals are present in the assemblage. The parts of the animals which are poor in meat are not common, but this is also the case with vertebral and rib fragments. These parts of the animals have a high meat value, and would probably have been preferred when it came to utility and meat consumption. Their rareness is interesting and indicates that some parts of the animals were actually taken from the site, possibly through trade. Some level of preservation bias may have to be considered since the ribs are rather fragile and may not have been preserved.

Butchery marks were identified on bones of domestic animals. Chop marks were found in all anatomical regions of the animals but there is an interesting difference between the species representation of the bones and the different types of marks. In both the northern and the southern areas, bones of large mammals more often exhibited chop marks, while middle-sized mammals more often exhibited cut marks on the bones. The ratio between chops and cut marks was 35:7 for large mammals but 14:12 for middle-sized mammals in Fields A/E, and 56:4 for large mammals and 24:15 for middle-sized mammals in Field C (and D). The slaughter technique was cruder for large mammals (cattle) where the body parts were chopped into smaller pieces. The meat parts of the middle-sized mammals (sheep, pig) were probably possible to dismember with less force as knives were more often used than heavier tools for sheep/goat and pig. The fracture analysis shows that the long bones of both cattle and sheep were regularly deliberately fractured in order to extract the within-bone nutrients (see data in Ystgaard et al. 2018).

The bones may highlight important aspects of the animals that were slaughtered and utilized not only for meat and dairy products but also for other reasons. The slaughtered animals provided hides and bone for raw material in craft activities, as is evident in the bone artefacts recovered during the excavations. The whale bone recovered at Ørland might also have been used as raw material.

Of some interest are the bones of horse that were found scattered in both areas of the site. A few of these exhibit marks of slaughter, and some bones also bear evidence of fresh fractures, i.e. they were fractured when still in a fresh state. It seems that the meat of horses, at least occasionally, was handled and consumed at the site. There was also one find of an almost complete foal in depression 512103, excavated west of House 2, Field C in the southern area. While the deposition is probably slightly later than House 2, it is of interest that a few bones bear evidence of slaughter. It is possible that the animal was skinned prior to deposition, see below.

Domestic animal kill-off patterns

It seems that the meat that was consumed at Ørland came from well prepared and selected parts of the slaughtered animals. Interestingly, the animals in the central areas of Fields A/E and Field C were slaughtered at different ages, as indicated by tooth eruption and wear. In the central part of Fields A/E, c.43-55% of the cattle were slaughtered as adult

animals, while in Field C the proportion was 28-45% (Figure 6). Layer 500200 has the lowest frequency of older animals. The culling of old cattle reflects the slaughter of older cows utilized for dairying, and the material thus implies that cattle were kept for dairy production to a slightly larger extent in Field A/E than in Field C. The difference between the areas is more marked when it comes to the slaughter of sub-adult animals. The higher incidence of older sub-adult individuals (2 yrs+) compared to younger sub-adults shows that breeding for meat was more important in Field A/E than in Field C.

There is also an interesting difference in the kill-off patterns between waste deposits 110297 and 106581, both in Field A. The culling age is fairly similar for sheep/goat and cattle in 110297, while in 106581 the sheep/goat bones are more often from younger animals, whereas for cattle there is a slight increase in the culling age for older animals. This could reflect a chronological change in sheep utilization, from the slaughter of older animals, possibly kept for wool production, to the culling of older sub-adult animals that were slaughtered in their second or third year of life. This culling would fit a breeding strategy for meat production. The higher incidence of old cattle indicates that milking cows were slaughtered, whereas, since most of the sub-adult individuals were older than 2 years, these younger animals may have been bred mainly for meat. The culling of pigs was similar in both excavation areas. Almost all pigs were slaughtered prior to adult age, which is a common pattern (e.g. Vretemark 1997).

The central parts of Field C exhibited a higher frequency of young cattle (calves) compared to young sheep (Figure 6). The high frequency of bones from old sheep indicates a husbandry strategy where old animals kept for wool were slaughtered. In contrast to this, the breeding strategy for cattle indicates the slaughter of young animals. The culling of sub-adult animals at a younger age could suggest that the husbandry of cattle in the central part of Fields C was more directed towards milk production than in the central parts of Fields A/E. Thus, even if the same parts of the animals were consumed – and discarded - in both excavation areas at Ørland, the husbandry strategies that are reflected through the osteoarchaeological finds were different for both

