

ARTICLES

THE INTRODUCTION OF MAMMALS TO THE OUTER HEBRIDES AND THE ROLE OF BOATS IN STOCK MANAGEMENT

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Summary

There appears to have been a sea channel between the Outer Hebrides and the mainland throughout the last glaciation. If so, all the mammals on the islands today, both domestic and wild, must have been carried there by man. Records from the late seventeenth century and present day (tab. 1) show that the fauna is very restricted. Archaeological records also show few species (tab. 2). Larger wild mammals were presumably introduced for products such as fur and antler and as fall-back food supplies, while the micromammals were carried unintentionally. Boats have been used for transport of stock from the time of Neolithic colonisation, and continue to be used for routine movement of stock to summer grazing grounds, to deserted islets to establish feral flocks, and to carry animals beyond the islands as part of the exchange network and commercial trade.

Key Words

Outer Hebrides, Scotland, Introduced Mammals, Boats.

The Outer Hebrides is a chain of islands, approximately 200 km long, which comprises Lewis and Harris, North Uist, Benbecula, South Uist, Barra and over

Résumé

L'introduction des Mammifères dans les îles Hébrides externes et le rôle des bateaux dans l'élevage.

Un bras de mer semble avoir existé entre les Hébrides Externes et l'Ecosse pendant toute la dernière glaciation. Cela implique que tous les mammifères vivant aujourd'hui sur ces îles, domestiques et sauvages, y ont été introduits par l'homme. Des observations de la fin du XVII^e siècle et actuelles (tab. 1) montrent une faune très appauvrie. Les données archéologiques conduisent au même constat (tab. 2). Les grands mammifères sauvages ont été introduits probablement pour leur production de fourrure et de bois et pour l'alimentation en réserve, alors que les micromammifères ont été transportés involontairement. Des bateaux ont été utilisés pour le transport des troupeaux depuis la colonisation néolithique. Ils le sont encore aujourd'hui pour le transport régulier des bêtes vers les pâturages d'été qui constituent les îlots désertés, en vue de créer des troupeaux marrons, et pour des échanges commerciaux d'animaux au delà des îles.

Mots clés

Hébrides Externes, Ecosse, Mammifères introduits, Bateaux.

100 smaller islands (fig. 1). The channel which separates the Outer from the Inner Hebrides, the Minch, is 27km wide at its narrowest point, between Benbecula and

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Tab. 1. : Historical records of mammals in the Outer Hebrides. Key : C17TH: Martin, 1716 ; PRESENT DAY: Darling & Boyd, 1964 ; Arnold, 1978. P = present ; O = no record

SPECIES	C17TH	PRESENT DAY
DOMESTIC		
Cattle (<i>Bos taurus</i>)	P	P
Sheep (<i>Ovis aries</i>)	P	P
Pig (<i>Sus domesticus</i>)	P	rare
Dog (<i>Canis familiaris</i>)	P	P
Horse (<i>Equus caballus</i>)	P	P
Cat (<i>Felis catus</i>)	P	feral
Goat (<i>Capra hircus</i>)	P	feral
Ferret (<i>Mustela putorius furo</i>)	O	feral
Wild		
Pygmy shrew (<i>Sorex minutus</i>)	O	P
Rabbit (<i>Oryctolagus cuniculus</i>)	O	P
Mountain hare (<i>Lepus timidus</i>)	O	P
Brown hare (<i>Lepus capensis</i>)	O	P
Vole (<i>Microtus agrestis</i>)	O	P
Field mouse (<i>Apodemus sylvaticus</i>)	O	P
Black rat (<i>Rattus rattus</i>)	P	O
Brown rat (<i>Rattus norvegicus</i>)	O	P
House mouse (<i>Mus musculus domesticus</i>)	O	P
Pine marten (<i>Martes martes</i>)	P	O
Red deer (<i>Cervus elaphus</i>)	P	P

Skye. The islands of the Outer Hebrides are separated from each other by shallow channels, most of which are thought to have come into existence since the maximum transgression of the sea at about

6000 BP. Here, the land is sinking in relation to sea levels more than any other area of the British Isles : peat dating from 516445 BP has been found at a depth of 3.7m below mean sea level (Ritchie, 1985).

Was there a land bridge?

