CHAPTER FOUR

Ecological and Ethnographic Analogies

'The prehistoric past thus begins to look the same everywhere, that is, like the current generalization of ethnographically known hunter-gatherers. We have built up remarkably detailed pictures of early human society complete with family bands of twenty-five people who share food, trace kin relations bilaterally, reside bilocally, eat a generalized diet with women gathering and men hunting, build alliances through monogamous marriage, and regulate their population to avoid environmental degradation. But this detailed picture comes not from archaeological evidence as much as from ethnographic analogy. Such misuse of modern hunter-gatherer research provides spurious support for the idea of a single primitive human society, a uniform hunter-gatherer sociocultural stage. If prehistoric hunter-gatherers all look the same in anthropological literature, it is because we supposed them to be that way from the outset.'

Kelly (1995: 339)

ABSTRACT

Our whole understanding of Mesolithic societies has relied, from the very first interpretations of the period, on analogies between modern environments and those in the Mesolithic, or between modern hunter-gatherers and Mesolithic hunter-gatherer groups. Information from both these sources can make a major contribution to our understanding of the period. However, the use of ecological and ethnographic data is often very simplistic. Moreover, misleading assumptions are easily perpetuated where they fit common preconceptions of the period or where the archaeological evidence is not available to refute them (or even appears to be supportive). Many of these assumptions have had a pervasive influence on studies of the Mesolithic, tending to support a very 'static' picture of past activities. In this chapter the origins, development and influence of misleading assumptions, dubbed 'eco-facts' and 'ethno-facts', are considered in turn. It is clear that we understand far less about Mesolithic subsistence and settlement than might first appear from the published literature. More dynamic ecological and ethnographic models are needed, but, since all models are limited by our poor knowledge of past environments, a better understanding of the unique environments in the Mesolithic and how they changed through time is an essential 'first step' in developing a better understanding of Mesolithic settlement (approached in chapter five).

ARTEFACTS, ECO-FACTS AND ETHNO-FACTS

The reconstruction of patterns of subsistence, population and settlement has been one of the key aims of Mesolithic research since the early 1970s. However, it is evident from the distribution and character of the evidence for Mesolithic occupation, as outlined in chapter two, that site-based evidence alone is woefully insufficient to build up a model of subsistence or settlement systems in Northern England. There is little evidence for site seasonality, and the distribution of surviving sites, largely consisting of lithic materials, is much biased by processes occurring at several different scales (as discussed in chapter two).

Although site-based evidence is taken into account in approaching past activities, rather than a 'top-down' approach, alternative 'bottom-up' models have usually been based on analogies with present environments, from two different perspectives:

- the resources available in present environments which are similar to those of Mesolithic Europe;
- the activities of modern hunter-gathers who live in similar environments to those of Mesolithic Europe.

In effect, reconstructions often involve a combination of these two sources.

Such analogical approaches depend on similarities between present and Mesolithic environments. They are thus somewhat problematic, since a major limitation that is often overlooked is that Mesolithic environments were *unique*. Different tree species spread gradually into Britain after the rapid warming at the end of the last ice age, creating somewhat different woodland ecosystems from any we find today (as discussed in chapter three). Modern birch forests, for example, are at present limited to high altitudes and very cold environments, whereas birch forests in the lowlands in the early postglacial flourished in approximately modern-day temperatures. The unique nature of Mesolithic environments also means that commonly used ethnographic analogies, such as the Boreal forest hunter-gatherers of the Canadian Arctic for example, are not necessarily relevant to Mesolithic lifestyles.

The unique nature of Mesolithic environments is equally problematic where both *direct analogies* and *general models* of environments or of ethnographic societies are concerned. A lack of understanding of Mesolithic environments and the way in which environments changed (particularly how the distribution of different types of environments evolved) is a fundamental limitation to 'bottom up' approaches. A more subtle problem is that, as discussed in chapter one, models are often very simplistic and are rarely subject to critical review. Initial assumptions or suggestions, based on ecological or ethnographic analogies, have often risen to the status of unquestionable 'eco-facts' or 'ethno-facts', which, like Chippendale's (1993) 'factoids' can easily come to dominate interpretations and restrict potential avenues of research (as illustrated by Kelly (1995) quoted at the start of this chapter).

The development of the two approaches to interpreting the evidence for Mesolithic societies, first the ecological, and then the ethnographic, and their influence on our understanding of Mesolithic settlement and subsistence, are considered in more detail in what follows.

THE ECOLOGICAL APPROACH

One of the main characteristics which mark out the study of the Mesolithic from that of other periods is the dominantly ecological approach of much of the research. This approach contrasts markedly with the more sociological or ideological orientation of studies of later periods, particularly the following Neolithic (McCormick and Buckland 1997). Early ecological approaches to subsistence and settlement (such as Clark 1954) were based on quite simple ideas about resource scheduling and seasonal movements of hunter-gatherer groups. However, later developments built on early concepts of resource scheduling by becoming more rigorously mathematical. One arm of the development of ecological models was concerned with specific methods of reconstructing settlement (inspired by patterns of resource exploitation in modern hunter-gatherer groups), and the other explicitly with mathematical methods of reconstructing diets (largely based on models derived from animal ecology). Both of these later approaches were widely influential to broader contemporary interpretations of subsistence and settlement and also to ideas about absolute population and increases in population.

It was argued in the last chapter that even simply defining subsistence resources is extremely difficult, however despite these problems quite specific interpretations of settlement have been proposed based on ecological models, and largely accepted uncritically. To understand how and why a number of common conceptions of Mesolithic ecology and society came to be accepted demands a closer consideration of the development and influence of these ecological models.