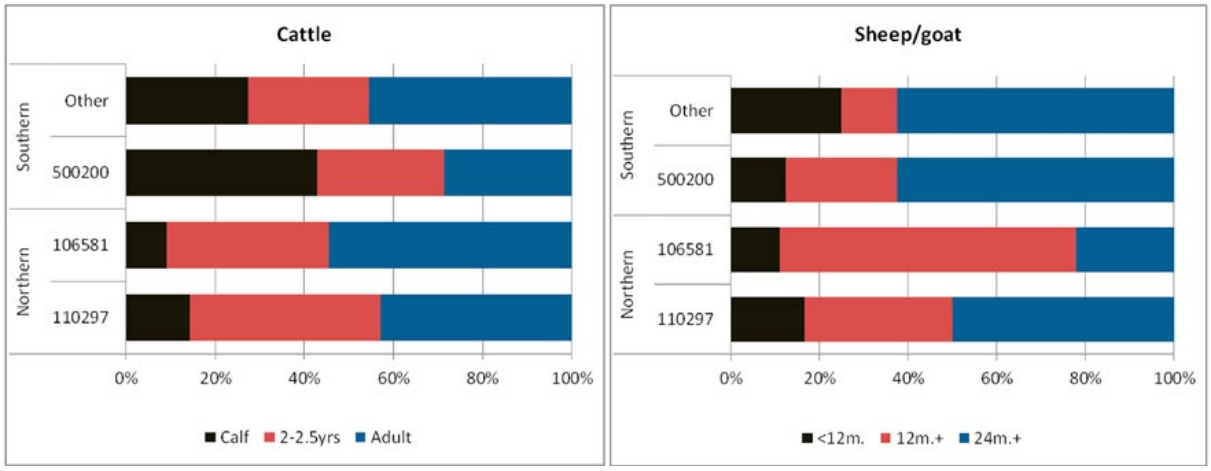

Figure 6. Age distribution for cattle (left) and sheep/goat (right) in the northern and southern areas. Ageing based on tooth eruption/wear and the minimum number of elements (MNE) in each age group. Illustration: Jan Storå.

cattle and sheep/goat. As very few bones of goat were identified, the breeding strategies probably concern sheep.

Wild mammals

The utilization of animal resources at Ørland was varied and included a variety of marine mammals and especially fish. It may be assumed that shellfish, too, were of importance at Vik since shells, notably cockles, were recovered in large quantities in the waste pit 210240 (Field E) and oyster shells were found in the large waste layers 110297, 106581 and 200500.

Bones of both seal and whale were present, but not in larger numbers. A similar number of wild species was identified in the central part of Fields A/E (6) and the central parts of Field C (5), although the number of specimens was higher in Field A, Table 2. Whale bone was more common in Fields A/E and here most of the fragments were recovered in a rather restricted area of the waste layer 106581 (19 fragments, Appendix C). The same layer also contained 26 bones of seal, including at least one each from harp seal and harbour seal, and 2923 fish bones. Three mandibular fragments of otter were identified in waste deposit 110297. One tibia (2 fragments) of brown bear was recovered in waste deposit 500200 in Field C. This isolated find is of interest when we consider the other specific depositions of animals and body parts found on the site (see below).

Fish

The number of fish bones was highest in the central part of Fields A/E, although here waste pit 210240 (NISP=4573) introduces bias into the comparison (see Table 2 and Appendix C). There is not only a difference between the two central areas in Fields A/E and C in the frequency of wild mammals and fish, but also in the species within the classes. Harp seal and harbour seal were identified in the central part of Fields A/E, while grey seal was identified in the central parts of Field C.

Atlantic cod is the most common fish species in the central part of Fields A/E. The central part of Field C exhibits a higher frequency of other fish species, among them various flatfish and even angler. Noteworthy in both areas is the low number of herring bones. This species is probably underrepresented due to preservation bias and possibly also some level of recovery bias, mostly the use of 4 mm mesh. It may be noted, though, that the soil in waste pit 210240 was sieved through a fine mesh and that this did not produce finds of herring.

The identified fish species varied within different contexts, and most visibly in the central part of Fields A/E. Here bones of haddock were more common in the waste pit 210240 than in the two waste deposits 110297 and 106581 (Figure 7). In contrast, bones of common ling were more numerous in the waste deposits, but infrequent in the waste pit, Appendix C.

There were, then, important differences in the representation of different fish species from context to context in the excavated areas at Vik, indicating extensive fishing that targeted different species. Another important difference between the areas in terms of the fish material is in the size of the Atlantic cod that were captured and utilized (Figure 8). In the central parts of Field C the captured cod

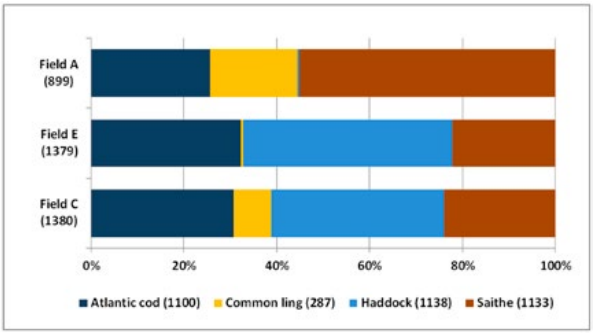

Figure 7. Identified codfish (NISP) in Fields A, E, and C of Ørland. Illustration: Jan Storå.

had a length of between 60–80 cm, while small (<50 cm) and larger cod (90 cm+) dominated in Fields A and E.