Crucial to the investigation of the arrival of the mammals is the question of when there was last a land bridge to the islands. The glaciers which covered the north of mainland Britain during the last glaciation, the Devensian or Wurm, are not now thought to have extended to the Outer Hebrides (von Weymarn, 1974). Relative sea levels began to rise from this time, and by the time Scotland was free of ice, at about 13,000 BP, they were higher than the present day. In the final cold episode at 11,000 to 10,000 BP, in Scotland the Loch Lomond glacial re-advance, local glaciers formed on the mountains of the Inner Hebridean islands of Skye and Rhum, but were otherwise confined to mainland Scotland. Though sea levels were then again relatively low, the mainland coastline is thought to have been in

Tab. 2. : Archaeological records of mammals in the Outer Hebrides. Key : Early Hist. c.AD 400 - 800 ; Viking c.AD 800-1450 ; L. Med c.AD 1450-1700. UDAL The Udal ; NOR Northton (Finlay 1984) ; ROS Rosinish (Serjeantson, NDa) ; SOLL Sollas ; ACHM A'Cheardach Mhor, South Uist ; ACHB A'Cheardach Bheag, South Uist ; BRU Bruach a Tuath and Bruach Ban, South Uist (Finlay, 1984) ; HORN Hornish Point ; BALE Baleshare (Halstead, ND) ; UDALN Udal (North) (Serjeantson, NDb) ; GAL Galson, Lewis (Baden-Powell & Elton, 1937). XX = 100 or more ; X = 99 or fewer ; ? I = ? intrusive

SPECIES	3rd millennium BC 2nd millennium BC						Wheelhouse phase								Barly Hist.		Viking		L. Med
	UDAL	NOR	ROS	UDAL	NOR	ROS	UDAL	NOR	SOLL	ACHM	ACHB	BRU	HORN	BALE	UDAL	GAL	UDALM	ROS	UDAL
DOMESTICS																			
Cattle (<i>Bos taurus</i>)	XX	XX	XX	XX	XX	X	XX	X	XX	XX	X	X	XX	XX	XX	X	XX	X	XX
Sheep (<i>Ovis aries</i>)	XX	XX	XX	XX	XX	X	XX	X	XX	XX	X	X	XX	XX	XX	X	XX	X	XX
Pig (<i>Sus domesticus</i>)	4	1	2?I	1	3		XX	2	X	X	7	X	X	XX	XX	X	XX		XX
Dog (<i>Canis familiaris</i>)	2			2	1		6	2	5	1	X		3	7	6		X		X
Horse (<i>Equus caballus</i>)					1			4	5								X		X
Cat (<i>Felis catus</i>)																	X		6
WILD																			
Rabbit (<i>Oryctolagus cuniculus</i>)																			X?
Vole (<i>Microtus agrestis</i>)				2?I															
Field mouse (<i>Apodemus sylvaticus</i>)				1?I															
House mouse (<i>Mus musculus domesticus</i>)				2?I															
Badger (<i>Meles meles</i>)					3?I														
Wild cat (<i>Felis silvestris</i>)																1			
Wild boar (<i>Sus scrofa</i>)																			
Red deer (<i>Cervus elaphus</i>)	X	X	X	1	XX	2	8	XX	X	X	X	3	4	X	X	X	X	1	XS