Clark's Ecological Approach to Settlement and Subsistence

After the 1950s, an increasing interest in the development of an ecological approach to prehistoric societies began to develop, with multidisciplinary projects aiming to understand all elements of prehistoric environments, such as the Iraq Jarmo project in the Near East (Braidwood 1974) and the Fenland Project in Britain (Clark 1972; Smith 1997). The excavation of Star Carr (Clark 1954) was at the vanguard of this 'ecological' approach. However, until the late 1960s most interpretations were still dominated by conclusions based largely on the typological study of artefacts. After this time however, academic questions began to be more commonly approached using an ecological perspective, the origins of agriculture being a particular case in point (Binford 1968; Flannery 1969; MacNeish 1977). Changing approaches to the Mesolithic were very much part of these developments. Both Price (1973) and Clark (1972) stressed that Mesolithic populations were part of an ecological system of dependant parts - an ecosystem - and that a better understanding of this system would make a major contribution to the study of the period. The work of Clark in particular paved the way for an approach that was to become the hallmark of Mesolithic studies.

Clark's (1972) model, mentioned in chapters two and three, was one of the first explicitly ecological approaches to Mesolithic resources and settlement, and warrants detailed consideration here. Clark's interpretation of Early Mesolithic subsistence was based on the faunal remains recovered from Star Carr (Frazer and King 1954). Since red deer were the most frequent remains recovered at the site, Clark considered that Mesolithic populations were probably heavily dependant on red deer for food. Clark noted that in Scotland today red deer tend to move between upland and lowland environments from summer to winter. He also noted that known hunter-gatherers tended to move seasonally to follow resources and also that periods of aggregation and dispersal appeared to be a common characteristic of these groups. The contemporary interpretation was that Star Carr was occupied in the winter, and Clark envisaged a clear settlement pattern in which Mesolithic groups would aggregate in the lowlands in Winter and disperse to the uplands in summer following red deer. Clark was even convinced that the same pattern of exploitation would be characteristic of any area with similar topography and that anywhere in Britain *'the recovery of scattered microliths on high ground should prompt a search for a winter base on low ground within the annual range'* (1972: 36).

Clark's model of Mesolithic settlement has been widely influential. The idea of a winter-summer seasonal movement between lowlands and uplands is a common theme of interpretations of Mesolithic societies (not only in the Early but also in the Late Mesolithic). Jacobi (1978) for example also proposed a model of upland lowland movement in the Early Mesolithic from winter lowland base camps to upland hunting sites following red deer. In this case, Jacobi linked sites at the Lincolnshire edge with those in the Pennines (see chapter 2). Myers (1986; 1989) developed Jacobi's model of upland-lowland contrasts between the Lincolnshire Edge and Pennines, but, in contrast to Jacobi, considered that the upland exploitation of red deer would have occurred in autumn. A similar approach to that of Clark has also been

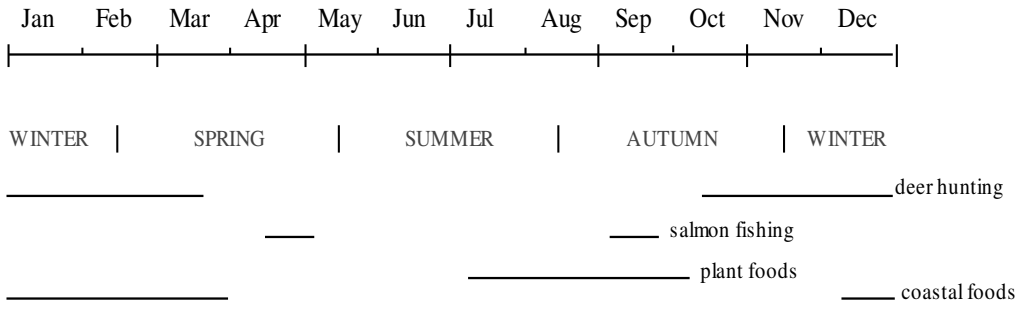

Figure 4.1 Proposed Late Mesolithic resource availability of north-east Yorkshire (Simmons 1979).

used by Simmons (1979), who extended the range of resources considered to include salmon, 'plant foods' and 'coastal foods'. Simmons constructed a simple resource use schedule for the North York Moors in the Late Mesolithic based on a simplification of ethnographic and environmental sources, outlining the supposed availability of the different resource classes according to basic environments. He again predicted that hunter-gatherer populations would have spent the summer in the uplands hunting deer, but with the winter being spent at the coast or in the lowland forest, with periods in spring and autumn on salmon rivers (**figure 4.1**).

Unlike many ecological models, Clark's model *has* been subject to recent criticism. The concept of a clear dependence on red deer, and also that of upland-lowland seasonal movement have recently been called into question. Legge and Rowley-Conwy (1988; 1989) in particular have challenged the dominance of red deer in subsistence, noting that at Star Carr elk and aurochs provide more meat weight than red deer. They also pointed out that in the forested environment of the Early Mesolithic red deer are unlikely to have carried out upland-lowland migrations. Myers (1986; 1989) in fact also questions the mobility of red deer in his model, suggesting that at least in the Late Mesolithic red deer would have only been present as small dispersed family groups rather than as migratory herds.

More recent models using a similar approach have taken the potential overemphasis on red deer into account. Simmons (1996) uses a range of different resources, including roe deer and aurochs, in his model of subsistence (**table 4.1**). The basic model of hunter-gatherer *mobility*, that is to say the idea of longer term seasonal base camps or aggregation sites and short term camps of dispersed members of a larger group *has* however remained undisputed. Thus, Simmons (1996) used the resource use schedule to suggest a range of 'possible' settlement system models, all of which were based on the long term aggregation site - short term dispersed camps model. The model that he concludes is the 'most likely' model for the settlement-resource schedule for the Late Mesolithic in England and Wales, **figure 4.2**, consists of a main base camp near the coast occupied for most of the year with a second base camp with subsidiary camps up-river occupied in the summer to autumn period.