All identified species occur today in the waters around Ørland, both in the waters in the fjord and west towards the open sea (Olson & Storå 2018). The size distribution of Atlantic cod in the central area of Fields A/E shows two size clusters that might represent different fisheries (Figure 8). At the time of occupation, the location was probably favourable for the fishing of various species of codfish, but also for species like flatfish and herring. As already mentioned, the importance of herring fishing cannot be evaluated, but the few finds are noteworthy. The species representation is rather varied at Ørland, and with differences between the excavation areas. Perhaps of some surprise is the lack of bones from salmon or salmonidae, fish that probably occurred in the waters around Ørland. There may be some preservation bias here as the fatty bones of salmon do not preserve well and are sensitive to destruction and degradation. If there was salmon fishing, the archaeological traces might have been lost. Regardless of this, the fish bone assemblage indicates that fishing occurred in different kinds of waters and probably also during different seasons.

Haddock is represented mainly by small individuals, and was presumably available in nursing grounds in the shallow waters close to the site area. Cod and saithe were probably caught some distance from the bay in the deeper waters of the fjord. The large ling must have been caught at a depth of 100 metres or more, presumably closer to the open sea. Finds of fish hooks indicate that hook and line fishing was used. Hook and line would have been used for catching medium and large codfish from boats some distance away from the shore. Fishing strategies may have altered somewhat through time. There

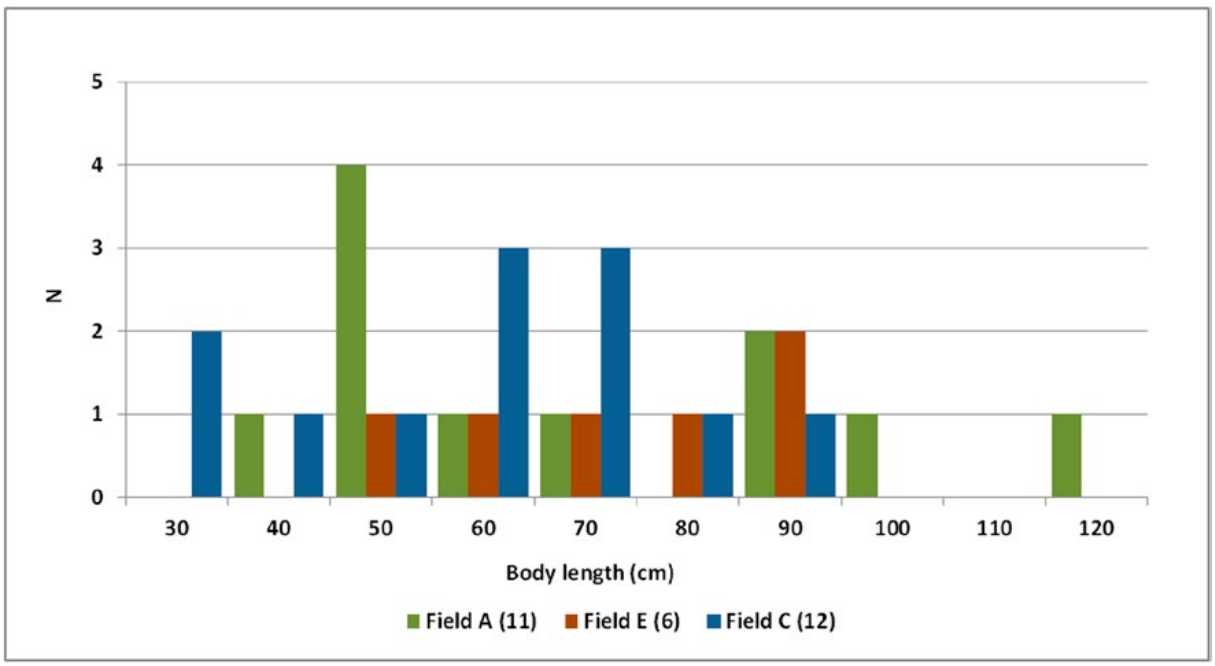

Figure 8. Size of Atlantic cod (NISP) in the northern (Fields A/E) and southern areas of Ørland. Size estimation is based on the dimensions of the first and second vertebra. Illustration: Jan Storå.

can be no doubt that fishing, and especially fishing for codfish, was a significant aspect of the Roman Iron Age subsistence economy at Ørland. Seasonal fishing settlements, such as that at Borgvær, were present in the Lofoten area as early as the Migration period (Wickler & Narmo 2014). Caves in coastal areas were also used for seasonal fishing settlement in the Iron Age (Haug 2012). Interestingly, it is around this same time that sites with large areas with (open-air) cooking-pits, such as the ones at Ørland, decrease in number (Bukkemoen 2016). The relatively small size of the codfish as a whole suggests that fishing was carried out in the local waters. Large cod (120 cm+) are rare at Ørland, possibly suggesting that deep sea fishing did not occur, at least not extensively. It does not seem that an extensive export or trade of fish and fish products, such as dried fish, took place at Ørland, although some level of trade of faunal resources, including fish, should not be excluded.

