Man and Bird in the Palaeolithic of Western Europe

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For Mike

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Preface

In putting together these chapters I have found that a study of the interaction between the avian world and that of the hunter - gatherer peoples of the Palaeolithic in Europe has been a search for pattern; pattern in avian ethology, pattern in human behaviour and how the separate patterns have intertwined from time to time. The outcomes show that during the timespan of the Palaeolithic cultures, ecological change was a constant and repetitive process and that in the study of the period, minute faunal detail was an important part of the interpretation of it.

The first three chapters are concerned with some aspects of avian ethology and the archaeological background; later chapters with the process and patterns of interaction between them. The pattern does not always come together. In the record of the Middle Palaeolithic in particular, the data from sites belonging to the Acheulean and early Neanderthal settlement is too patchy, intermittent and inconsistent to give more than a tiny glimpse of what might have been the bigger picture. As the Neanderthal populations expanded across Europe each with its own cultural markers, a pattern begins to emerge showing how resources, including birds, were exploited and put to use.

The gradual penetration into Western Europe of what we call Upper Palaeolithic cultures shortly before 40,000 Kyr BP. probably did not change the relationships greatly but the available information has suffered less erosion from time-factored forces and has remained intact in more detail. So much is now known and continuously being brought to light about the way these hunter-gatherer groups lived, used their resources even trading in them and in consequence how they socialised one group with another. Clear patterns are beginning to emerge, as a result of increasingly meticulous excavation techniques, awareness of the different ways in which tiny fragments of evidence might be interpreted and the use of advancing technology have all had a part to play in the field operations. Yet, just as important is always the research that takes place both before and after any excavation is carried out. The choice of sites selected to demonstrate the way in which avian resources were put to use and attained increasing importance in the development of hunter gatherer society has been based in part on the amount of available data and in part on personal research experience.

To a great extent, in the study of faunal remains, context may determine what material evidence will be found and what will have perished; the location and its environment may affect the phenotype and genotype of the animal species under examination in terms of size, coloration, dietary preferences, movements or breeding potential, amongst other factors. Post excavation research, as technology changes, has become crucial to the extraction of all possible information from the objects revealed. Absolute dating methods, chemical analysis, mass spectrometry, and advances in microscopic, photographic and photometric studies of all types have advanced so much over the last 50 years and are continually evolving so that the researcher may now ask questions that were beyond the reach of earlier previous generations of archaeologists. The entire process takes longer and requires a diversity of specialist expertise but usually the results may be said to justify the extra cost.

And, over time, the questions change as does the relative emphasis placed on them. Currently in the field of anatomical studies, the emphasis is on the study of taphonomy, the treatment bone remains have undergone since death, who ate them, why and how were they modified, the purpose of the modification etc. And besides, what these conclusions may have to say about that social group and its lifestyle.

One of the difficulties associated with the interpretation of bone assemblages arises from the diversity of dating methods used currently and in the past and the difficulty in reconciling the data they provide. Tyreberg had to address this problem in 1998 and it is one faced by all researchers of the Palaeolithic. How to correlate the time sequences across Mammal Neogene zones, traditional glacial and biostratigraphy sequencing in different regions of Europe, reconciling them with cultural sequences. The absolute dating methods, though they present a more precise tool for comparing one site with another have imposed another hurdle to surmount, because of necessity they use different techniques. The most useful most frequently employed and consistent of the Radiometric dating, techniques within its parameters of accuracy is probably Carbon 14. As far as possible sites have been selected that carry secure uncalibrated C14 dates, although, where applicable, the sequence of Oxygen isotope (OIS) stages and land Mammal Zones (MNQ zones) have also been referred to.

Nomenclature may also create confusion not only in the changes in the scientific designations of birds but also for cultural sequencing. In the 1950's glacial phases continued to be referred to under the names of the Alpine sequence, while these fluctuations are now recognised as having regional variations and the task is to reconcile the local sequences with the evidence of ecology and cultural change.

By the start of the 21st century, the search for the evidence left by Early Man had already had a over 150 years of history of exploration behind it and some of the early excavations have needed to be revisited and the data revised, using the residue of what was left behind by the earlier archaeologists, left behind for their re-assessment. Added to which, at the time some of the objects, documenting the discoveries recovered by these pioneers were presented as gifts to friends and colleagues. When these objects of antiquity were given to a national or local museum they have normally been conserved. But too frequently individual pieces were given to private collectors and have been difficult to trace. At the time small bones were regarded as of lesser importance. The remains of microfauna or of the birds was seldom considered of sufficient value to be studied or retained.

Nevertheless, it is on the foundations laid by these pioneers that all recent research is founded. Without such scholarly leadership from researchers and antiquarians of the past, the present level of knowledge would be a great deal poorer. Each of us has their heroes who have taught or inspired them. Among my personal heroes I count independent thinkers like Dorothea Bate, André Leroi Gourhan, the Abbé Henri Breuil and some recent researchers. I am also hugely grateful my tutor, John Waechter, at the Institute of Archaeology in London who when told, as he was handing me his bird bone collection from Gorham's cave, Gibraltar for study, that although birds were quite a thing of mine, my knowledge of anatomy was sketchy, he replied that it would be greatly improved by the time *you have dealt with this lot.* Deal with it I did and carried on.

Despite the wonderful co-operation of museum staff and the use of their collections, the priority was to prepare an avian skeletal reference collection for personal use, despite the demands it made on the tolerance and patience of family, friends and sympathetic organisations. Most specimens were collected in the field, where by experience one learnt that dried, skinned and eviscerated corpses, wrapped in newspaper, not polythene travelled better and attracted less official attention than fresh ones; and that insects, especially hornets were exceedingly efficient flensing operators if allowed to work on specimens hung out on a line, provided that line and attachments were wire, otherwise eager ants would devour the strings and their nest would require excavation to retrieve the fragmented specimen next morning. Happily, only one bird, a dunlin that had lost a wing was ever deliberately killed but it was under attack from gulls at the time without any chance of survival.

I have depended to a large extent on other researchers in ornithology and Palaeolithic archaeology. In the main most of these are referred to in the text but there has been particular dependence on the nine volumes of Cramp and Cramp and Simmons work in the *Handbook of birds in Europe, the Middle East and north Africa; Birds of the Western Palaearctic, (*1977-1994) for most of the ornithological data and on Tyreberg's site lists in *Pleistocene birds of the Palaearctic* (1998). For Anatomical detail and nomenclature, Baumel ed. (1979) has everything to recommend it and the volumes produced by the Institut fur Palaeoanatomie, domestikatione forschung und Geschichte der Tiermedizin of the University of Munich, directed bt Dr Boessneck, with Angela Von Dreisch (1976) *A Guide to the measurement of animal bones* can be useful.

But time and research move on, new techniques are becoming available all the time in answer to the increasing number of questions that are asked about animal and human behaviour, their chemistry, origins and development. And the means of seeking answers to these questions are being discovered all the time, usually emerging out of the requirements in other areas of research. Photographic techniques, photogrammetry and the electron microscope, the fields of biochemistry and materials research are being adapted for service in archaeology. Each new tool opens up the possibility of more precise information, though each has its advantages and limitations. In the end, any results depend on subjective judgement and the imaginative scope to ask the questions in the first place and explore the possible solutions, even if the answer is likely to be negative.