Season	Inland	Coastal
spring	roe deer, pig, plants, eggs	eggs, nestlings, fish
summer	red deer, plants, fish aurochs	red deer, freshwater fish, plants
autumn	roe deer, pigs, fish, plants, aurochs	fish, plants
winter	roe deer, pigs, red deer	seals, shellfish

Table 4.1 Seasonal resource use model for England and Wales (Simmons 1996: 199).

Clark's approach essentially involved defining settlement patterns on the basis of the distribution of a single key resource, or in the case of later work such as Simmons (1979; 1996) a few key resources. Clearly the most obvious

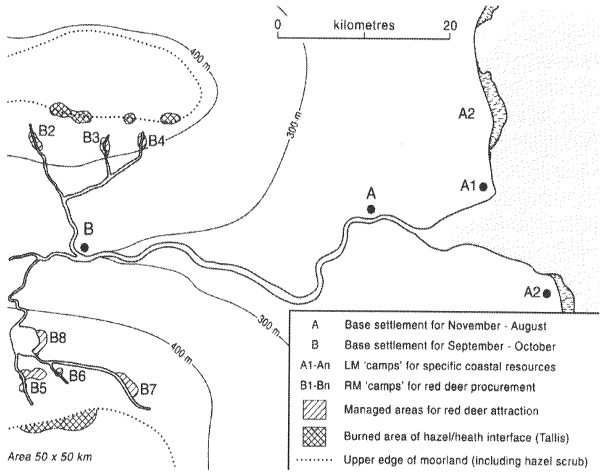

Figure 4.2 Simmons' (1996: 215) 'most likely' model of Mesolithic settlement.

limitation to this approach is that there is no explicit methodology for defining *which* resources were important. It was clear from chapter three that the resources considered to be important are often much influenced by the 'spirit of the time' and thus a lack of any means of objectively isolating genuinely important resources presents a clear problem. The simplistic nature of the ethnographic model is also problematic (discussed in the following section on ethnographic analogies). The ecological models which followed Clark attempted to solve the first of these limitations by defining explicitly mathematical means of reconstructing subsistence and settlement. The first of these developments, Jochim's (1976) subsistence-settlement model, has been a direct influence on interpretations of Mesolithic societies. More recent approaches, based on Optimal Foraging Theory, have had a broader influence on interpretations.

Jochim's Subsistence-Settlement Model and its Descendants

From the 1950s onwards, a prevailing optimism about reconstructing subsistence and settlement patterns on the basis of seasonal scheduling was much influenced by research into contemporary hunter-gatherer groups. Some research in particular showed clear quantifiable relationships between environments, resources and hunter-gatherer diets (Birdsell 1953; Baumhoff 1963; Casteel 1972; Keeley 1988; Thomas 1981; Kelly 1995). On this basis, various authors have attempted to apply explicit mathematical models to Mesolithic European data in order to determine the resources which would have been most beneficial to exploit, and ultimately the settlement system.

The first, and undoubtedly the most influential mathematical model of Mesolithic subsistence and settlement was that of Jochim (1976). Since the development of this model, the model itself or various aspects of its construction, have been widely applied to other areas of Mesolithic Europe by authors such as Price (1978; 1980), Tilley (1979), Zvelebil (1981) and Simmons (1996). Jochim studied ethnographic accounts to understand the important factors which determine which resources hunter-gatherers exploit, and

which factors determine the arrangement of their seasonal exploitation camps and aggregation sites. On the basis of these findings he designed a specific mathematical model which would predict the most likely seasonal resource utilisation and the location of seasonal camps (in effect the settlement system) given adequate knowledge of the characteristics of both the contemporary environment and the available resources (Jochim 1976). The model consisted of three subsystems - the *'Resource Use Schedule'*, the *'Settlement Location Model'* and the *'Demographic Model'*. Jochim first demonstrated the utility of the model using an ethnographic example (the Round Lake Ojibwa of east-central Canada), and then, using contemporary environments and available resources as the base data, he applied the model to the Mesolithic of south-west Germany.

The structure of Jochim's model was much more complex than that of previous subsistence models applied to the Mesolithic (Clark's 1972 model for example). The first element of Jochim's model, the *Resource Use Schedule,* was based on defining the important *'goals'* (on the basis of ethnographic accounts) which governed the decisions hunter-gatherers made about which resources to exploit. Jochim identified two main goals - *the attainment of a secure level of food and manufacturing needs*, and *the maintenance of energy expenditure within a predefined range, determined partly by the need for population aggregation* (Jochim 1976: 25-26). The taste of different resources (largely governed by the fat content), the variety of resources exploited and the prestige associated with exploiting a resource were factors that were also important, although Jochim chose to consider these factors after the resource use schedule was constructed. The important characteristics of a resource in relation to these two goals were identified as the weight, density, aggregation size, mobility, fat content and non-food yields. Resources would 'score' highest for the first goal - secure income of food and manufacturing items - with greatest weight and non-food yields, with greatest density (as risk of not capturing or collecting the resource decreases) and with the lowest mobility (where risk of not capturing or collecting is again the least). With regard to the second goal, a resource would be less expensive in terms of energy expenditure the greater its yield and aggregation size and the lower its mobility. The relative benefits of each resource at any month (for the two combined goals) could thus be calculated to give a measure of the importance of each different resource type in that month. By totalling the contribution of a resource to the diet for each month, and then calculating the fraction of the cumulative 'attraction', a model of the 'predicted distribution of utilisation' - the seasonal exploitation of each resource - could be generated.