Fishing, and especially cod fishing in Northern Europe, has been the focus of extensive research, and this has traced the development of deep sea fishing in the Viking Age, which later developed into the important stockfish trade in coastal Northwest Europe (e.g. Enghoff 2000, Barret et al. 2004, Perdikaris & McGovern 2007, 2008). So far, it has not been possible to illuminate conditions in the Early Iron Age through osteoarchaeology, as has been done for the Stone Age and Late Iron Age – this is largely due to the lack of extensive faunal assemblages.

Considering the character of the site and the archaeological finds at Vik, we might expect that the farmsteads had well developed networks for trade and communication. To cast light on this, we might examine the size distribution of cod at Ørland in relation to the possible trade of dried cod. At Ørland cod smaller or larger than the optimal size range suitable for drying (60–110 cm, Perdikaris 1999) are most common in Fields A/E. In Field C, the most common size of cod is 60–80 cm, i.e. at the lower end of the scale. The size variation for the codfish is, then, not typical for the processing of stockfish. Neither is the anatomical representation for cod (including codfish). The Late Iron Age processing sites are often characterized by certain biases in the anatomical representation for cod(fish), where cranial elements are frequently found on the processing sites while the backbone and the cleithrum (of the pectoral girdle) follow the dried body of the fish from the sites. At Ørland we see no such bias in element representation; we identified 76 premaxillae, 64 maxillae, 63 dentary bones of the cranium and 70 cleithrale of the pectoral girdle (at the gill opening). In total we identified 332 cranial elements and 1508 vertebra of cod and codfish. Thus, at Ørland, we probably do not see the same specialized fishing for cod(fish) with extensive production of stockfish for export and trade that developed in Norway in the Late Iron Age (e.g. Enghoff 1999, 2000, Perdikaris 1999, Barrett et al. 2004, Barrett et al. 2011, Perdikaris & McGovern 2007, 2008, Wickler & Narmo 2014, Star et al. 2017). It seems that this fish trade actually developed after the site at Ørland had been abandoned.

Depositional patterns

The recovered animal bones stem from refuse deposited after the utilization of the animal carcass. The depositional patterns were structured, and the refuse handling was, it seems, to some extent organized, at least spatially. The houses had varying amounts of bone, which is probably a reflection of function. However, the number of bones may in some cases be related to the cleaning of the houses. House 2 in Field C had high numbers of bones in many different types of feature, while Houses 34 and 4 in the same area exhibited fewer finds. In House 34 most of the bones were recovered in a hearth,

while the bones in House 4 the bones were almost exclusively recovered in post holes (see Appendix B). House 4 had probably been cleaned out, while the later dated House 2 does not seem to have been cleaned out after abandonment (Heen-Pettersen and Lorentzen, Ch. 6).

Utilization pattern of animals through time

There is evidence that the utilization patterns of animals changed over time at Ørland. In the northern area this may be illustrated by comparing the faunal remains in the two main waste deposits, 106581 and 110297. The latter layer is probably slightly older than 106581, even if the datings for both layers still fall within the Roman Iron Age. There are only minor differences between the two layers in the representation of domestic species. The features excavated below the waste deposit 106581 lack bones of, for example, deer, carnivores, seal, whale and bird bones, which occur in the overlying waste layer. It seems as if the area was initially used to process meat of domesticated animals in cooking pits and other features. In a later phase, wild resources were also utilized here. Interestingly, the skeletal elements that are uncommon in layer 106581, such as phalanges and other distal elements, are uncommon also in the older features. Thus, the selection of anatomical parts seems to have been consistent, even if we see differences in the species representation over time.

Waste deposit 110297 overlays only a few features, but is overlain itself by several features. The composition and character of the faunal remains in the later overlying features is rather similar to that of the waste layer. Even if new features such as pits for cooking or food processing were used in the same area as the older waste layer, the utilization patterns of the faunal resources and the meat apparently did not change markedly. Thus the osteological finds show that the activities developed differently through time in the two waste layers. In the area of waste deposit 106581 we see a change in the utilization of species through time, while the anatomical representation remains similar. Here, the waste layer overlays smaller features. In the area of waste deposit 110297, the utilization patterns seem to have remained unchanged as regards the handling of species and anatomical parts, but here the waste deposit is overlaid by smaller features.