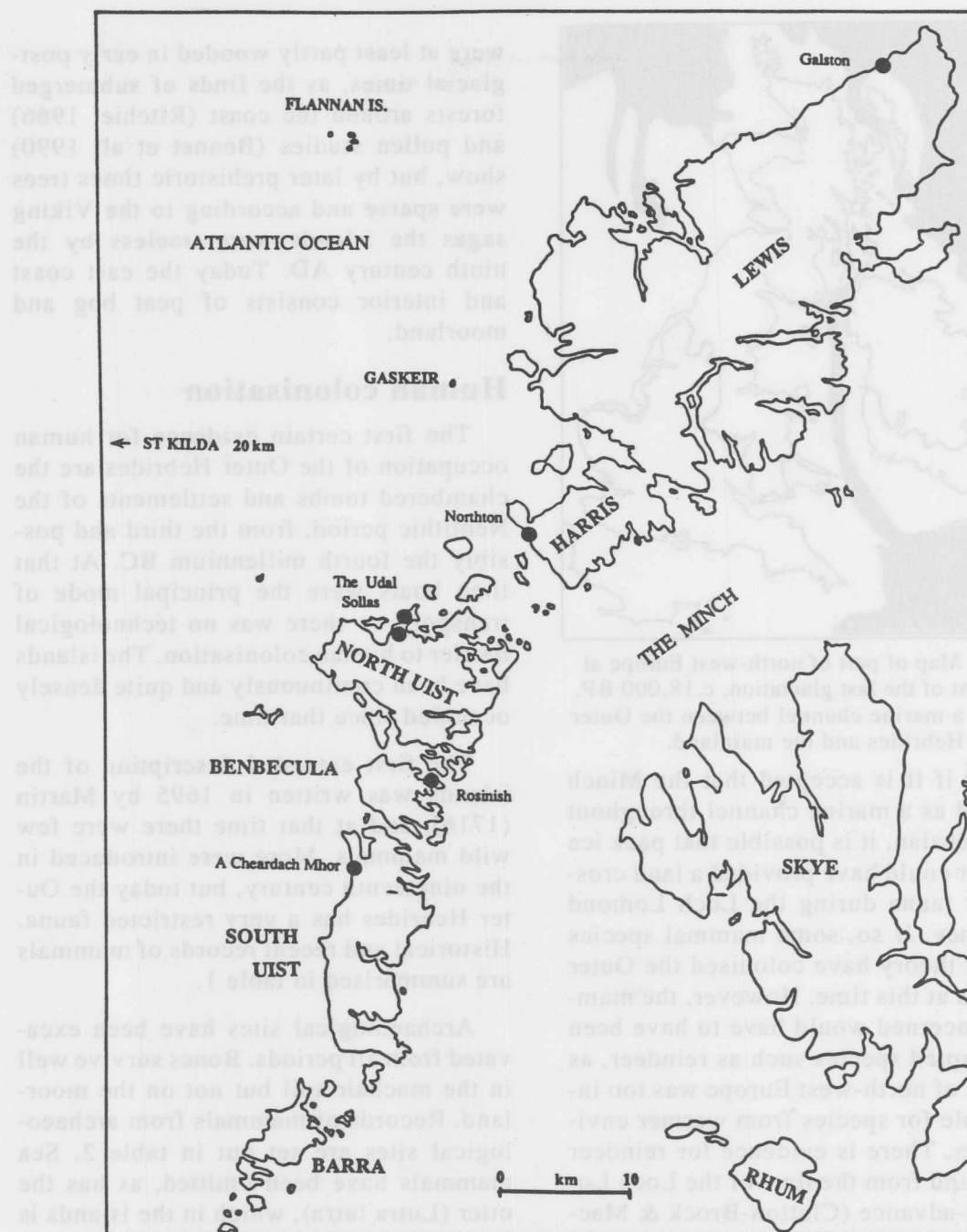


Fig. 1 : Map of the Outer Hebrides, showing the larger islands, the Inner Hebridean islands of Skye and Rhum and the main sites mentioned in the text.

approximately the same position as it is today (Price, 1982).

The Minch is a trough, 200m in depth, over-deepened by glaciation (Sutherland, 1987). At this depth it would have existed as a marine channel since at least c.

18,000 BP (fig. 2). Relative sea levels have risen c. 61 - 73m since that time and the Outer Hebrides have continued to sink in relation to sea levels, as they have not experienced the isostatic uplift which has taken place on the mainland and the Inner Hebrides.



Fig. 2 : Map of part of north-west Europe at the height of the last glaciation, c.18,000 BP. There is a marine channel between the Outer Hebrides and the mainland.

Even if it is accepted that the Minch persisted as a marine channel throughout the Devensian, it is possible that pack ice in winter could have provided a land crossing for fauna during the Loch Lomond re-advance. If so, some mammal species could in theory have colonised the Outer Hebrides at this time. However, the mammals concerned would have to have been cold-adapted species such as reindeer, as this part of north-west Europe was too inhospitable for species from warmer environments. There is evidence for reindeer in Scotland from the time of the Loch Lomond re-advance (Clutton-Brock & MacGregor, 1988), but none from the Hebrides.

The bedrock is Lewisian gneiss and granites, which weather to thin acid soils. There are surface tills, and along the western side of the islands, especially in North and South Uist, is a strip of calcareous shell-sand, the machair, today the main cultivable soil. The Outer Hebrides

were at least partly wooded in early post-glacial times, as the finds of submerged forests around the coast (Ritchie, 1966) and pollen studies (Bennet et al, 1990) show, but by later prehistoric times trees were sparse and according to the Viking sagas the islands were treeless by the ninth century AD. Today the east coast and interior consists of peat bog and moorland.

Human colonisation

The first certain evidence for human occupation of the Outer Hebrides are the chambered tombs and settlements of the Neolithic period, from the third and possibly the fourth millennium BC. At that time boats were the principal mode of transport, so there was no technological barrier to human colonisation. The islands have been continuously and quite densely occupied since that time.

The first extended description of the islands was written in 1695 by Martin (1716), and at that time there were few wild mammals. More were introduced in the nineteenth century, but today the Outer Hebrides has a very restricted fauna. Historical and recent records of mammals are summarised in table 1.