Jochim suggested that this resource schedule, and the 'pull' of various resources in the 'second stage' of the model, could be used to predict the patterns of the settlement system. This could be done via a *'Settlement Location'* model and a *'Demographic'* model. The Settlement Location Model was based on 'gravity' models of spatial attraction used extensively in geography to predict patterns such as the movements of consumers to new shopping centres (for example Foot 1981; Haynes and Fotheringham 1984; Birkin and Clarke 1991). The principle of these models is that resources are more or less attractive depending on how successfully they fulfil requirements and the distance that people have to travel to exploit them. Jochim assumed that hunter-gatherers would be prepared to travel different distances from a base camp to resources based on the 'pull' of those resources. The relative distance of any settlement from each resource group was calculated on the basis of the dietary proportion of the resource (from the resource use schedule) for each month. The likely location of each seasonal settlement could then be suggested on the basis of the actual geographic location of the primary resource distributions. The *'Demographic Model'* was a further step, which assessed the potential for people to aggregate in each season on the basis of the resources available (based on the sum of weight, non-food yields, aggregation and density, divided by mobility for all resources). Settlements in the season with the highest potential for aggregation would be expected to be aggregation sites.

Resource	Percentage of yearly diet
Red deer	26
Roe deer	3
Boar	22
Beaver	1
Fish	13
Small game	13
Birds	2
Plants	20

Table 4.2 Percentage contribution to diet of major resource groups (Jochim 1976: 108).

In order to apply the model to south-west Germany, Jochim collected data on the ecology of different resources to generate figures for weight, density, aggregation, mobility and non-food yields for each resource. In effect, detailed figures (described in chapter three) were only available for large game where each species could be considered separately. Other groups of resources - fish, small game, plants, birds - were considered in very general terms. In fact, both plants and birds were given a 'dummy' figure rather than being calculated on the basis of the attributes, and small game 'filled in' where other resources were limited. Jochim's predictions of the overall contribution of resources to the diet in Mesolithic south-west Germany are shown in **table 4.2**.

A graph of the year round 'predicted distribution of utilisation' of resources was then generated (**figure 4.3**).

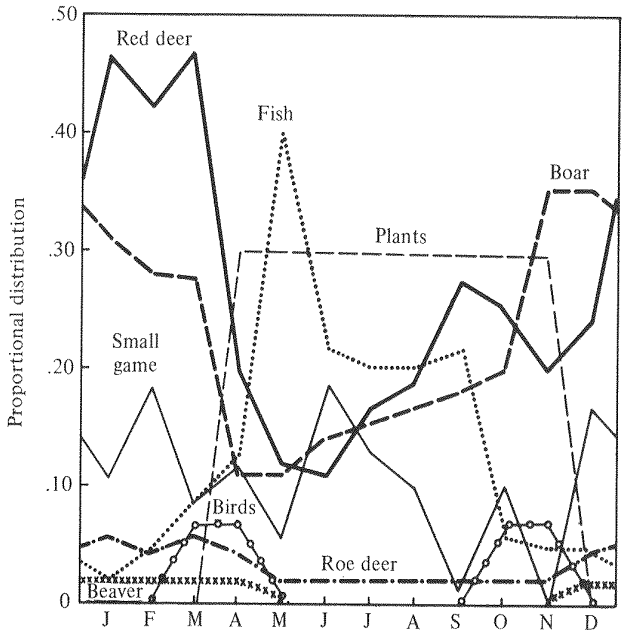

Figure 4.3 Model of seasonal resource exploitation in the Mesolithic of south-west Germany (Jochim 1976: 115).

Jochim simplified the predicted seasonal exploitation of resources into a series of six 'seasons' of resource exploitation for south-west Germany (**table 4.3**). He supported the seasonal distinctions proposed by reference to the exploitation patterns of the Salishan Indians of the North American interior, living in an environment including mixed forests, dry grassland and subalpine communities (Jochim 1976: 116).

According to Jochim's Settlement Location model and Demographic model, base camps in Mesolithic south-west Germany would have been located close to each other on the floor of the main Danube valley, with either a two base camp or four base camp system. This observation fitted well with ethnographic evidence of hunting groups typically travelling farther to the best areas for hunting large game, with base camps being located nearer more reliable and bulkier resources, a model which Binford (1980) came to define as *Logistical Foraging*.

Jochim's model is often taken as the 'final word' on Mesolithic subsistence practices, not only for south-west Germany but also for elsewhere in Europe. Although Jochim commented that *'the patterns of subsistence and settlement formulated for the Late Mesolithic of Germany are adapted to this region and time period and should not be generalised*'(1976: 187), the resource use schedules used in later studies have been remarkably similar to Jochim's model. Price (1978; 1980) applied the same model as Jochim (1976) to the Mesolithic of the Netherlands and Tilley (1979) constructed a similar model for the Mesolithic Communities of the Fenland edge of East Anglia. These later models have used a similar approach with progressively less rigour. It is noticeable that Price (1978; 1980) used far less detailed ecological studies than those of Jochim with little attempt to assess the archaeological or ethnographic support for the model. Nearly all elements were remarkably similar to Jochim's model (aurochs, red deer, wild boar and small game are calculated as each contributing about 15% of the diet) although Price 'guessed' bird contribution at 5% and plants at 15%. Unsurprisingly, the final model of seasonal resource exploitation was remarkably similar to Jochim's. Tilley's model was based on insight rather than mathematical comparisons, he commented that *'A non-quantitative use of this general model is applied here'* (Tilley 1979: 15). Thus when Tilley considered the types of available resources and estimated their percentage contribution to diet, he proposed a higher contribution of plant foods to the diet (in the wake of Clarke's 1976 paper), and rather lower contribution of both boar and fish. Inevitably, the differences between Tilley's model and Jochim's model are more related to individual opinions about which resources *ought* to be important than genuinely reflecting different environments.

Other later approaches have again drawn on Jochim's model although less explicitly. Zvelebil (1981) compared the site catchments of various sites in prehistoric Finland through a similar resource use schedule, but used this as a basis for catchment analysis (based on the productivity of different resources). In this case the resource use value (calculated bi-monthly) was constructed from measures of reliability of capturing prey, non-food and nutritional yields, procurement and transport costs, as well as yield and storage potential (Zvelebil 1981: 183). Once again, large game were the only resource for which detailed data was available upon which to make judgements of relative importance.