Chapter 1

Some aspects of bird life during the Palaeolithic of western Europe

Some of the aspects of avian ethology as they are related to Palaeolithic hunter-gatherer settlers are revealed in the fossil record that has been recovered from occupation sites and caves in western Europe and have something to say about the life of the birds themselves during the Upper Pleistocene. Conversely while an avian presence may provide some information regarding the environment of hunter-gatherer peoples, its absence may be a reflection of ecological or other issues of human priorities. Yet an even more important situation relevant to the issues raised by current climate change is that even though there were long periods when the European climate deteriorated to a point where it could not support a number of species whose niche requirements demanded temperate or Mediterranean conditions to survive, these came back fairly rapidly as the temperature rose again and restored the ecology to match their needs. The situation never became one of extinction due to catastrophic external forces, as perhaps happened during the Cretaceous, but an internal fluctuation subject to later restoration.

In his introduction to the comprehensive lists of the *Pleistocene birds of the Palaearctic, a Catalogue, 1998* Tyreberg takes the starting point of the Palaeolithic as around 1.64 MA BP, a date that follows after the Olduvai geomagnetic event. The point at which birds began to be exploited as a resource for hunter-gatherer peoples in western Europe appears to be around 500,000 Years BP, during the early Middle Palaeolithic, from which time there begins to be some clear evidence of human and avian inter-action rather than possibly random juxta positioning of bones or scavenging on the kills of other predators. The discovery of assemblages of animal and avian bone makes it possible to attempt a partial reconstruction of the changing environment and ecology of the locality. Useful data for this is preferentially obtained from the stable sequences in cave or open air settlements. Material from river terraces or shorelines is less useful, since it has frequently been re-deposited and therefore the date and context is more doubtful.

The effect of climate fluctuation on bird populations was profound. Habitats, for both summer and winter visitors to western Europe, breeding behaviour and distribution areas were all dependent on the niche requirements of individual species that were subject to changes in the environment. Some of the ecological changes brought about by climatic fluctuation, may be traced in the evidence of species distribution as derived from the archaeological record. Migration patterns undoubtedly changed, as noted by Moreau in 1972, who listed many of the passerines as having disappeared from the European list in times of glacial advance. Food availability is a major factor in defining the suitability of a habitat to support a varied bird fauna, A diverse avifauna in a particular context may therefore indicate a rich variety in the local ecology since across the spectrum birds will relate to every other taxon present, either in the sense of being broadly sympatric or in a prey/predator relationship.

The data is complicated, as noted by Tyreberg, by the different dating methods used. Not only do many older excavation publications rely on cultural chronology but the various means of absolute dating are not always consistent or standardised. Where recent C14 dates are available, these have been used as being within the range of probability. The record is also biased and incomplete. Whereas large mammals have always been a priority in considering the human environment, the significance of birds, micro-mammals and other species in the ambient fauna and flora was not fully recognised by the early excavators and the evidence was not always retained.

Seasonal movement patterns

The following tables show the species and contexts of the bird species recorded as present in dateable excavated cave deposits in western Europe. The sites where each one has been recorded are broadly and somewhat arbitrarily grouped into the major Palaeolithic cultural and climatic sequences. It attempts to give a broad picture, based on Djindjian, F., Koslowski, J., and Otte, M. 1999. There may be local discrepancies in the lists, and some noteworthy sites have been omitted since some of the determinations may require revision.

The species listed in Table 1 shows many of those species identified by R.E. Moreau in 1972 as unlikely to be able to survive in western Europe during a glacial advance.

Of particular significance is the small number of deposits dated to the Last Glacial maximum from which bird remains have been recovered, that confirm Moreau's

Species	**250 – 40 Kyr BP Mousterian**	**40 – 28 Kyr BP transition to Upper palaeolithic Aurignacian**	**28 – 22 Kyr BP transition to Gravettian, deteriorating climate**	**22 – 17 Kyr BP Local Solutrean Last Glacial maximum**	**17 – 10 Kyr BP Magdalenian sequence, ice retreating**	**10 Kyr to recent Mesolithic <**
Coturnix coturnix	A. Olha, Pyr Atlant. Aurensan Hte Pyr. B. de Gigny Jura. Valdegoba Burgos C.N. de Bellus Jativa	B. de Gigny Jura	B. de Gigny Jura Le Flageolet Dord.	A. des Pecheurs, Ardêche.	Aurensan Hte Pyr. Cauna de Belvis Hte Pyr. Bois du Cantet Hte Pyr.	B. de Gigny Jura Baume des Grottes Isère. B. des Gonvillars Hte Saône
Burhinus oedicnemus					La Madeleine, Dord. A. Dufaure Landes	
Otus scops	Combe Grenal, Dord Pech de L'Aze. Dordogne		A, Pataud Dord. A. des Pecheurs Ard. Arbreda Gerona	Bois de Brousse Herault	Cauna de Belvis Aude Laroche II Herault	Pont d'Ambon Dord Salpêtre Herault
Apus melba	Hortus Herault C.N. de Bellus Jativa Devil's Tower Gib.	C. de Zafarraya Malaga			G. des Romains Ain Cingle Vemell Barcelona	Balme des Grottes Isère
Apus pallidus		Es Poussas, Eivissa				Es Poussas, Eivissa
Merops apiaster	Combe Grenal Dordogne					Salpêtre Herault
Cuculus canorus					G. d'Eyzies Dord. Abr. de Campalou Drôme	
Corracias garrulus	Arbreda Gerona				Trou Violet Ariège Gr. dela Madonna Calabria	C. Genovesi sicily G. Polesini Lazio Es Poussas Eivissa
Hirundo daurica	Balauzière Gard G. Simard Charente Hortus Herault Pech de l'Aze Dord. Salpêtre Herault			A. du Blot Hte Loire Jaurens Corrèze	Cauna de Belvis Aude Gr. des Romains Ain	G. St Pierre Hte Savoie
Luscinia megarhyncos						C. de Nerja Malaga
Phoenicurus phoenicurus	Fontechevade Charente			A. du Blot hte Loire	A. Lafaye Tarn et Garonne	

Table 1. Some examples of the records of Summer visitors to western Europe during the Upper Palaeolithic with reference to Tyreberg 1998 and Moreau 1972.