Archaeological sites have been excavated from all periods. Bones survive well in the machair soil but not on the moorland. Records of mammals from archaeological sites are set out in table 2. Sea mammals have been omitted, as has the otter (*Lutra lutra*), which in the islands is a marine species. The table is based on published data and reports awaiting publication by Finlay (1984), Halstead (ND) and the author (Serjeantson, NDa ; NDb). There are three Neolithic sites : the Udal, North Uist, (Crawford, ND), Rosinish (Shepherd, 1980), and Northton (Simpson, 1976). The Udal and Northton were also occupied in the second millennium BC. Bones from settlements of the Wheel-

house period, the later first millennium BC and early first millennium AD, have been studied from excavations at Baleshare and Hornish Point (Halstead, *op cit*), the Udal and four small sites (Finlay, *op cit*). There are two faunal samples from the Early Historic period (c.AD 400 - 800), from Udal North and Galson, Lewis, a small scale investigation carried out in the 1930s. The Viking or Norse period samples are from Udal North and Rosinish, and at the Udal occupation continued until the seventeenth century AD.

Wild Mammals

There were no relict mammals in the Outer Hebrides such as those of the Mediterranean islands, and whereas the domestic mammals were undoubtedly carried to the islands by man, whether all the wild mammals were is open to question.

Red deer

The species about which there has been most doubt is the red deer (*Cervus elaphus* L.). Two writers on the early fauna of Scotland (Ritchie, 1920 ; Lacaille, 1954) were of the view that they colonised the islands without human intervention. Lacaille wrote : "Among other early post-glacial immigrant cervids, the red deer, spread everywhere, even reaching the Orkneys, Shetlands and Hebrides", and this conclusion was accepted by Berry (1979) in his survey of the Outer Hebridean fauna. He wrote "only two species (the Pygmy Shrew, *Sorex minutus*, and the Red Deer), can be fairly definitely asserted to have arrived without the intervention of man". Though this was the common view, it was not unanimously accepted. In the recent analysis of the fauna from the Inner Hebridean island of Oronsay (Grigson & Mellars, 1987) the authors concluded that there was a real "possibility that red deer and conceivably other species could have been deliberately introduced into the outlying islands, such as

Colonsay and Oronsay, by the Mesolithic communities themselves." This argument was based on the distance (9km) of Colonsay from the nearest islands, Islay and Jura. They also wrote "it is equally possible that man was responsible for the deliberate introduction of some of the larger mammals - for example the red deer present on....Harris", and this paper will support that view.

Remains of red deer have been recovered from all the earliest sites (tab. 2). At Rosinish these include bones and both worked and unworked antler. It has become increasingly apparent that deer were commonly transported to islands by early man : some of the best examples are the fallow deer of Cyprus (Davis, 1984) and the red deer of Sardinia and Corsica (Vigne & Marinval-Vigne, 1988). Handling the deer and transporting them was within the technical competence of a people who were able to transport cattle between islands, as the Neolithic population clearly did. Though red deer swim short distances, 27km would be most unusual. As Vigne & Marinval-Vigne say of the introduction of red deer to Corsica : "ce comportement ne fait pas partie, à proprement parler, de l'ethologie 'normale' de l'espèce".

Why should deer have been taken to the islands when other meat animals under closer human control were also taken? A wild deer population provides a fallback food resource in years of failure of the agricultural economy, and the importation of deer to the Mediterranean islands has been attributed to this cause (Cherry, 1981). There is an additional important benefit from the presence of deer, and that is the usefulness of antler. This was a vital raw material for tools before the use of metal became widespread, and where preservation is suitable, antler has been found on all Neolithic sites of any size in Europe.

Wild boar

Finlay concluded that one suid tusk from Iron Age Northton had beading characteristic of wild boar (*Sus scrofa*). This single tooth need not imply a wild boar population on the island, since such objects were used for ornament, and could have been brought over from the mainland.

Smaller wild mammals

Historical and modern records alike (tab. 1) show a paucity of the smaller wild mammals in the Outer Hebrides (Darling & Boyd, 1964; Arnold, 1978). The only wild small mammals other than the micromammals are the two hares (*Lepus capensis* and *L. timidus*) and the rabbit (*Oryctolagus cuniculus*), which had been introduced to the Inner Hebrides by the sixteenth, but is not mentioned on the Outer Hebrides until the nineteenth century. There are feral, but not wild, cats (*Felis catus*) and feral ferrets (*Mustela putorius furo*), but no true wild polecats (*M. putorius putorius*). The "mertrick" or pine marten (*Martes martes*) lived on Lewis in the seventeenth century, but was extinct by 1870.

Archaeological finds of the smaller mammals (tab. 2) are few. There were three bones of badger (*Meles meles*) from layer B VII at Northton which were thought to be possibly intrusive, but the presence of badger bones at any period is interesting, in view of the lack of any record of the species on Harris. The bones are from the skull, a part of the skeleton which may be left on a skin used for decoration or clothing (Serjeantson, 1989a), so need not necessarily imply that the animal lived on the island. A rib of wild cat (*Felis sylvestris*) was identified at Galson by Bate, but it is doubtful if wild and domestic cat can be reliably distinguished on the basis of a single rib. Rabbit bones have been found in most excavated sand dune sites, but rabbits are ubiquitous to-

day on the machair, and burrow readily into the sandy soil.