After Jochim's model, alternative approaches to modelling past subsistence practices were developed. In the 1980s a new series of models came to the fore, these new approaches offered the potential for assessing the relative importance of different groups of resources both objectively, and more simply. These models, derived from the discipline of animal ecology, are subsumed under the title of 'Optimal Foraging Theory'.

JanFebMar	April	May	JunJulAug	SeptOct	NovDec
red deer	plants	fish	plants	plants	boar
boar	deer	plants	fish	deer	deer
small game	fish	deer	deer	boar	plants
			boar	fish	

Table 4.3 Resource exploitation seasons (Jochim 1976: 116).

Optimal Foraging Theory

'Optimal Foraging Theory' gained major recognition through the work of Stephens and Krebbs (1986). Though the ideas were widely influential, Winterhalder and Smith (1981) played an important role in exposing archaeologists to these models, and Mithen (1987; 1989; 1990) to applying aspects of the theory to the Mesolithic. The central assumption of optimal foraging theory was that hunter-gatherers choose from available resource options in order to optimise certain criteria (often maximising calorific yield compared to calorific expenditure) whilst being subject to certain constraints. Whilst Jochim's model considered the relative benefits of exploiting different resources in terms of their abundance and costs in terms of 'search time' (through the density and aggregation attribute), models from optimal foraging theory take into account the absolute 'cost' of both procuring *and* processing a resource (for example, costs of collection and processing can be considerable for some plant foods). The *'Diet Breadth'* model, used to determine the relative importance of different subsistence resources, has been the most important influence on discussions of Mesolithic subsistence. Other components of optimal foraging theory, such as the *'Patch Choice'* model, defining the length of time a 'patch' of resources is exploited, have not been explicitly applied to the Mesolithic situation.

The Diet Breadth Model

The most relevant element of foraging theory to discussions of past subsistence resources is the '*Diet Breadth Model*'. This model assumes that hunter-gatherers will choose which resources to exploit on the basis of their 'return rates' (the overall benefit of exploiting the resources taking into account the time taken to exploit and process them). Resources are ranked in terms of their return rates (post encounter), search, pursuit, capture, transport, processing and handling time. The highest ranking resources can be analysed on a seasonal basis to determine the 'optimum' seasonal resource exploitation. Although hunter-gatherers do not make *explicit* decisions in this way, research has shown that subsistence and settlement behaviour can be explainable in terms of such optimal use of available resources. O'Connell and Hawkes (1981; 1984) and Hill and Hawkes (1983) found some success with using the diet breadth model to predict the resources which the Alywara (in Central Australia), and Ache (in Eastern Paraguay), exploit.

The most important conclusion of the diet breadth model is that a resource's abundance alone cannot be used to predict whether it will be utilised. Resources which have low return rates may be ignored if other resources which provide higher 'returns' on investment are available and fulfil requirements (acorns may have been abundant in oak forests in the Mesolithic but this does not necessarily imply that they were an important food source as they are time consuming to collect and process). Rowley-Conwy (1986: 27) illustrates this point, noting that highly *productive* resources such as earth-worms are not exploited because hunter-gatherers clearly take search and processing costs into account rather than exploiting resources solely on the basis of their abundance. The diet breadth model also predicts that an increase in the search costs of high ranked resources (such as large game) may cause lower ranked resources to be included in the diet. Perhaps the most interesting applications are those not aiming to reconstruct completely the range of resources used, but instead addressing the likely effect of changes in environment or exploitation (such as changes in technology). Hill and Hawkes (1983) for example showed that, as expected, the Ache decreased their diet breadth when shotguns were adopted to hunt animals, dropping lower return resources such as monkeys and small birds out of their diet.

Early applications of optimal foraging theory used energy as the 'currency' comparing the relative energetic costs and benefits of acquiring different resources. However the successful survival of hunter-gatherer populations is often dependant on other criteria (discussed in chapter three). For example, other characteristics than calorific yields may determine which resources are preferred. Speth and Spielman (1983) stress the importance of *fat* in hunter-gatherer diets at times when only very lean meat is available (the protein metabolism problem), thus hunter-gatherer populations are known to frequently crave fat when supplies are short (Kelly 1995). Not only fat but also *protein*, *vitamins* and *minerals* are as vital to diets as energy. Bailey (1975) points out that the daily requirements of almost all nutritive substances can be obtained from only a small amount of shellfish, counterbalancing their low energetic returns.

Furthermore, certain resources may be important because, even if their calorific or other yields are low, they are reliable, as noted in chapter three. The exploitation of plant foods incorporates a much lower risk of coming home 'empty handed' than hunting (particularly when hunting large game). On the other hand, by taking risks, hunter-gatherers may reap higher benefits overall. Mithen (1990) explores the issue of risk and the role of prehistoric decision-making. He suggests that a diverse range of resources at coastal sites allowed Mesolithic hunters in these locations to gear their hunting strategy to exploiting large game more efficiently (they could afford to take the risk of failure as other resources were always available), whereas in inland areas (in this case south-west Germany), they would have to avoid returning empty-handed since they had fewer 'back-up' resources (such as marine fish or plant resources) (1990: 89-193). He compares Upper Palaeolithic hunting strategies at the Spanish site of La Riera with Mesolithic strategies at coastal sites in Denmark, concluding that at the latter, hunters were indeed able to concentrate on more 'risky' resources because 'back-up' resources were available if they came back empty-handed (Mithen 1987; 1990).