Species	250 – 40 Kyr BP Mousterian	40 – 28 Kyr BP transition to Upper palaeolithic Aurignacian	28 – 22 Kyr BP transition to Gravettian, deteriorating climate	22 – 17 Kyr BP Local Solutrean Last Glacial maximum	17 – 10 Kyr BP Magdalenian sequence, ice retreating	10 Kyr to recent Mesolithic <
Monticola saxatilis	Aurensan Hte Pyr.				B. Loire Hte Pyr. Boids du Cantet Hte Pyr.	
Monticola solitarius	Combe Grenal Dord. C.N. de Bellus Jativa	Gatzarria Pyr. Atlant Zafarrya Malaga			Cingle Vermell Barcelona C. de Nerja Malaga	
Acrocephalus paludicola					A. des Romains Ain	
Acrocephalu palustris					A. de Rochdune Doubs	
Acrocephalus scirpaceus					Erralla Guipuzcoa	
Acrocephalus arudinaceus					A. du Calvaire Htee Pyr.	
Hippolais icterina	Combe Grenal, Dord					
Sylvia hortensis	Combe Grenal Dord					Gr. St Pierre Savoie
Ficedula hypolleuca	Salpêtre Herault Hortus Herault				G. des Romains Ain	
Lanius collurio	Combe Grenal Dord					
Lanius minor		Es Poussas, Eivissa				
Lanius excubitor		Es Poussas, Eivissa				
Lanius senator		Es Poussas, Eivissa				Salpêtre Herault

Table 1. Continued.

hypothesis. Warblers, Flycatchers and Shrikes, all of whom depend to a considerable extent on insect life, are totally absent from the selected sites. Nevertheless, as the climate warmed and the ice retreated during the final stages of the Last Glaciation, the majority of these species, many of whom depend to some degree on airborne insect life, returned to recolonise southwest Europe, re-entering via the Mediterranean regions in the south and east. This resurgence was interrupted relatively briefly by the stages of renewed cold, known as Dryas 1, 2 and 3.

The extended timespan of Mousterian development presents a more confused picture when taken as a whole but the changes become locally clearer as individual sites are studied in detail or re-examined in the light of recent revisions. Sites like Pontnewydd in north Wales (Aldhouse Green *et al.* 2012), or the current investigations into the sequence of occupations in Gorham's cave on Gibraltar. Or, the sequence at Combe Grenal in the south of the Dordogne where there appears to have been an influx of small passerine summer migrants arriving during a temperate phase towards the end of OIS 5a; species that included a beeeater, *Merops apiaster,* blue rock thrush, *Monticola solitarius* icterine and garden warblers, *Hippolais icterina* and *Sylvia borin,* with a red backed shrike, *Lanius collurio*, that with the excavations at Pech de l'Aze revealed the presence of a red rumped swallow, *Hirundo daurica*, all summer migrants into warm temperate zones (Mourer Chauviré 1975).

An examination of the fossil record would therefore appear to confirm Moreau's prediction that the ecology of Europe to the north of the Garonne and west of the Rhone was not able to support many of these small migrants during times of glacial advance.

Table 2
Apart from cave sites along the Cantabrian littoral, where the inshore waters remained at a considerable depth even during glacial maxima, the majority of sites are close to the Mediterranean shores of Iberia and Italy, where sea levels fell considerably during cold phases and shorelines extended as much as 30 kilometres. A lower mean sea level during the Last Glacial Maximum may go some way towards providing a reason for the absence of seabirds in the record of any site except Arene Candide, Savona, Italy, situated above the deep waters of the Ligurian coast.

Once the climate had begun to ease and sea levels to rise, seabird populations began to increase in these coastal locations of the Mediterranean and Cantabria.

Table 3
Table 3 aims to show the winter movements of northerly breeding wildfowl over the same time span. At the present day, many fresh and brackish water wildfowl breed in northern and arctic regions, moving southwards in Winter. There is little evidence for the breeding locations during the Palaeolithic but it appears evident that during periods of prevailing glacial advance the wintering zones of many species extended southwards of the current limits. So that *Cygnus columbianus bewickii*, the Bewick swan remains were identified in a Mousterian level at Carnello, near Soria on the river Liri in Lazio province of Italy at a latitude of 41.43^{0}N. It was also present at Dufaure, one of the rock shelters in the Pastou cliffs beside the Gave d'Oleron, France at a latitude of 43.33^{0}N, in a Magdalenian level, dated to Dryas II (12,200-11,000 BP). There are also records of identifications in the UK and Ireland but some of the dating is a little uncertain.

Finds of Whooper swan, *Cygnus cygnus* have been found to be more widely distributed in Europe, both within possible present day wintering areas and further south to regions not currently thought to be within their range. The identified sites in France where they were present during the Mousterian occupation seem to be mainly confined to southern and eastern parts of the country: at Balauzière in Gard, Ramandils in the Aude and in a dated deposit at the Baume de Gigny in the Jura carrying dates between 45,000 ans 32,000 BP. In Italy the whooper swan was recovered in association with Mousterian at the Grotta della Cava di Sezze Romano in the province of Lazio (Cassoli 1980) and at Grottoni in the Abruzzo (Giustizia 1979).

There are no certain records of either species of these swans between the end of the Mousterian in France until the beginning of the Magdalenian, although there is an undated record of bone(s) from the Grande Grotte at Arcy sur Cure in Lambrecht 1833 and Milne Edwards 1867-71 (quoted by Mourer Chauviré 1979).

The presence of whooper swan in the southwest of France and the Mediterranean seems to have become more frequent as climatic conditions began to ameliorate at the end of the Last Glaciation. Deposits at Arene Candide on the Ligurian coast of Italy contained a long sequence of 'Tardigravettian occupations dated to around 11,000 BP, each with remains of Whooper swan (Cassoli 1980) and there was a possible discovery of a bone in the Grotta Romanelli as far south as the province of Puglia on the Adriatic coast (Cassoli and Tagliacozzi 1994).

In the Pyrenean region of France, there were finds of whooper swan in Magdalenian contexts in the caves of Massat in Ariège (Clot and Mourer Chauviré 1986) Gourdan in Haute Garonne (Ibid) and in the Atlantic Pyrenees among the debris left behind by clandestine diggings into late Magdalenian deposits at the Grotte de Bourrouilla at Arancou (Eastham in Chauchat 1999).

Species	**250 – 40 Kyr BP Mousterian**	**40 – 28 Kyr BP Transition to Upper Palaeolithic, Aurignacian**	**28 – 22 Kyr BP Climatic shift, transition to Gravettian**	**22 – 17 Kyr BP Last Glacial Maximum local Solutrian**	**17 – 10 Kyr BP Ice in retreat Magdalenian sequence**	**10 Kyr BP to recent Holocene Mesolithic to present**
Calonectris diomedia	Devil's tower Gib. A. Olha Pyr. Atlantic C. Genovesi, Sicily	Es Poussas, Eivissa			C. de Nerja Malaga C. Genovesi Sicily	C. de Nerja Malaga C. Genovesi, Sicily G. della Madonna, Calabria
Puffinus gravis					C. de Nerja Malaga	C. de Nerja Malaga
Puffinus griseus						C. de Nerja Malaga
Puffinus yelkouan					Gorham's cave, Gib.	
Puffinus puffinus	C. Genovesi, Sicily				C. de Nerja Malaga	C. de Nerja, Malaga Sewell's, cave Gib.
Sula bassana	Archi Cave, Calabria				C. de Nerja, Malaga C. de Torre, Guipuxcoa	
Phalocrocorax carbo				Arene Candide, Lig.	G. Romanelly, Italy	
Phalocrocorax aristotelis	Gorham's cave, Gib. C.N. de Bellus, Jativa			Arene Candid, Lig.	C. de Nerja, Malaga Gorham's, cave Gib. Gr. de Colombi, Lig. C.N. Negra de Bellus, Valencia	
Larus ridibundus	Gorham's cave, Gib.	Castillo, Santander Ekain, Guipuzcoa		Arene Candide, Lig.		
Larus canus			Brillenhohle, Baden Wurtemberg		C. de Nerja, Malaga G. des Romains, Ain La C olombière, Ain	Bois du Cantet, Hte Pyrenees
Larus fuscus	Gorham's cave, Gib.	Gorham's cave, Gib. Devil's tower, Gib.			G. des Romains, Ain La Colombière	
Larus argentatus	Tournal, Aude	Gorham's cave, Gib.				
Larus marinus		Casillo, Santander			Nerja, Malaga Arene Candide, Lig.	