Towards abandonment

There are observations that hint at specific depositional practices both within the house structures and outside of them, although they are difficult to interpret. Still, they suggest practices beyond the economic utilization of animals (for a discussion see e.g. Carlie 2004, 2006; Hamerow 2006; Lucas & McGovern 2007, Magnell et al. 2013 - for the slightly later Uppåkra). A few finds of near-complete skeletons are of interest here. In House 2, Field C, the near-complete skeletons of a foal and a pig were found. The foal was approximately 6 months old and the pig 12–16 months old. The pig was recovered from cooking pit 512883, in the western part of House 2 (Figure 4), and radiocarbon dated to cal. AD 250–385 (TRa-11648). This places it in late Phase 3/early Phase 4, and corresponds to the final occupation phase of the house. The foal was recovered west of House 2 in posthole 512103 (Figure 4), and was radiocarbon dated to cal. AD 361 – 538 (Beta 478375, Phase 4). While the foal was probably deposited after the house had been abandoned, the remains and the foundations of the building must still have been visible. These illustrate that the activities on the site included specific deposition of animals, or large parts of animals, on the site of the abandoned remains of House 2. The latest finds in House 2 date to approximately the same period which means that the deposition of the pig might actually be one of the last actions there. The near-complete skeleton of a calf was recovered in a

refuse pit 512115, c.14 m north of House 2 (Figure 4), and dated to cal. AD 552 - 648 (Beta 478358), i.e. later than the house structure and in Phase 5, a phase where almost no other activity is recorded on the entire site (Ystgaard, Gran & Fransson, Ch. 1). The spatial connection between the deposit and the house is noteworthy; maybe the house foundations caught the attention of the successors on the site (Carlie 2004, Heen-Pettersen and Lorentzen, Ch. 6).

While the Early Iron Age activities at Ørland in Vik decrease in intensity after the 4th century AD, the osteological finds provide a picture of a dynamic subsistence economy that must have been flexible. When the subsistence economy as a whole is considered, it does not appear likely that the settlement decline reflects changes in available natural and/or domestic resources.

Ørland in comparison to other Norwegian Iron Age sites with animal bones

The faunal assemblage from Ørland is in many respects unique, but it does exhibit both similarities and differences to other previously recovered assemblages. The osteological finds from open air (settlement) sites are often not well preserved, a point which emphasizes the value of the assemblage from Ørland (Hufthammer 2015). Favourable preservation has been observed in cave sites, which at least on some occasions were in use during the Iron Age, for example at the rock shelter Smiehelleren in Rauma, where bones of domesticated animals date back to the Pre-Roman Iron Age (Haug 2012). In general, cave sites have revealed important information on Stone Age subsistence and, to a lesser extent, highlighted Iron Age conditions (see e.g. Bergsvik & Hufthammer 2009). In contrast, open air settlement sites have, so far, most often revealed information on the Late Iron Age, especially the Viking Age, but also later periods – the sites in question include Tjøtta in Helgeland (Berglund 1996), Toften and Bleik (Perdikaris 1999), and Borgvær (Wickler 2013; Wickler & Narmo 2014), all three in the Lofoten area, Modvo in Sogn (Lie 1993), and finally Avaldsnes in Karmøy (Macheridis 2013), to name a few. A recent study has also shown the importance of pre-modern fresh water fishing in the southern Norwegian inland (Hufthammer & Mjærum 2016).

The roughly contemporaneous site at Modvo (in Luster, Sogn), c.300 km S-SW of Ørland, offers some insights, although the bones were burnt and highly fragmented (N=6570). Rolf Lie (1993) identified bones from sheep/goat (29), goat (1), cattle (7), pig (3) as well as canidae (1) and hare (1). In addition, nine fragments of birds were identified (whereof one of an indeterminate galliform bird, probably domestic fowl). Even if the material was limited in size it shows that a variety of faunal resources were exploited along the Norwegian coastal and fjord areas in the Early Iron Age. The finds from Ørland are, as mentioned, richer and more extensive, and the preservation of unburnt bone has provided new opportunities for osteoarchaeological analyses. Furthermore, few sites have offered insights into the spatial patterning of faunal remains as Ørland has. Here we might mention the Avaldsnes site where the faunal remains were highly fragmented, primarily burnt, and recovered from many different contexts and layers (Macheridis 2013). Even if the number of bones was limited (644,97g/2310 fragments) the distribution patterns seem to resemble those at Ørland. Identified species at Avaldsnes were cattle, sheep/goat, sheep, domestic pig, red deer and polecat (Macheridis 2013). The assemblage also included fish, mostly from cod, and one bird bone.