Rather than any specific model, foraging theory has perhaps been more influential in forwarding the understanding of the range of factors which might influence any subsistence or settlement pattern. The range of criteria which influence decisions about which resources to exploit are clearly very varied (and may change radically over time). In certain cases it is even non-food resources which may determine settlement patterns, and thus the food resources exploited are determined by the location of settlement rather than vice versa. The availability of water or firewood may be more important than the energy efficiency of foraging in certain conditions, especially in cold or arid regions (Kelly 1995). Although attempts have been made to combine different criteria to address the ranking of resources (Hill 1988), this

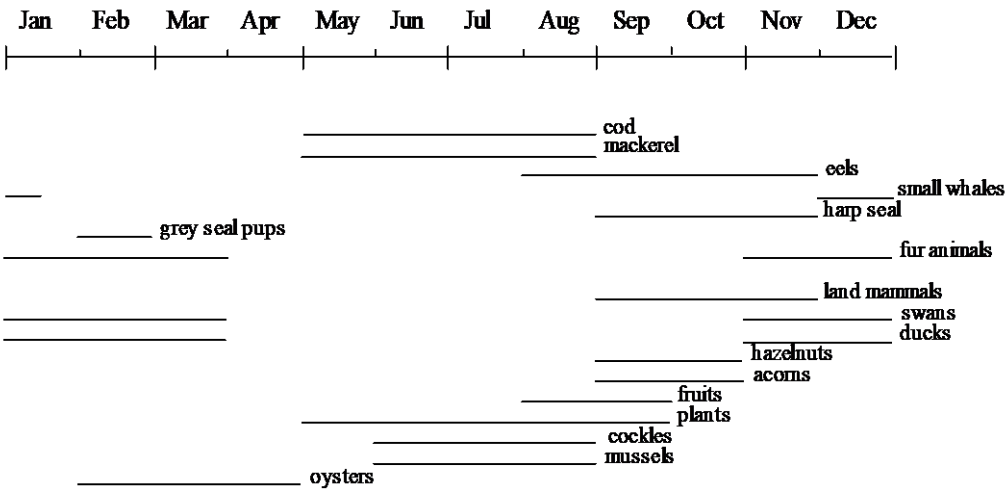

Figure 4.4 Proposed resource availability schedule for the Danish Ertebølle (Rowley-Conwy 1984).

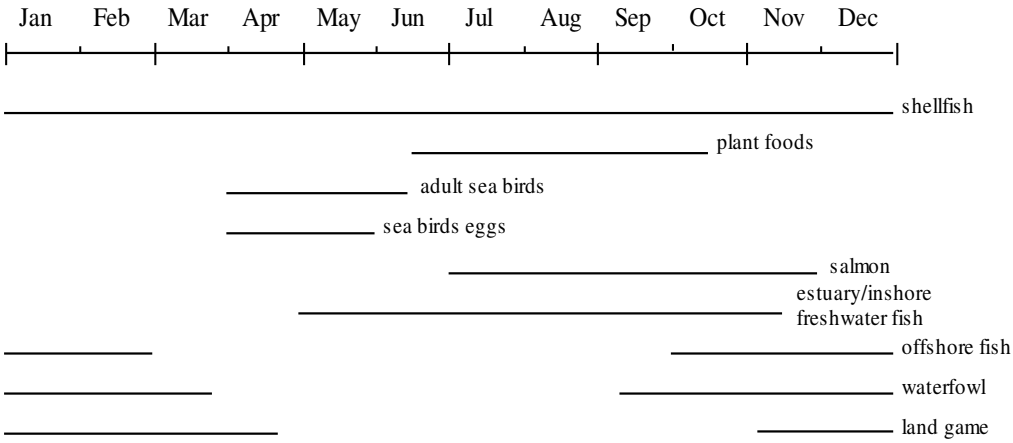

Figure 4.5 Proposed Late Mesolithic resource availability in the Eskmeals area (Bonsall 1981: 466).

type of approach is undoubtedly extremely difficult given the range of important characteristics. In fact, perhaps the most significant development to stem from foraging theory has been the growing recognition that the factors determining prehistoric diets would have been extremely complex.

Of the interpretations that have been influenced by developments in foraging theory, possibly the most notable are discussions of the subsistence patterns of potentially sedentary coastal populations. At the coast, as discussed in chapter three, abundant migratory resources are potentially available at little cost. The year round availability of resources with high return rates has been a key element in the argument for sedentary complex coastal communities. Rowley-Conwy (1984) for example used return rates in considering which resources were available at coastal sites in the Danish Ertebølle (although not quantitatively) with largely only the 'high-ranking' resources included in the resultant resource-availability schedule (**figure 4.4**). Bonsall (1981: 466), **figure 4.5,** also represented resource availability in this way for Late Mesolithic populations at Eskmeals in Cumbria. In general terms however, the influence of foraging theory, a whole body of theory based on developments in ecology, is much less visible than that of Jochim's (1976) model, perhaps because the conclusions of the latter, presented as a clear graph, have been easier to apply as a piecemeal 'eco-fact'.

THE LIMITATIONS TO CURRENT ECOLOGICAL MODELS OF SUBSISTENCE AND SETTLEMENT

The Source Data

The influence of the above models has been far-reaching. Explicit models are often taken as the 'last word' on subsistence, and even where this is not the case, their components, a heavy reliance on large game for example, are frequently a common preconception brought to bear on understanding the period. In fact, each successive model of subsistence and settlement, whilst also incorporating elements of contemporary preconceptions, has clearly been built upon the conclusions of previous models. Jochim's proposals about the relative contribution of different resources thus present us with prime examples of 'eco-facts' since, without any serious criticism, they were used directly by Price (1978; 1980) and Tilley (1979) and also clearly influenced many later interpretations including Zvelebil (1981) and Simmons (1979; 1996).

The most obvious limitations to models of subsistence and settlement which are built on the basis of resource availability are, as outlined in chapter three, *the limitations to our knowledge of past environments*, and of *how Mesolithic populations exploited them*. Mesolithic environments were not only unique, with no modern parallels, but the evidence for the presence and availability of different resources (particularly resources other than large game) in these environments is also very limited. Equally, even if we had a perfect knowledge of past environments, Mesolithic subsistence would still not be predictable. Populations could have exploited their environments in many different ways, depending on the use of specific technologies (such as fish nets or traps for game), on how intensively resources were exploited (determined in part by the population pressure on resources as well as other factors) and whether characteristics such as storability or fat content were important (as discussed in chapter three).