Table 2. Some pelagic species recovered from Palaeolithic occupation sites in western Europe.

Species	250 – 40 Kyr BP Mousterian	40 – 28 Kyr BP Transition to Upper Palaeolithic, Aurignacian	28 – 22 Kyr BP Climatic shift, transition to Gravettian	22 – 17 Kyr BP Last Glacial Maximum local Solutrian	17 – 10 Kyr BP Ice in retreat Magdalenian sequence	10 Kyr BP to recent Holocene Mesolithic to present
Rissa tridactyla					A. Gay, Ain G. St. Pierre I, Savoie G. de Lourdes, Hte Garonne. G. Romanelli, Puglia. G. dei Fanciuli, Lig. C. de Ermittia, Guipuzcoa	
Sterna sandvicensis		Devil's tower, Gib.				
Sterna hirundo	A. Olha, Pyr. Atlantic	Castillo, Santander				
Sterna paradisea				Arene Candide, Lig.	A. Gay Ain. Gare de Couze, Dord.	
Uria aalge				Arene Candide, Lig.		
Alca torda				Arene Candide, Lig.		
Pinguinis impennis	Gorham's cave, Gib.				Arene Candide, Lig.	
Alle alle	B. de Gigny, Jura				Bois du Cantet, Htes Pyr.	
Fratercula arctica		Gorham's cave, Gib.		Arene Candide, Lig.		

Table 2. Continued.

Species	250 – 40 Kyr BP Mousterian	40 – 28 Kyr BP Upper Palaeolithic Aurignacian	28 – 22 Kyr BP Transition to Gravettian, climate cooler	22 – 17 Kyr BP Local Solutrean cultures. Last Glacial maximum	17 – 10 Kyr BP Magdalenian sequence Ice retreating	10 Kyr to recent Mesolithic < Holocene
Gavia stellata					Gr. Romanelli, Puglia Petersfels Baden Wurtemberg	
Gavia arctica					Gr. Romanelli, Puglia Isturitz, Pyr. Atlantic/immer?	
Gavia immer					Dufaure, Landes	
Cygnus columbianus	Carnello Lazio Italy Pontnewydd Clwyd Wales				Dufaure, Landes	
Cygnus cygnus	Carnello, Lazio. G. del C di Sezze. di Romano, Lazio Grottone, Abruzzo. Balauzière, Gard Ramandils Aude B. de Gigny Jura				Arene Candide Liguria Gr. Romanelli, Puglia Gourdan Hte Garonne. Gr. des Romains, Ain La Madeleine, Dord. Rond do Barry, Hte Loire. Rmandils Hte Loire	G.della Madonna, Calabria
Anser fabalis				Brillenhohle B. Wutemberg.	Kleine Scheuer, B. Wurtemberg.	
Anser brachyrhynchus	Pech de l'Aze, Dord.	Gr. des Fées, Allier.			Gr. Gazelle Aude. G. Romanelli, Puglia. Little Hoyle S.Wales	
Anser erythropus					Gr. Romanelli, Puglia. Little Hoyle S. Wales	G. Polesini Lazio
Anser albifrons					Arene Candide Liguria Gr. Romanelli, Puglia Little Hoyle S. Wales	C. Genovesi Sicily
Anser anser	Soulabé, Ariège. Aurensan Sup. Hte Pyrenees	Pair non Pair, Gironde			Abr. Dufaure, Landes. Gr. Romanelli Puglia. Gr. de Gouerris Hte Garonne. Rond-du-Barry, Haute Loire. Urtiaga, Guipuzcoa. Little Hoyle S. Wales	Santimamine, Viscaya
Branta leucopsis	La Cotte de St Brelade Jersey			Liitle Hoyle S. Wales	Urtiaga, Guipuzcoa Little Hoyle S. Wales	

Table 3. Some of the freshwater waterfowl species recorded as wintering outside their recent range in western Europe on Palaeolithic sites.

Species	250 – 40 Kyr BP Mousterian	40 – 28 Kyr BP Upper Palaeolithic Aurignacian	28 – 22 Kyr BP Transition to Gravettian, climate cooler	22 – 17 Kyr BP Local Solutrean cultures. Last Glacial maximum	17 – 10 Kyr BP Magdalenian sequence Ice retreating	10 Kyr to recent Mesolithic < Holocene
Branta bernicla	G. de Giganti, Puglia La Cotte de St Brelade Jersey	Arbreda, Gerona.			C. de Nerja, Malaga. G. Romanelli, Puglia.	
Tadorna tadorna			Isturitz, Pyr. Atlantic.	Aitzbitarte IV, Guipuzcoa.	Hoyle's Mouth S. Wales	
Anas querquedula	G. del Principe, Liguria Grottone, Abruzzo.	Arbreda, Gerona.		Volcan, Valencia	La Riera, Asturias	La Riera, Asturias
Netta rufina	Gorham's cave, Gib.			Volcan, Valencia	Arene Candide, Liguria	G. della Madonna, Calabria
Aythya nyroca	Balazuc, Ardeche. Gorham's cave, Bib.				Aurensan Inf, Htes Pyr. Bois de Brousses, Herault Nerja, Malaga	A. de Campalou, Drôme
Aythya marila					Kniegrotte, Thuringen	
Clangula hyemalis				B. de Gigny, Jura	Berroberia, Navarre Gr. Romanelli, Puglia Gr. des Romains, Ain G. de Lourdes, Hte Garonne Abri Gaiy Ain	La Crouzade, Aude
Melanitta nigra	Abri Olha, Pyr. Atlant B. de Gigny, Jura				G. de Lourdes. Hte Garonne Gr. des Romains, Ain Arene Candide, Liguria	Nerja, Malaga
Melanitta fusca	Gorham's cave, Gib.	Castillo, Santander Isturitz, Pyr. Atlantic			Gr. Romanelli, Puglia	
Mergus albellus	Carnello, Lazio			La Colombière, Ain	Aurensan Inf, Htes Pyr.	
Mergus serrator	Devil's Tower, Gib. Aurensan, Sup. Htes Pyr.	Isturitz, Pyr. Atlantic			Freydiéres, Drôme Arene Candide, Liguria	Gr. de Gouerris, Htes Garonne Gr. des Harpons Htes Garonne
Mergus merganser	Gr. Simard, Charente Soulabé, Ariege	Pair non Pair, Gironde	Aitzbitarte IV, Guipuzcoa		Gr. de la Vache, Airège Gr. de L'Homme mort, Htes Pyr. Rond du Barry, Hte Loire	

Table 3. Continued.