The most likely mode of introduction for these species is deliberate transport by man. The purpose was likely to have been in order to establish populations of fur-bearing animals, but may have been for sport, the reason for the nineteenth century introductions.

Micromammals

Today there are five insectivores and rodents on the Outer Hebrides (Darling & Boyd, 1964; Arnold, 1978): pygmy shrew (*Sorex minutus*), field vole (*Microtus agrestis*), which is found only on Uist, field mouse (*Apodemus sylvaticus*), house mouse (*Mus musculus domesticus*), and brown rat (*Rattus norvegicus*). The last has lived on Lewis since at least 1768, when some escaped from a ship which foundered and sank off the island (Lever, 1977). The black rat (*Rattus rattus*) was recorded by Martin, but is now absent.

Three rodents have been identified in excavated remains, all from Rosinish (tab. 2), where all the deposits were sieved to 1mm or 2mm: the house mouse (*Mus musculus domesticus*), field mouse (*Apodemus sylvaticus*) and field vole (*Microtus agrestis*). Though they were found with Beaker period material, it is impossible to exclude the possibility that they have burrowed into earlier layers at any time.

Sorex minutus is found on more of the offshore islands of the British Isles than any other micromammal (Matthews, 1982) and therefore is believed to have reached them before they were isolated by rising sea levels. If this was not possible for the Outer Hebrides, as I have argued above, then *Sorex minutus*, like the rodents, must have been introduced by man. Skeletal differences of the skull were used in an attempt to sort out the rela-

tionships between the races of field mouse (*Apodemus sylvaticus*) from the islands, the Scottish mainland, and Norway (Berry, 1979). He rejected the subspecies which have been proposed in the past, and found that the relationships fit closely with the expectations of closely founded populations, and not at all with the possibility that the mice are relicts. Mice from Shetland and Eigg are closest to the Norwegian form, which led Berry to conclude that the introductions were by Norsemen.

A separate form of vole, *Microtus agrestis*, has been claimed for the Outer Hebrides, based on the shape of the upper third molar, but Berry considers that for this species too the tooth variation fits better with later introduction by man.

The micromammals are likely to have been carried to the islands inadvertently, some with grain or fodder, as hypothesised by Berry and also by Vigne (in press) for the micromammals of Corsica.

Domestic Mammals

Cattle (*Bos taurus*) and sheep (*Ovis aries*) were certainly taken by the first farming groups to colonise the Outer Hebrides, and it is probable that pigs (*Sus domesticus*) and dogs (*Canis familiaris*) were also taken from the first (tab. 2). Other domestic species introduced later were the horse (*Equus caballus*), the cat (*Felis catus*), the goat (*Capra hircus*) and the ferret (*Mustela putorius furo*).

Cattle

The aurochs (*Bos primigenius*) was present in mainland Scotland in post-glacial times, but its remains have not been found in the Hebrides. Domestic cattle therefore had to be introduced by the first groups to colonise the islands. They were the mainstay or at least one key part of the economic and social life of the first farmers in the Outer Hebrides, as the abundance of remains testifies.

Sheep

The sheep was the second most important animal species in the early Hebridean settlements. The excavated finds suggest that they were kept in higher proportions than on contemporary sites in mainland Britain. This was no doubt because the natural sward on the sand dune machair, which had already developed by the end of the third millennium BC, provided ready grazing without the necessity for tree clearance.

Pigs

Remains of pigs are present but rare on settlements of all periods except the first millennium BC (tab. 2). At Rosinish the only pig bones identified, a pair of jaws, were at the top of the midden deposits and may be later than the Beaker period. They are uncommon at Udal North, where they make up less than 3% of the identified bones of domestic mammals from c.AD 300 until AD 1500. Only in the 17th century did this increase to 7%. Two features of the environment make the Outer Hebrides unsuitable for keeping herds of pigs. The first is the lack of woodland for grazing; the second, the vulnerability of the arable soils to disturbance by rooting and trampling. It has been shown that pig keeping was restricted or heavily controlled in many parts of Scotland because of the damage pigs may cause (Ross, 1983), and this control was particularly important in the Outer Hebrides where any disturbance of the ground cover of the sandy machair soils was and still is liable to lead to destructive sand blows. It is not surprising that there is no historical tradition of keeping pigs in the Outer Hebrides. These disincentives make it all the more surprising that they do seem to have been quite common during the Wheelhouse period in the first millennium BC.

Dogs

Remains of dogs are very sparse at all times. None were found among the bones

from Rosinish, nor did any of the bones of the food mammals show certain traces of gnawing. The main practical reason for keeping dogs in early times was to protect domestic stock from wolves and other predators. As terrestrial predators were absent, the need to keep dogs was apparently less pressing. All the same, the relationship between man and dogs is such a close one that it is not surprising that occasional evidence of dogs is found.