Even quite simple interpretations of the most important resource groups in fact depend on a detailed knowledge of environments and exploitation patterns. Like Clark, Simmons (1979; 1996), constructed his settlement models simply on the basis of defining a few key resources and their seasonal availability and distribution. He included not only different types of large game at different seasons (red deer, roe deer and aurochs) but also in the later model includes other resources such as eggs and nestlings as key resources (Simmons 1996). This model may be attractively simple, but is worrying dependant on the correct resources being identified. The resources which appear to be most obvious to ourselves can be very different from those exploited by past or present hunter-gatherers.

Jochim's (1976) model may have been *less* subjective than Clark's (1972) approach, but it is still far from a clearly objective approach. Though widely accepted, even Jochim's (1976) model is much biased by a series of assumptions about resources and by problems with a lack of evidence for past resources or exploitation patterns. As Zvelebil (1994: 58) points out, studies of the relative benefits of plant and animal exploitation are not available for temperate woodlands akin to those in Mesolithic Europe. Thus, Jochim *guesses* the relative contribution of plant foods to diets as 20%. The contribution of birds is also *guessed* at 2%. Fish resources *were* compared quantitatively with other resources, but with difficulty, since measures such as *density* and *mobility* are difficult to define for fish (Jochim rates fish mobility as extremely low as they cannot escape from the river). The factor of fish resources is also made more problematic since different technologies (nets or weirs) would have had a major impact on the relative benefits of fish exploitation. Small game resources were perhaps the most problematic being even intriguingly accorded a 'fill in' status - their use being inversely related to the utilisation of other classes of resources.

The least subjective element of Jochim's (1976) model was large game resources, for which detailed information on densities and food and non-food values in modern forest ecosystems was available. It is probably only because the comparisons between different large game components were the most reliable aspect of this model that the model was successful at predicting Ojibwa subsistence practices. Even for large game resources however the figures used by Jochim are disputable. Bay-Peterson (1978: 123) for example publishes figures for ungulate densities that vary by as much as a factor of ten. In fact, because of the problematic nature of the evidence for present large game availability in Europe, Mithen (1990) had to use data on ungulate availability in East Africa in his foraging theory based model of Mesolithic hunting tactics.

Even given the best information and the most careful and detailed analysis, the issue of defining resources can be more complicated than it first seems. The abundance of any resource can vary widely across quite limited scales of time and space, moreover modern ecological work suggests that animal populations can be stable at different levels in the same environments depending on the past history of predator-prey relationships (Flowerdew 1987: 130-135) a phenomenon known as the 'multiple stable state'. However, the problematic nature of the evidence for resource availability and use used in Jochim's model, and thus in his conclusions, was rarely considered by later similar models (such as Price 1978; 1980; Tilley 1979 and Zvelebil 1981).

Fortunately, the seasonality (or seasonal availability) of different resources is somewhat less prone to problems with non-analogous environments than their abundance - plants flower and seed, animals breed and hibernate, and birds and sea mammals migrate at what can be assumed to be broadly analogous times in the present and the past. Resource availability schedules can thus provide a useful tool for studying the seasonal scheduling of past hunter-gatherer groups. There are a number of limitations however. Resource availability schedules cannot be used to determine if resources were important, as they give no indication of the abundance of resources (only their potential availability). Bonsall (1981: 466), **figure 4.5**, for example, shows salmon at Eskmeals being available for five months, whereas they would only be significantly abundant for a very limited period - the salmon 'run' - within this time. Similarly, resource availability schedules can also differ depending on source data. Cod and mackerel are available from May to

August according to Rowley-Conwy (1984), **figure 4.4**, but the exact opposite (as 'offshore fish') of September to February for Bonsall (1981), **figure 4.5**.

The year round availability of resources is often used specifically to suggest that since sufficient resources were available local populations may have been sedentary. There are a numbers of problems with these inferences. First, resources may not abundant or productive enough to support populations - for example Rowley-Conwy's (1984) suggestion that oysters may have been a vital poor season resource for the Ertebølle is debatable, given their low calorific content and high processing costs. Secondly, even abundant 'high-return' resources which are available all year round are not necessarily linked to sedentary or complex societies - Schalk (1981) demonstrates a wide variety of settlement behaviour despite very similar availability of coastal resources along the north-west coast of North America. Equally, many societies are sedentary where resources are *not* available all year round by virtue of systematic storage of resources available at other times.

Spatial and Temporal Variability

'Bottom up' models suffer not only from limitations with evidence for the availability and use of different resources, but also from problems with the way in which ecological models are constructed. The most serious limitation is that most models present an almost exclusively 'static' model of past subsistence and settlement. Spatial and temporal variations in resources can be significant on both small and large scales. Early Holocene environments were not only very variable across different landscapes - uplands, lowlands, coasts, rivers - but also changed markedly through time as different tree species spread from glacial refugia, and climatic fluctuations took place. Thus a substantial variability in subsistence and settlement behaviour *ought* to be expected. In contrast, one of the main aims of ecological studies has been to define *the* subsistence or settlement system.

As a result of the static emphasis of most, if not all, ecological models, some of the most interesting aspects of Mesolithic subsistence and settlement - the potential responses to marked changes in early Holocene environments - are often overlooked.

Some of the most fundamental limitations of ecological models, in particular the static or normative nature of most models, have been much influenced by the application of concepts derived from ethnographic sources. These sources are largely much oversimplified and moreover place a constraint on possible interpretations. But, before considering the use, and misuse, of ethnographic analogies in the following section, the use of ecological determinants to reconstruct population numbers is considered below.