Further north in Aquitaine at La Madeleine in the Dordogne Delpech (1975) identified whooper swan. There were also finds dated to around 12,000 years BP recorded at Rond du Barry, in the Haute Loire, and around 11,000 at the Grotte des Romains, Ain. a date very similar to that at Gough's Cave, Somerset in England for the presence of the species in those deposits (Harrison 1980).

Most of the Anser species of geese whose bones have been identified in Palaeolithic occupation sites in Western Europe breed at the present day in the far north: *A.fabalis* and *A.brachyrhyncos* in Iceland and Greenland. *A.albifrons* breeds in the tundra of northern Russia and Novaya Zemla while *A. erythropus*, selects sites on the margins of open and wooded tundra, their range extending across arctic and northern Fennoscandia. *A. anser*, however breeds mainly in boreal and temperate zones in wetland habitats. The wintering grounds of all these species involve movement southwards to a greater or lesser extent, some to western Europe, other populations, like the bean goose and the whitefront geese towards the Mediterranean and eastern Europe.

The Branta species of geese are also present during the span of the Palaeolithic in Europe. Both breed in the high arctic, *B. leucopsis*, barnacle goose in Iceland and Novaya Zemla, *B. bernicla*, brent goose mainly in Iceland and Spitzbergen, Autumn and winter movements are currently towards the South and West, to the shores of western Europe and Britain in the case of barnacle geese, whereas the brents also settle in parts of eastern England. In Palaeolithic deposits in Britain barnacle goose was found in the Cotte de Saint Brelade on Jersey and at Pontnewydd cave, Clwyd in Mousterian contexts. Later, as the ice retreated during the final phases of the Last Glaciation bones of barnacle geese were recovered at both Hoyle's Mouth and Little Hoyle, caves in the Ritec Valley, Pembrokeshire, South Wales and also at Urtiaga in Guipuzcoa province of the Cantabrian region of Spain. A C14 dating for one of the Little Hoyle bones gave a date around 19,320 ± 120 years BP (OxA33902 NC95), a date just prior to the Last Glacial Maximum, indicating that west Wales may have been a periodic stop off on the Autumn migration, one that may have been anticipated by the hunter-gatherers camping there. The bones at Urtiaga were more compatible in date with the later deposits at Little Hoyle at 10,280 ± 190 BP (CSIC64).

The Brent goose also was present in Jersey in both the Mousterian and subsequent levels. On the European continent bones were recovered from a Mousterian context at the Grotta di Giganti in Puglia and in the early Aurignacian levels of the cave of Arbreda in Gerona province. Towards the end of the Last Glaciation remains were found as far South as Nerja in Malaga and the Grotta Romanelli.

By comparison with winter dispersals at the present day this pattern of the distribution during the colder periods of the latter part of the Pleistocene would appear to confirm that there was a southerly shift in the wintering grounds of both swans and geese at those times of glacial advance; and further, that this shift appeared less marked in the west, especially in Britain. On the sites in southern Aquitaine wintering populations of some wildfowl species would seem to have been displaced southwards by up to 500 kilometres. A change that may have had some small impact on the seasonal diets of hunter-gatherer peoples in those areas.

Both the range of sites and the species featured in the foregoing tables have been selected because the dating of the bones and their stratigraphic context in the archaeological sequence are relatively precise. The data appears to be consistent and indicates a certain pattern in bird/Hunter-Gatherer contact between around 250 Kyr BP and the early Holocene. Based on these records the pattern of distribution across the somewhat generalise climatic fluctuations is generally consistent. They show a diversity of species on a fairly extensive range of sites during the extended timespan of the Mousterian, reducing between 40 Kyr and 17 Kyr BP, and thereafter on the increase once more. This may be a genuine reflection of climate and human behaviour, although, especially on earlier excavations it may have been a consequence in a few cases of the collection bias of the excavator.

Some examples of avian diet as it informs the regional ecology

Another aspect relevant to the interpretation of bird assemblages during the Palaeolithic is the study of the variety and particularity of avian diet and the requirements and preferences of individual species as a tool to go some way towards a reconstruction of the ecology of a hunter-gatherer site at a point in time. Such reconstructions depend on assumption that the diet of individual species, has remained broadly the same over time and it is possible to trace its known food intake as it changes during an annual cycle, to build a picture of the ecology of that species in the archaeological context in which it was found by using the records of pollen and other faunal data for that site.

A look at the likely feeding behaviour (based on Cramp Vol. I 1977) of the wildfowl recovered from the Neanderthal occupation site of Pontnewydd, near St Asaph, north Wales, implies that the range of the plant and animal life taken as food by wildfowl at the present day, was also available, at least in part, to those species of geese and duck whose bones were found in at the cave. Their presence would seem to indicate the probability that a sufficient quantity of some at least of

Plant species	*Anser anser*	*Anser brachyrhyncoc*	*Anser albifrons*	*Branta leucopsis*	*Branta bernicla*	*Aythya fuligula*	*Melanitta nigra*	*Mergus albellus*
Salix glauca, Bluish willow		S	S					
S trianda, Almond willow	A							
S.herbacea, Dwarf willow				S/A	Spr			
Equisetum, Horsetail	S	S/A	S/A	A/W				
Selaginella sp., Club moss		S	S					
Oxyria digna, Mountain sortrel		S	S	S	S			
Polygonum viviparum, Bistort	S	S/W	S/W	S/W				
Chenopodiae, Goosefoot	S							
Stellaria sp., Chickweed	S	W	W					
Salicornia, Marsh samphire				Spr	W/Spr			
Cerastium sp., Mouse ear		S/A	S/A	S	S			
Ranunculus sp., Buttercup family				S/W	S/W			
Capsella bursa pastoris, Shepherd's purse	S							
S.saxiifrage, Saxifrage	S	S/A	S/A	S	S			
Apium nodiflora, Fool's watercress				W				
Potentilla palustris, Cinquefoil	S							
Dryas octopetala, Mountain avens				S				
Trifolium sp., Clover family	S			A/W				
Veronica sp., Speedwell	S							
Platago maritima, Sea plantain				W				
Triglochin maritima, Sea arrow grass				A/Spr	W			
Armeria maritime, Thrift				A/W				
Aster trifolium, Sea aster				W/Spr	W			
Sonchus sp., Sow thistle family	S							
Taxacum sp., Dandelion family	S							
Potamogatonaceae, Pondweeds	S					W/S	S	W/Occ
Zostera sp., Eel grass family				W	W/Spr			W/Occ
Ruppia maritima, Tassel weed						W/S		W/Occ
Lemnaceae, Duckweeds	S							W/Occ
Sparganaceae, Burr weed	S/A		S					
Bolboschoenus maritima, Sedge	S/W							
Cyperaceae eriophorum, Cottongrass		S	A		S			

Table 4. Plant species known to be taken by the Wildfowl species represented in the Mousterian deposits at Pontnewydd cave. A. platyrhyncos, Mallard is omnivorous and omitted from this list (after Cramp Vol. I. 1977)
(**Spr**. Taken in Spring; **S.** Takin in Summer; **A.** Taken in Autumn; **W,** Taken in Winter; **Occ**. Taken occasionally).