Horse

The earliest Outer Hebridean sites from which horse bones have been recovered are from the Bronze Age (tab. 2) ; it was at this time that the use of horses spread throughout the British Isles.

Cat

Domestic cats seem to have been introduced late. No bones of domestic cats have as yet been found which predate the middle of the first millennium AD.

Goat

Some domestic goats were kept on Lewis and Harris from at least the seventeenth century (Martin 1716). A feral flock established itself on Harris, as happens on so many islands, though it may now have died out. Goat remains have not been reported as yet from any archaeological sites.

Ferret

There are feral ferrets are reported on Lewis (tab. 1), but no archaeological evidence for these.

Use of Boats for Animal Management

Island dwellers have no option but to use boats as a principal means of transport, including the movement of stock. In order to use all available grazing a form of transhumance has survived almost until the present day in the islands. Much of the cultivated arable land remained unfenced until 30 years ago, and the cattle and

sheep were removed from the fields at the time the crops were growing and taken to graze at a distance. Some were taken to the moorland, to use the summer grass there, but others were taken to small offshore islands. Martin refers to many of the smaller uninhabited islands as "suitable only for pasturage". for instance, Sella, one of the islands between Harris and North Uist "yields extraordinary pasturage for sheep" and Gaskeir "about half a mile in Circumference ... maintains 8 or 10 cows". Hermetra, "two miles in Circumference : affords great plenty of Milk in January and February beyond what can be seen in the other Islands." "Between Ensay and the main Land of Harries, lie several small Islands, fitter for Pasturage than Cultivation". The offshore islands were also used to isolate the male animals ; Martin recounts that bulls were taken to Valtos, off Lewis, for the summer.

The more remote uninhabited islands were used in a rather different way ; sheep were taken to these and allowed to run as feral flocks. The islands were visited once a year by a group of the men from the community to which the island belonged and the flock culled for meat. The best example of this is the island of Soay, in the St Kilda group, where the well-known small primitive Soay sheep lived. The men of St Kilda went to Soay once a year to cull the flock until St Kilda was deserted in the 1930s. The feral sheep live on Soay still, but their annual visitors are now teams of scientists.

The other islands which were used in this way into historical times were the Flannan Isles. "To the North-west of Gallan-head, and within six Leagues of it, lie the Flannan-Islands, .. they are but small Islands, and six in number, and maintain about seventy sheep yearly." Men from Lewis visited the islands once a year to cull the feral sheep and capture wild fowl

and their eggs, for meat, down, feathers and quills (Martin 1716).

Boats were also used to move stock to the Inner Hebrides and the Mainland. So far as trade outside the islands was concerned, the Hebrides remained substantially isolated from the money economy of England and lowland Scotland until the seventeenth or eighteenth century (Smout, 1969, Shaw, 1980). However, under the clan system which survived until the eighteenth century in the west, goods were owed as tribute to the chiefs, and these often included live animals. The pattern of clan holdings of territory was such that each clan held some of the Outer and some of the Inner Hebridean islands, as well as part of the adjacent mainland, (Mackenzie, 1903), which gave access to the arable land of the Outer Hebrides as well as the extensive grazing of the Inner Hebrides and the mainland. There was therefore constant communication and movement of stock and produce between the islands.

From the eighteenth century onwards there was a market for cattle on the mainland. The steers were transported across the Minch to Ullapool or Skye in boats. From Skye to the mainland, a distance of from one to two km, depending on the route chosen, cattle were either taken by boat (fig. 3) or swum across. Martin relates how this was done : the beasts were tied five at a time tail to head with withes and swum across to the mainland by men in four-oared boats. From that point they were driven to cattle markets in the south and east of Scotland and England. Cattle are still swum between islands ; in 1987 a bull drowned while being swum across from Barra to Vatersay to service the 40 cows on Vatersay (*Independent*, 28-1-88).

The boats used

No remains survive of prehistoric boats from the region, but it is likely that



Fig. 3 : Cattle being carried to the mainland from Skye in an open boat, nineteenth century [from Cameron, 1986] (copyright Royal Museum of Scotland).

the boats used by the first farmers around the western seaboard of Europe in the fourth millennium BC were made of a wood or wicker frame covered with sewn hides (Banbury, 1975). Such boats are stable even in the rough seas around the western coasts of the British Isles and may be up to 10m in length or more, quite large and sturdy enough to transport people and stock around the coast and the islands. By at least the first millennium BC clinker built wooden boats were being used. The Hebrides were among the first to feel the impact of Viking raids and later colonisation, both of which depended on the superior sea-going qualities of Viking craft. The long boat was the basis for subsequent boats used in the west of Scotland until the 18th century. These, later known as birlinns, were open galleys or barges, rowed by six or eight rowers, which sometimes also carried a sail. There is a car-

ving of one such boat (fig. 4) on a tomb of 1528 on Harris. Until recently open boats with flat keels were used, which were suitable for drawing up on the beaches. Immense care was taken when carrying out visits to offshore islands. For instance Martin described how "they always imbark [sic] with a contrary Wind, for their security against being driven away by the Ocean". When steam ships began to ply between the islands and the mainland in the nineteenth century, cattle and sheep were winched aboard. Only in the past 20 years have roll-on/roll-off ferries and cattle trucks seen the end of this practice.