CONCLUSIONS

The faunal assemblage recovered at Ørland is in many respects unique. The preservation and the contextual information provide insights into the Roman Iron

Age of coastal Norway. Subsistence was based on a varied utilization of cattle and sheep, where kill-off patterns vary within the different areas. Husbandry strategies, as interpreted through the kill-off patterns, include preferences for meat production and wool production, but also for dairying. Pigs were not as commonly utilized, and occasionally horsemeat was consumed. The assemblage comprises mainly of parts from the meat-rich areas of the animals. The parts which are poor in meat, and also some meat bearing parts, are uncommon. Possibly some parts of the animals, including good meat parts and also hides, were transported/traded from Vik. Preservation bias does need to be considered, however. The number of bones from wild mammals is small, but shows that marine mammals were utilized, probably both as food and as a source of raw materials (whale bone, seal fat, skins etc.). Bones of birds are uncommon at Ørland, while the assemblage of fish bones is extensive. The fish bone assemblage shows that fishing occurred not only in the coastal waters but also in the open sea. Codfish were important and Atlantic cod, saithe and haddock, as well as common ling, were the most frequent species. The fish bones were recovered in many areas of the site, but there are a few contexts with high numbers of fish bones suggesting some differences in the handling and processing of fish. The material does not provide evidence for stockfish processing. The osteoarchaeological analyses show that the subsistence economy was dynamic and flexible, and that refuse handling was organized and structured. Towards the end of Phase 3, more or less complete animals were deposited in association with the abandonment of House 2. The general conclusion must be that the osteological finds from Ørland provide a picture of a flexible and dynamic subsistence economy. It is thus not likely that the settlement decline commencing from c. AD 350 reflects changes in available natural and/or domestic resources.

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APPENDIX A

Identified classes of animals and level of firing in the central areas of Field A/E, C and D at Ørland, Vik. 1, according to number of identified specimens and 2, according to weight (g).

1. Field/class of animals	Unburnt	Slightly burnt	Charred	Varying	Incinerated	Total
Central area of Field A and E						
Human	2					2
Mammal	3178	58	90	189	116	3631
Marine mammal	68					68
Bird	36		2			38
Fish	8692		16		35	8743
Indeterminate	15	3		100	3	121
Central area of Field C						
Mammal	3753	52	68		31	3904
Marine mammal	11	1				12
Bird	10					10
Fish	5035	3	2		5	5045
Indeterminate	3					3
Central area of Field D						
Mammal	15	2			4	21
Marine mammal	2					2
Fish	1					1
Total	**20821**	**119**	**178**	**289**	**194**	**21601**

2. Field/class of animals	Unburnt	Slightly burnt	Charred	Varying	Incinerated	Total
Central area of Field A and E						
Human	1,8					1,8
Mammal	6500,44	43,1	37,8	57,7	32,2	6671,24
Marine mammal	428,3					428,3
Bird	9		3,7			12,7
Fish	9554,1		1,43		3,14	9558,67
Indeterminate	5,11	1,6		35	0,3	42,01
Central area of Field C						
Mammal	7547,8	115,8	29,5		11,6	7704,7
Marine mammal	70,7	13,5				84,2
Bird	5,5					5,5
Fish	701,8	0,22	0,16		0,23	702,41
Indeterminate	1,23					1,23
Central area of Field D						
Mammal	22,5	1,5			9,6	33,6
Marine mammal	146					146
Fish	0,6					0,6
Total	**24994,88**	**175,72**	**72,59**	**92,7**	**57,07**	**25392,96**

APPENDIX B1

Distribution of different classes of animals in different contexts at Ørland, Vik, Number of identified specimens (NISP).

	House/Feature type	Domesticated	Wild	Mammal	Bird	Fish	Indet.	Total
Central part of Fields A and E	**Waste deposit 110297**	**309**	**29**	**1965**	**10**	**809**	**14**	**3136**
	130832 cooking pit	4	28	8		40	4	28
	130923 cooking pit	2	7			9	2	7
	130997 cooking pit	1	1			2	1	1
	131071 cooking pit	3				3	3	
	132878 waste pit					1	1	2
	143733 waste pit	2						2
	146921 cooking pit	6	22	17		45	6	22
	148846 layer	7	1	170		18		196
	150737 layer	4	1	48		19		72
	151748 pit			7				7
	152996 waste pit	5		50	1	45		101
	Waste deposit 106581	**169**	**48**	**403**	**9**	**2923**	**6**	**3558**
	117181 cooking pit			16	100	116		
	117222 cooking pit	1	5	15		21	1	5
	117579 cooking pit	13	189	1		203	13	189
	117654 waste pit	3		3				6
	136581 cooking pit	2		8		1		11
	217254 road	1						1
	Waste deposit 210240	**19**	**5**	**101**	**9**	**4573**		**4707**
	222581 pit			3		59		62
	222597 pit					++		nc
	225670 pit					150		150
	222741 post hole	1		4	7	19		31
	222755 waste pit	1				57		58
	272152 post hole	4		1		4		9
	Waste depsoit 216960			**6**				**6**
	282784 pit					1		1
	225081 post hole	1						1
	225092 post hole			5				5
	225256 post hole			4		7		11
	214857 waste pit			1				1
	House/Feature type	Domesticated	Wild	Mammal	Bird	Fish	Indet.	Total