Plant species	***Anser anser***	***Anser brachyrhyncoc***	***Anser albifrons***	***Branta leucopsis***	***Branta bernicla***	***Aythya fuligula***	***Melanitta nigra***	***Mergus albellus***
Carex, Sedges	W	A						
Scirpus, Club rush	S/W					W		
Eleocharis palustris, Spike rush						W		
Phalaris sp., Reed grass	S/W		S					
Leersia, Cut grass	S							
Festuca sp., Fescue	S	S		W	W			
Phragmites communis, Reed	S							
Pulchinella maritima, Sea poa				W	W/Spr	Spr		
Glyceria sp., Water grasses	S			W				
Poa sp., Poa	S	W	W	W				
Triticum sp., Wheat	W	W						
Hordeum seccanum, Barley	W	W	W					
Agropyron repens, Couch grass	W		W					
Avena sp., Oats	W	W	W					
Phleum sp., Cat's tail grass	S	W						
Lollium sp., Rye grass	S	W		A/W				
Agrostis stolonifera, Fiorin				A/W				
Juncus gerardii, Mud rush				A/W				
Algae: Fucus. Cladophora, Enteromorpha, Viva				S/W	S/W			

Table 4. Continued.

these items were present and available to sustain the birds during the period of Hunter-gatherer occupation.

Tetraornidae the grouse family and other game species provide a further example of a group of birds all with similar dietary requirements, while each normally occupies a separate habitat zone within a restricted yet distinct environment, their diets overlap and yet the foraging zones are fairly separate. During the phases of the Last Glaciation, this family has been shown to include the most heavily predated by both humans and other animals, with the result that their bones are often the most numerous in the avifaunal assemblages.

On some sites and the site of the Upper Cave at Buhlen, Kr.Waldeck-Frankenberg in Hessen, Germany is a good example, the bones of several species of the group form the largest element of the avifauna. The grouse and related species at Buhlen include six of these game species: capercaillie, black grouse, willow grouse, ptarmigan, partridge and snipe. The bones of a number of raptors were also present at Buhlen and their agency in the mortality of the game birds cannot be ruled out. Nevertheless, the assemblage demonstrates the complexity of the habitats around the site.

The hazel grouse *Bonasia bonasia*, not present at Buhlen favours a habitat in damp forest clearings up to 2,000 m. OSL Palaeolithic records of it are mainly restricted to eastern Europe in East Germany, Austria, through to Hungary, Romania and the Balkans.

The blackcock, *Tetrao tetrix*, preferentially occupies a niche transitional between open heath and light forest in the subarctic and boreal climate zones. At the present day it is found in the Alps and highland areas up to 2,500 metres above sea level. It is not strong on the wing unlike the more bulky capercaillie *Tetrao urogallus*, a bird of arboreal habit often in conifer forests that feeds in the canopy.

Species	*Aythya fuligula*	*Melanitta nigra*	*Mergus albellus*	*Mergus mergsnser*
Mollusca, freshwater				
Deissena polymorpha	W			
Hydrobia jenkinsi	W			
Pisidium sp.	W/S			
Anodonta sp.	W	All		
Lymnea sp.	W/S	All		
Unio sp.	S			
Valvata sp.	S			
Viviparus duboisiana	S			
Marine				
Mytilis edulis	W	All		
Cardium sp.	W	All		
Littorina sp.	W	All		
Hydrobia sp.	W	All		
Mya sp.		All		
Spisula sp.		All		
Nassa sp.		All		
Crustacea, freshwater				
Gammarus sp.	S/All			S
Asellus sp.	S/All			
Marine				
Idonta sp.		All		
Isopodiae sp.		All		
Carcinus sp.		All		
Invertebrate, *Annelidae*		All		
Insect				
Phruygmea sp.	S	S		
Hydropsyche augustiponis	S			
Chironimidae		S		
Fish				
Anguilla Anguilla, Eel			All	All
Clypea harenga, Herring			All	All
Salmo salar, Salmon			All	All
Salmo trutta, Trout			All	All
Thyamalis thyamalis, Grayling				All

Table 5. Mollusca, Crustacea, invertebrates and fish known to be taken by Wildfowl species whose remains are recorded in the Mousterian deposits at Pontnewydd Cave (after Cramp Vol. I. 1977)
(**S.** Taken in Summer; **W.** Taken in Winter; **All** Taken at all seasons).

Species	*Aythya fuligula*	*Melanitta nigra*	*Mergus albellus*	*Mergus mergsnser*
Esox Lucius, Pike			All	All
Abramis brama, Bream				All
Albumus albumus, Bleak			All	
Barbus barbus, Barbel				All
Gobio gobio, Gudgeon			All	
Leuciscus leuciscus, Dace				All
Phoxinus phoxinus, Minnow		W/S	All	All
Rutilus rutilus, Roach			All	
Scardinus erythrophthalmus, Rudd				All
Cobitidae, Loach				All
Gadus morhua, Cod				All
Lota lota, Burbot			All	
Zoarces viviparous, Blenny			All	
Gasterostidae, Stickleback		W/S	All	
Perca fluviatalis, Perch				All
Cottus gobbio, Bullhead				All
Ammoditidae, Sand eel			All	
Pleuronectes platessa, Plaice			All	All

Table 5. Continued.

By contrast, the habitat of the willow grouse, *Lagopus lagopus,* extends from the arctic into boreal or even temperate zones, into open habitats of treeless tundra, moor, heath, marsh and even wetlands and feeding mainly on shoots leaves and berries. The feeding pattern of the ptarmigan, *L. mutus* is similar but, since it tends to occupy the higher altitudes and latitudes, its consumption habit varies with availability. The skeletal remains of both species are found in abundance on occupation sites of the Last Glaciation, especially in Montane regions, but it is not always clear what animal predated them, since both species were a favoured food of many carnivorous mammal and some raptorial bird species, including, the ground nesting snowy owl, *Nyctea scandiaca.*

For most species in the grouse family plant food is the dietary staple and protein secondary. Invertebrate foods being mostly fed to broods of very young chicks. Between the species the habitat in montane regions tends to be separated by altitude. Ptarmigan take the higher slopes, willow grouse the lower, blackcock in the clearings on the margins of forested areas, with capercaillie often feeding in the canopy, while the lower margins of grasses and low scrub belong to the partridges and snipe in wetlands around, at Buhlen an ancient lakebed.