Fig. 4 : A birlinn (galley) carved on a grave at Rodel, Harris, sixteenth century AD (thanks to Royal Commission on Ancient and Historical Monuments, Scotland).

Conclusion

If it is accepted that there has been no land bridge to the Outer Hebrides since the height of the Devensian glaciation, it follows that all the land mammals of the islands, with the possible exception of the pygmy shrew, were transported there by man, either deliberately or accidentally. Archaeological work in progress will continue to clarify the date of introduction of the larger mammals and the micromammals, though it will be more difficult to pin-point the time of introduction of the latter because of the problems of intrusive

burrowing. Berry's theory for the introduction of the field mouse is an attractive one, but at present it cannot be tested against archaeological finds, and increased knowledge of the patterns of Viking colonisation do not support it.

The fact that all the species which did reach the islands were probably introduced by man helps to account for the exceptionally impoverished wild mammal fauna which is attested to by the sparse archaeological finds and the historical records. The combination of the exposed climate, and the restricted vegetation types and soils will have contributed to the failure of some introduced species to survive. It is possible that the sparse archaeological records of, for instance, the badger and wild boar, represent early unsuccessful attempts to introduce these mammals. Survival was precarious even for the micromammals: Martin commented that "mice do not live in this island, and when they chance to be carried there among corn they die quickly after", just as the St Kilda house mouse has not survived the human population's desertion of that island.

At all times the domestic stock was also more restricted than is found on contemporary mainland sites. Even the domestic fowl (*Gallus gallus*) spread to the Hebrides at least 400 years after it was introduced to the rest of the British Isles; the evidence from the Udal shows that it was not at all common before the ninth century AD (Serjeantson 1989b).

All except the most local journeys must have been made in boats, and effective use of the land demanded the use of boats for moving livestock to pasture. The amount of movement of livestock outside the islands can only be guessed at but the excavated material culture is evidence of continued cultural contact with the rest of Scotland, and this is likely to have inclu-

ded movement of animals after the initial introduction.

Since the stormiest area of the whole of the British Isles is the Butt of Lewis (Manley, 1979), this is impressive testimony to the seamanship and hardihood of the islanders.

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BIBLIOGRAPHY

- ARNOLD H.R. (1978) : *Provisional Atlas of the Mammals of the British Isles*, Abbots Ripon, Natural Environment Research Council edit.
- BADEN-POWELL D. & ELTON C. (1937) : On the relation between a raised beach and an Iron Age midden on the island of Lewis, Outer Hebrides, *Proc. Soc. Antiquaries of Scotland* : 347-365.
- BANBURY P. (1975) : *Man and the Sea*, London, Granada edit.
- BENNET K.D., J.A. FOSSIT, M.J. SHARP & V.R. SWITSUR (1990) : Holocene vegetational and environmental history at Loch Lang, South Uist, Western Isles, Scotland, *New Phytologist*, 114 : 281-298
- BERRY R.J. (1979) : The Outer Hebrides : where genes and geography meet, in : J.M. BOYD edit., *The Natural Environment of the Outer Hebrides*, *Proc. Royal Soc. of Edinburgh*, 77 : 21-43
- BRAY E. (1986) : *The Discovery of the Hebrides : Voyagers to the Western Isles 1745-1883*, London, Collins edit.
- CAMERON A.D. (1986) : *Go Listen to the Crofters*, The Napier Commission, Stornaway, Acair Ltd edit.
- CLUTTON-BROCK J. & A. MACGREGOR (1988) : An end to medieval reindeer in Scotland, *Proc. Soc. Antiquaries of Scotland*, 118 : 23-35
- CRAWFORD I.A. (ND) : *The West Highlands & Islands : A View of 50 Centuries*, Cambridge, Great Auk Press edit. PO box 262.
- DARLING F.F. & J.M. BOYD (1964) : *The Highlands and Islands*, London, Collins edit.
- DAVIS S.J.M. (1984) : Khirakitia and its mammal remains : a neolithic Noah's ark, in : A. Le Brun edit, *Fouilles recentes a Khirakitia (Chypre) 1977-1981*, Paris, Recherche sur les Civilisations edit.
- FINLAY J. (1984) : *Faunal evidence for prehistoric economy and settlement in the Outer Hebrides to c.400 AD.*, PhD thesis, University of Edinburgh
- GRIGSON C. & P. MELLARS (1987) : The mammalian remains from the middens, in : P. Mellars edit., *Excavations in Oronsay*, Edinburgh, University Press edit.
- HALSTEAD P. (ND) : *Remains of mammalian fauna from Baleshare and Hornish Point*. Unpublished MS
- HALSTEAD P. and O'SHEA J. (1989) : Introduction *Bad Year Economics*, Cambridge University Press edit.
- LACAILE A.D. (1954) : *The Stone Age in Scotland*, Oxford University Press edit.
- LEVER C. (1977) : *The Naturalised Animals of the British Isles*, London, Hutchinson edit.
- MACKENZIE W.C. (1903) : *History of the Outer Hebrides*, Paisley, Gardner edit.
- MANLEY G. (1979) : The climatic environment of the Outer Hebrides, in : J.M. BOYD edit., *The Natural Environment of the Outer Hebrides*, *Proc. Royal Soc. of Edinburgh*, 77 : 47-59
- MARTIN M. (1716) : *A Description of the Western Islands of Scotland*, (2nd Edition, reprinted 1981), Edinburgh, The Mercat Press edit.
- MATTHEWS L.H. (1982) : *Mammals in the British Isles*, The New Naturalist Series, London, Collins edit.