Central parts of Field C	**Waste deposit 500200**	**151**	**9**	**627**	**2**	**136**		**925**
	523529	1		7		1		9
	523777 hearth			1				1
	523529 layer	4		1				5
	522925 cooking pit	22		208	1	34		265
	522612 layer			33				33
	522626 layer	4						4
	523593 layer	4		1				5
	523679 layer	7		38		4		49
	Waste deposit 521623	**23**	**1**	**269**	**1**	**108**		402
	524312 waste layer	12		92	1	26		131
	523989 cooking pit	4		60		86		150
	524509 cooking pit	2		11	1			14
	Agricultural layer 511160	**5**		**7**				**12**
	521585 cooking pit			1				1
	Waste deposit 521360	**1**		**4**	**1**	**58**		**64**
	521358 waste layer	4	2	6		31		43
	521359 waste layer			9		6		15
	521397 waste layer	9		53	1	224		287
	521429 layer	11	1	36		310		358
	Central courtyard Field C							
	523481 depression	2	1	4		24	2	33
	503886 hearth	4		61		578		643
	504395 depression			4		9		13
	504742 layer			2		3		5
	505161 depression			1		3		4
	505507 post hole	1				12		13
	506186 post hole			1				1
	518859 depression					2		2
	505507 post hole	1				12		13
	518845 depression	4		36		2		42
	515648 cooking pit			1				1

APPENDIX B2

Distribution of different classes of animals in different contexts at Ørland, Vik, Number of identified specimens (NISP).

	House/Feature type	Domesticated	Wild	Mammal	Bird	Fish	Indet.	Total
Field C	**Northern courtyard Field C**							
	514663 post hole			1				1
	517296 post hole			1				1
	517440 post hole			2				2
	Western courtyard Field C							
	523746 post hole	1						1
Central parts of Field C	**House 4**	**7**		22		**3**		**32**
	507539 depression			1				**1**
	508212 depression			1				**1**
	507350 post hole	1						**1**
	507448 post hole			1				**1**
	507462 post hole	1						1
	507501 post hole			3				3
	507619 post hole	1						1
	507631 post hole	1		3				4
	507644 post hole			2				2
	507671 post hole			1				1
	508156 post hole			4				4
	508265 post hole	1						1
	508359 post hole			1				1
	508371 post hole			1				1
	518291 post hole	2		4		3		9
	House 17			**2**				**2**
	Post hole							
	506268 post hole			2				2
	House 34	**10**		**35**		**7**		**52**
	522089 depression			4				4
	512922 hearth	3				2		5
	514373 hearth	3		23		2		28
	503802 pit	2		4				6
	504038 post hole			1				1
	504920 post hole			2				2
	505331 post hole					3		3
	505987 post hole	1						1
	512836 post hole			1				1
	515307 post hole	1						1

Central parts of Field C	**House 2**	**437**	**5**	**308**	**1**	**165**		**916**
	512989 cooking pit	2		5				7
	513032 cooking pit	1		6		2		9
	513085 cooking pit	1				2		3
	513154 cooking pit	6	1					7
	512883 cooking pit/pig	314		3				317
	503066 depression			2				2
	506827 depression			1				1
	513189 depression			2				2
	517131 depression	1	1	6		33		41
	523364 depression	1		1		1		3
	512103 depression/foal	1						1
	512162 hearth	3						3
	512212 hearth	2	2	43		8		55
	512802 hearth	9						9
	515236 hearth	8		3				11
	519507 hearth	25		135	1			161
	523611 hearth			49				49
	523647 hearth					1		1
	500301 post hole			1		1		2
	500332 post hole			2				2
	502045 post hole	2		1		11		14
	502090 post hole	1		1		1		3
	502116 post hole	1		1		1		3
	502139 post hole			13				13
	502315 post hole	1						1
	502381 post hole			1				1
	504306 post hole	11		8				19
	504320 post hole			1				1
	504349 post hole	1						1
	505836 post hole			1				1

APPENDIX B3

Distribution of different classes of animals in different contexts at Ørland, Vik, Number of identified specimens (NISP).

	House/Feature type	Domesticated	Wild	Mammal	Bird	Fish	Indet.	Total
Central parts of Field C	**House 2, continued**							
	506784 post hole	1	1	5		14		21
	511782 post hole	3		3		33		39
	512137 post hole					1		1
	512249 post hole			1		1		2
	513059 post hole	2						2
	521710 post hole	2		2		2		6
	521731 post hole			2				2
	521805 post hole					15		15
	521819 post hole			2		29		31
	522059 post hole	3		3		8		14
	522072 post hole	3		2		1		6
	522202 post hole	1						1
	523217 post hole	25						25
	524377 post hole			1				1
	525905 post hole	6		1				7
	House 21							
	616104 post hole			1				1
	House 28							
	603861 post hole			1				1
	611892 post hole			1				1
	614895 post hole	1						1
	614905 post hole			1				1
	616900 post hole		1					1
	616916 post hole			1				1
Central parts of Field D	603861 post hole			1				1
	611892 post hole			1				1
	611777 waste pit		1					1
	House 30							
	605914 hearth			1				**1**
	House 24							
	671339 hearth			1				1
	612709 posthole	1						1