Raptorial birds. Amongst the wide range of raptorial species, a considerable diversity of prey is taken. There is the honey buzzard for whom the staple food are the bees and wasps of the family of *Hymenoptera;* the scavenging predators of kites and vultures, the marsh-hunting *Circus aeruginosus,* taking snakes along with numbers of waterfowl, songbirds and voles, or the mainly aerial hunting family of hawks, *Accipitridae*, capable of taking prey up to the size of capercaillie and hare, or the eagles of whom the *Aquila chrysaetos,* golden eagle has been known to take animals as large as red deer but is relatively omnivorous in relation to live prey. There are also the fishing eagles like the osprey *Pandion haliaetus,* that subsists entirely on fish or the fishing eagles, in Europe, *Haliaeetus albicilla,* or that is known to forage on other species besides fish, and the falcons, *falconidae*, that vary their hunting between a mixed mammalian and an avian diet according to size, from the Gyrfalcon, *F. rusticolus,* to the kestrel, *F. tinnunculus*, or the mainly insect diet

Plant material	*Bonasia bonasia*	*L.lagopus*	*Lagopus mutus*	*Tetrao tetrix*	*T.urogallus*
Juniperus, Juniper				* S/A	
Salix, Willow species	* W/Spr	* All	*All		
Populus, Popular	* W/Spr	* S			
Betula, Birch species	*W/Spr	* W/All	*All	* All	
Corylus, Hazel	*W/Spr				
Pinus, Pine species	* W/Spr			* All	* W
Picea, Spruce	W/Spr*				* W
Abies, Fir	*W/Spr				* Spr/S/A
Larix, Larch	* W/Spr				
Alnus, Alder	* W/Spr				
Corylus, Hazel	* All				
Tilia, Lime	Spr/S*				
Vaccinium myrtilis, Bilberry	Spr/S*	* Spr	* Spr/S	* Spr/S	* S
V. uglinosum, Whortleberry	Spr/S*	* Spr/S	* Spr/S	* Spr/S	* S
Vitis idaea, Cowberry	Spr/S*	*Spr/S	* Spr/S	* Spr/S	
Empetrum nigrum, Crowberry	Spr/S*	*Spr/S	* Spr/S	* Spr/S	* S
Calluna vulgaris, Heather		*All	* All		
Errica, Heath species	*All				
Andromeda polifolia, Bog rosemary		*S/A	* A/W		* S
Polygonum, Bistort species	*	*Spr/S	* Spr	* S	
Filipendula ulmaria, Meadowsweet	Spr/S*				
Rubus Bramble family	******				* S
Malus, Sorbus Pyrus, Apple, Pear and sorbus family	***				
Sambucus, Elder species	*				
Oxalis, woodsorrel species	*				
Equisetum, Horsetails		*Occ			* S
Dryas octopetala, Mountian *avens*			* Spr		
Carex, sedges				* A	* All

Table 6, A range of plant foodstuffs taken by Tetraornidae at different times of year
(**Spr**. Taken in Spring; **S.** Takin in Summer; **A.** Taken in Autumn; **W,** Taken in Winter;
All. Taken at all seasons; **Occ**. Taken occasionally).

of the lesser kestrel, red footed or eleanora's falcon, *F.naumanni, F.vespertinus, F.eleanora.*

Sea birds. Marine species have similarly varied diets that depend very much on distribution and behaviour patterns of their prey, that alters in proportion to the length of time during the year is spent entirely at sea. Skuas, *Stercorariidae*, for instance are entirely pelagic outside the breeding season as are the auks, *Alcidae* and the shearwaters, *Procellaridae* and *Sulidae,* gannet. gulls, *Laridae,* are more variable, breeding on sea cliffs and coasts from the Arctic to the Mediterranean but most remain on coastal waters or large lakes or fiver deltas outside the breeding season. Marine species are recorded from Upper Pleistocene sites around the coasts of western Europe but not in significant numbers and the probability is that some were carried ashore by storms or even predated by other species. The inshore

Species	*Bonasia bonasia*	*L.lagopus*	*Lagopus mutus*	*Tetrao tetrix*	*T.urogallus*
Coleoptera, Beetles	*		Chicks		Chicks
Diptera, Flies	*	* Spr/S	Chicks		
Lepidotera, Butterflies & moths	Occ *				Chicks
Orthoptera, Grasshoppers	Occ *				Chicks
Arachnidae, Small spiders	*			Chicks	Chicks
Hymenoptera, Ants				Chicks	Chicks

Table 7. Some of the invertebrates taken seasonally by Tertraornidae
(**Spr**. Taken in Spring; **S.** Takin in Summer; **Occ**. Taken occasionally; **Chicks.** Fed to neonatal young).

distribution of some western European gulls in Winter appears to have increased in recent centuries, an increase that some authorities believe is the result of the growth in the systematic disposal of human waste from population conurbations, like sewage plants and landfill sites.

Finds of skeletal remains of marine birds from previous centuries and prehistoric sites are relatively rare and the probability is that some were carried ashore by storms or even predated by other species. At the present day however, in some species the normal pelagic pattern of out of seasonal behaviour has recently modified and they are frequently seen inland on cultivated land.

Many gulls tend to be predatory, scavenging and opportunistic. For instance, greater black backed gulls *Larus marinus* are notorious for killing manx shearwaters, *Puffinus puffinus* as they come ashore to feed their young, safely hidden down rabbit burrows and most will take eggs and young from the nests of neighbours or other species.

Man as predator

Very few species of birds have escaped predation by human populations. Wildfowl, game birds, waders, raptorial birds and scavengers, corvids and passerines have been hunted for meat, bone, feather and eggs, sometimes to actual extinction as in the case and to a he great auk, *Alca impennis*, in 1844. On the other hand, in Britain, for instance, the limits placed on the seasonal culls of the gannet *Sula bassanus* populations and the replacement of gannet oil by industrial products largely derived from coal tar have promoted a huge increase in population of that species and the industrial practices of the fishing industry have seen a similar increase in fulmars, *Fulmaris glacialis.* Neither species is commonly recovered in Palaeolithic settlements. A certain number do occur in coastal regions in prehistoric times but were not it would appear hunted systematically, as they have been in more recent times as much for the qualities of the oil they produce as for their flesh or plumage.

Other marine birds have likewise been subjected to predation by human populations and sometimes to actual extinction, as in the case of the great auk, Alca impennis, finally killed in 1844 by seamen desperate for fresh meat. At the present time human activity may be driving many other species the same way.

Despite systematic culling of the existing species of wildfowl, seabirds and game species by humans and other carnivorous animals, they have so far escaped from extinction at the hands of the large numbers of potential animal predators. Partly they have continued to thrive on account of producing large clutches of eggs and hatching sizeable broods of young but also been saved from human hunters by the invention of firearms that has imposed a much lower limit on the numbers that could be taken at one time in comparison with the traditional means of trapping, decoy or netting. Legal measures of protection have also played their part, initially to preserve the birds for the use of landowners and in recent times for the protection of the avian community as a matter of ecological conservation.