- PRICE R.J. (1982) : The magnitude and frequency of late quaternary environmental changes in Scotland : implications for human occupation, *Scottish Archaeol Rev.*, 1 (2) : 61-73.
- RITCHIE J. (1920) : *The Influence of Man on Animal Life in Scotland*, Cambridge University Press edit.
- RITCHIE W. (1966) : The post-glacial rise in sea level and coastal change in the Uists. *Trans. Inst. Brit. Geog.*, 39 : 79.
- RITCHIE W. (1985) : Intertidal and subtidal organic deposits and sea-level changes in the Uists, Outer Hebrides, *Scottish J. Geol.*, 21 (2) : 161-176.
- ROSS E.B. (1983) : The riddle of the Scottish pig, *BioScience*, 33, (2) : 99-106.
- SERJEANTSON D. (1989a) : Animal remains and the tanning trade, in : D. Serjeantson & T. Waldron edit., *Diet and Crafts in Towns : the evidence of animal remains from the Roman to the Post-Medieval periods*, BAR, British Series, 199 : 129-146.
- SERJEANTSON D. (1989b) : Archaeological and ethnographic evidence for seabird exploitation in Scotland, *ArchaeoZoologia*, 2 (1-2) (1988) : 209-224.
- SERJEANTSON D. (NDa) : The mammal, bird and fish remains from Rosinish, in : I.A.G. Shepherd edit., *Excavations at Rosinish, Benbecula*, forthcoming.
- SERJEANTSON D. (NDb) : *The mammal, bird and fish remains from Udal North* : interim report. Unpublished ms.
- SHAW F.J. (1980) : *The Northern and Western Islands of Scotland* : Their Economy and Society in the Seventeenth Century, Edinburgh, John Donald edit.
- SHEPHERD I.A.G. (1980) : The archaeology of the Rosinish machair, in : D.S. Ranwell edit., *Sand Dune Machair*, 3. NERC, Institute of Terrestrial Ecology edit., University of East Anglia, p. 24-29.
- SIMPSON D.D.A. (1976) : The later neolithic and Beaker settlement at Northton, Isle of Harris, in : C. Burgess & R. Miket edit., *Settlement and Economy in the Third and Second Millenium BC*, BAR British Series, 33 : 221-231.
- SMOUT T.C. (1969) : *A History of the Scottish People, 1560-1830*, London, Collins edit.
- SUTHERLAND D.G. (1987) : Submerged rock platforms near Sula Sgeir, *Scottish J. Geol.*, 23 (3) : 251-260.
- VIGNE J.-D. (in press) : Biogeographical history of the mammals on Corsica (and Sardinia) since the final Pleistocene. Int Symp Biogeographical Aspects of Insularity (Roma 1987). *Accad Naz Lincei*.
- VIGNE J.-D. & M.-C. MARINVAL-VIGNE (1988) : Contribution à la connaissance du cerf de Corse (*Cervus elaphus*, Artiodactyla, Mammalia) et de son histoire, *Bull. Ecol.*, 19 (2-3) : 177-187.
- VON WEYMARN J.A. (1974) : *Coastline development in Lewis and Harris, Outer Hebrides, with particular reference to the effects of glaciation*, PhD thesis, University of Aberdeen