APPENDIX C1

Identified mammals in different areas of the fields at Ørland at Vik, NISP.* includes 317 specimens of a complete pig. See original osteological reports for description of the subareas (Ystgaardet al. 2018)

Field/ subarea	Human	Horse	Cattle	Moose	Red deer	Large bovid	Large mammal	Large ruminant	Large ungulate	Sheep	Goat	Sheep/goat	Pig	Middle sized ruminant	Middle sized ungulate	Middle sized mammal	Bovid	Ungulate	Ruminant	Canid	Deer	Brown bear	Otter	Carnivore	Grey seal	Harbour seal	Harp seal	Seal	Middle sized - large mammal	Middle sized - large ungulate	Small - middle sized mammal	Small mammal	Whale	Mammal	Total
Central area of Field A and E																																			
106581		8	62	1	2		77		3	4	2	77	14	1		156	2	1	10	1	6		3	1			1	24	5			2	19	142	620
110297	1	29	82	3	1	1	182	20	17	2		131	54	22	1	487	10	6	86	1				1			1	14	7	1	4	2	1127	2303
Eastern area			10				8					13	2	3		91			1									5			1		5	139
Near 106581		1	4				4					14				194			1														6	224
Near 110297	1	1	8				34		1			20	4	1		56	1		23									2	3				216	371
Western area			3				1					3				24			1															32
Strayfind												12																							12
Central area of Field C																																			
500200		6	75	2			139		55	2		48	19			210	1	7	47	1		2				1	4				1	167	786
Near 500200		1	14				42		15		1	8	7			44	7	1	10									2				174	326
521623		3	5		1		66		5			12	3		1	54		2	4								3	1			3	133	293
Central area			6				21					1	4			49	2		10						1							68	162
House 02		1	79				18		2	2		32	323*		2	113		108	7								4				1	58	750
House 04		3	2				3		3			1	1			12			1													3	29
House 17																			2															2
House 34		1	6				11					3				7			2													15	45
NE area		8					2		1			1	2		1	28			1													1	45
North area			15									1				5																32	53
NW area			3				4		6			8	11		1	85	3		1												2	11	136
SW area		5	19				78		9	2		23	5		3	224			14									39					868	1289
Central area of Field D																																			
House 21																												1						1
House 24			1													1																		2
House 28												1				3			1												2			7
House 30																			1															1
North area							3									4																1		8
SW area			2					1				1																						4
Total	**2**	**67**	**396**	**6**	**4**	**1**	**693**	**26**	**117**	**12**	**3**	**410**	**449**	**27**	**9**	**1847**	**26**	**125**	**223**	**3**	**6**	**2**	**3**	**1**	**1**	**1**	**1**	**53**	**58**	**1**	**4**	**10**	**26**	**3027**	**7640**

APPENDIX C2

Identified birds and fish in different areas of the fields at Ørland at Vik, NISP. See original osteological reports for description of the subareas (Ystgaardet al. 2018)

Field/subarea		Chicken	Galliformes	Galliformes?	Red-breasted Merganser?	Anseriformes	Little auk	Great cormorant	European herring gull?	Falconiformes	Passerine	Bird	Atlantic cod	Haddock	Saithe	Haddock/Pollock	Whiting	Common ling	Ling	Codfish	Codfish?	European flounder	Flatfish	Righteye flounder	Pike	Herring	Angler	Fish	Total
Central area of Field A and E																													
106581			1						1			7	188	4	423			160	44	605						4	1	1492	2932
110297							1	1				8	42		61			6		91								609	819
Eastern area						3				1	6	6	445	620	307	9		7		537						3		2934	4878
Near 106581															4													29	33
Near 110297												1	1		8			2		19								78	109
Western area				1	1							1																8	10
Central area of Field C																													
500200		1										1	10	2	15			2	1	33						1		72	138
Near 500200												1		2						14								23	40
521623												1	5	4	7			1		21	2							68	109
Central area													101	2	38	1		1	1	65				1				428	638
House 02												1	18	1	25			18		40			1					62	166
N of House 02														26	1					3								17	47
House 04																				3									3
House 34														2	2					2								1	7
NE area					1								3		32				1	15								93	146
North area																				5						1		6	11
NW area												2	115	35	20			3		113								343	631
SW area												2	172	440	190		6	87		400		2	1	11				1808	3119
Central area of Field D																													
North area													1																1
Total		**1**	**1**	**1**	**1**	**3**	**1**	**1**	**1**	**1**	**6**	**31**	**1101**	**1138**	**1133**	**9**	**7**	**287**	**47**	**1966**	**2**	**2**	**2**	**13**	**1**	**9**	**1**	**8071**	**13837**