The snowy owl, a case study. In the fluctuating climatic and environmental conditions of the last glaciation distribution, behaviour and feeding patterns of some species appear to to have been markedly different to that observed at the present day. A particular case is the subject of a study in Chapter (8): of the snowy owl *Nyctea scandiaca* and the quantity of bones of individuals recorded on a number of sites in the Aquitaine region of France towards the end of the Last Glaciation and in association with late Magdalenian culture. The research carried out on this species by Potapov and Sale (2012) has produced a huge amount of detailed data about the current distribution, feeding snd breeding behaviours across its entire Palaearctic range. Their findings taken in conjunction with the research into the ethology of snowy owls as summarised in Cramp 1985 gives a clear account of their natural history during recent times. Nevertheless, the patterns of behaviour prior to the environment changes that followed the retreat of the ice and the effect of increasing human populations on

Species	250 – 40 Kyr BP Mousterian	40 – 28 Kyr BP Upper Palaeolithic Aurignacian	28 – 22 Kyr BP Transition to Gravettian, climate cooler	22 – 17 Kyr BP Local Solutrean cultures, Last Glacial Maximum	17 – 10 Kyr BP Magdalenian culture sequence. Ice retreating	10 Kyr BP to recent Mesolithic and Holocene prehistory
Loxia curcirostra, common crossbill	Fontechevade Charente Certova Dira Moravia Balcáka Moravia	Installósko Bukk Sandalja II Croatia	Arene Candide Lig.	Pilissanto I Hungary Arene Candide Lig. Herma Otto Bukk Sandalja II Croatia	G de Massat Ariege Puskaporos Bukk Karstein Westphalia Kleine Scheuer B. Wurtemberg Pilissántó I Hungary	
Loxia leucoptera, two barred crossbill				Arene Candide Lig.		
Loxia pytyosittacus, parrot billed crossbill			Salpêtrière Gard Riparo di Fumane Verona			
Pinicola enucleaata, pine grosbeak		Abri des Pecheurs Ardèche	Arbreda II Gerona	Arene Candide Lig.	Arene Candide Lig. Nisloch	

Table 8. The presence of Crossbills and Pine grosbeak on Palaeolithic sites in western, central and Mediterranean Europe (after Tyreberg 1998).

the landscape are a great deal less certain; a consideration that may apply besides to other animal species. Recent breeding success in arctic populations depends on the abundance or otherwise of the lemmings in a specific region, including in Europe arctic, wood and Norway lemming, *Dicrostonyx torquatus, Myopus schisticolor* and *Lemmus lemmus* that in good years form up to 90% of the food intake (Mikkola 1983). In seasons when the supply of lemmings is low it is replaced by other small mammals and birds (Potapova and Sale 2012).

The faunal records of the excavated sites of late glacial date in Aquitaine where the remains of snowy owls were found to be most abundant show a complete absence of any species of lemming among the spectrum of small rodents. The case study of the snowy owls at the Grotte de Bourrouilla, Arancou, Pyrénées Atlantiques (Chapter 8) shows that the rodent population was dominates by Microtus voles, including the root vole, associated today with northern climates, some mice and the occasional dormouse (*Glis glis*).

Crossbills. Some groups among the passerines are extremely specialist feeders and in this respect become indicators of the presence of particular elements within the local biotope. Among them are the European crossbills. The three species recorded from Upper Palaeolithic contexts in Europe are the Common, the two-barred and the parrot-billed, *Loxia curvirostra, L. leucoptera* and *L. pytyopsittacus,* and pine grosbeak, *Pinicola enucleata* often appearing in association. The current distribution of these species tends to be limited to Fennoscandia. Russia and Eastern Europe and extends as far south as Spain and eastern France, with occasional occurrences in the southern Britain and the Netherlands. At the present day their diet is based on the seeds of conifers supplemented by the seeds and fruits and seeds of other species, larch, *Larix,* birch, *Betula,* poplar and alder, *Populus, Alnus* and juniper, *juniperus,* with bogs, *Hemiptera* and invertebrates. Table 8 shows a number of sites in Italy, Hungary, Croatia, Mallorca and France during relatively favourable climatic periods, giving a specific indication of the surrounding vegetation. The Common crossbill was also identified as from a Mousterian context at Pinhole

Cave in Derbyshire (Bramwell 1960) but there is some confusion over the stratigraphy, of individual layers of the excavation and the species determinations at that site (Tyreberg 1998).

Birds and men in a shared environment

Hominid, Human, Hunter- gatherer social groups are all part of the animal world and participate in similar natural hazards and advantages as other species even with the development of urban societies. In Prehistoric times they remained part of the animal food chain and shared their lives and accommodation with other species, sometimes to the advantage of all.

The, mainly winter, residences of caves and rock shelters, occupied by the hunter-gatherer settlers also provided shelter for colonies of cliff roosting birds and hibernating mammals. The most frequent avian lodgers in western Europe tend to be choughs, red-billed and yellow-billed, *Pyrrhocorax pyrrhocorax* and *P.graculus* and *Columbidae*, species of doves. The ubiquitous nature of these species across Europe and Asia during the Palaeolithic means that their bones have regularly been recovered in considerable quantities in association with Hunter-Gatherer occupations throughout western Europe and not infrequently besides in levels, without, it was thought, any recognisable signs of Hominid interventions. However some recent research has changed this conclusion, and shown that microscopic examination has revealed significant cut and scratch marks on the bone surfaces and it is now thought that these species were exploited for food on some sites and may even have been used as a staple in times of hardship.

Dove population has remained a strong element, since they have replaced a rocky cliff and cave environment for a home in a high rise built environment in urban areas. Choughs populations, on the other hand, have declined in recent centuries. The alpine, yellow-billed chough, Pyrrhocorax graculus, has declined throughout its range and is now confined to a few montane regions in Europe, while the red-billed is restricted mainly to Iberia and Mediterranean locations with relict populations in the western extremities of Europe. While in Malaga and Granada provinces of Spain large mixed flocks of both species may still be seen feeding on the open prairie. Yet, compared with the situation during the Last Glaciation, the current decline in the demographic seems dramatic (Eastham 2001).

The avifauna on an individual site may furnish a partial picture of bird life present at the time, yet the evidence may be misleading. At the Late Glacial site of Hoyle's mouth, in Pembrokeshire south Wales, a fissure was found to contain successive layers of small passerine bones that by their fresh appearance seemed to be more recent than the material from other contexts. The obvious conclusion was that these birds arrived naturally via the fissure. At Creag nan Amph, Highland, Scotland, the intrusive element was a Capercaillie with 1.5 mm shot holes in the wing, clearly a runner from a grouse shoot. A third example came from the cave of Pontnewydd in Clwyd, north Wales, where, amongst the New Entrance avian material, currently stored in the Boyd Dawkins collection in Buxton Museum, was the tarsometatarsus of a male peacock, *Pavo cristata.* The cave itself, on Williams Wynn prperty had a 19th century summer house attached to its entrance. On the hill above the cave Plas y Cefn was the mansion of a considerable estate and it is possible that at one time its terraces were graced by a colony of peacocks and this one fell prey to the local fox, who left the residue of his meal buried in the cave. It pays to be cautious in the interpretation of bone assemblages.