POPULATION

Only a limited number of authors have attempted to define *absolute* population numbers on the basis of resources; most authors prefer to draw on ethnographic rather than ecological parallels to suggest population numbers. Where specific population numbers have been suggested, the idea of a large game hunting base to subsistence practices (discussed in chapter three) has once again been very influential. Clark (1972: 38) for example, based his figures for population density on the yield and meat weight of deer (from studies in the Scottish Highlands) and human calorific requirements. He concluded that there would have been 3,300-8,800 people in England and Wales in the Mesolithic, that is a density of 0.03-0.07 persons per km^2. More recently, Smith (1990: 14) also assumed a dominant role for meat from large game animals in the diet, although he somewhat more cautiously used large game densities to determine *maximum* population densities, that is the *'carrying capacity'* of the environment. He used measures of ungulate biomass and potential yields in present boreal and temperate deciduous forests, calorific yields of ungulates and calorific requirements of human groups to calculate population densities. Smith concluded that there would have been a maximum population density in the Mesolithic of 0.05 persons / km^2 for boreal forest and 0.16 persons / km^2 for temperate deciduous forest (with an unstated implication that populations would increase as woodland types changed through time).

Aside from the problems of using large game densities from *modern* woodland environments (or the Scottish Highlands) in the above cases, a more fundamental problem is that studies of the ecological determinants of historic hunter-gatherer populations suggest that it is the bottleneck of the resources *at the poorest season* (rather than overall yields of any resource) which determine population numbers (as discussed in chapter three). This relationship was also noted by Jochim (1976: 134) and Mellars (1975: 54). Thus measures of the carrying capacity (such as those of Clark and Smith above) which do not take the seasonality of the environment into consideration will greatly overestimate the real population in an ethnographic situation. Casteel (1972: 27-35) showed that estimates of carrying capacity on the basis of year-round resource yields were 20-25 times the actual ethnographic figures for many New World groups. He demonstrated that for the Chipewyan, fish, the main 'poor season' resource, could be used to calculate maximum population. Baumhoff's (1963) study of historical Californian populations also showed that in the Lower Klamath province, fish yields were the best predictor of population numbers. Jochim proposed that fish (as the 'lean season' resource in his subsistence model) would be the main determinant of population numbers in Mesolithic south-west Germany. He suggested that the upper limit for population would be 0.13 persons per km^2 (Jochim 1976: 135) but that, given factors such as the structure of the river basin and the organisation of hunter-gatherer groups, the actual numbers might be much less. Jochim's approach is more clearly related to ethnographic studies, however there is no *a priori* reason for fish to have been the key poor season resource in Mesolithic south-west Germany. Clearly the importance of fish resources varies between different

hunter-gatherer groups, and in other regions of California Baumhoff (1963) demonstrated that a combination of three resource categories - fish, acorns and game - could be used to predict populations, depending on the relative role of these resources for hunter-gatherer groups. As noted in chapter three, defining the relative roles of different resources is extremely difficult.

It is notable that very few authors deal with a *change* in absolute population numbers, although many suggest that populations were gradually increasing (e.g. Newell 1973; Meiklejohn 1978: 75; Morrison 1980: 136; Price 1983; Gendel 1984; Vang Petersen 1984; Myers 1986; 1989: 89; Verhardt 1990; Smith 1992). Ecological changes are normally seen as the prime motivator for changes in population (as discussed in chapter one) and several authors interpret changes in woodland types in the Mesolithic (from boreal to temperate woodlands) and warming climates in terms of an increase in populations both in Britain and more widely in the rest of Western Europe (for example Jacobi 1978; Myers 1989; Rowley-Conwy 1983). In a later article partly based on his 1976 volume Jochim (1989), in contrast, suggests that populations during the Mesolithic in south-west Germany would actually *decrease* as forests increased in density, and undergrowth plants and forage for game animals was reduced.

The range of interpretations both of absolute populations and of changes in population illustrates that measures of population numbers are very problematic, and measures of changes in population more so. Certain critical 'poor season' resources may have determined Mesolithic populations but, as noted in chapter three, it is not clear which resources these might be, and even if these resources were definable, the yields are similarly equivocal. Successful determinations of population numbers have only been made where both the available resources, and methods of exploitation, are known in detail (i.e. in cases of modern populations where detailed ethnographic records exist and modern environments are a suitable analogy for near modern resource availability). Without the knowledge that acorns were intensively processed, for example, estimates both of critical resources and of resource yields for Californian populations would be very different and unlikely to be as good a predictor of aboriginal populations as Baumhoff (1963) found.

Clearly it is difficult to separate the influence of ethnographic concepts from ecological ones, whether of subsistence and settlement or population. At a more fundamental level, it was the ethnographic analyses of the relationships between environment and subsistence and settlement in known hunter-gatherer groups (Birdsell 1953; Baumhoff 1963; Casteel 1972; Thomas 1981; Keeley 1988; Kelly 1995) which first provoked a pervasive optimism about reconstructing subsistence, population and settlement on the basis of *past* environments. The formulation and acceptance of many models applied to the Mesolithic followed ethnographic analyses which demonstrated clear relationships between environments and subsistence and settlement. That either subsistence or settlement patterns *should* be clearly predictable, given a detailed knowledge of environments, is itself an eco-fact. An essential problem with this inference being that the goal of the former analyses - *explanation* - and the goal of the latter applications of ecological models to the Mesolithic situation - *prediction* - are very different things. Given the problems outlined in chapter three and above, the optimism for predicting of *the* past subsistence and settlement patterns on the basis of environments may have been misplaced. This is not to imply that the understanding on past environments is not essential to any understanding of Mesolithic societies, if not a means of reconstructing the settlement pattern, it is a crucial component of any attempt to understand variability or change in past societies.

One of the key lines of support for the concept of the definable subsistence and settlement system have been ethnographic analogies. The development of influence of models of Mesolithic subsistence, settlement and population based on ethnographically documented hunter-gatherers is considered in the following section.

THE ETHNOGRAPHIC APPROACH

Figure 4.6 The Selk'nam of Tierra del Fuego: Hunter-gatherers in a forested environment.

Almost from their first discovery by Europeans, modern hunter-gatherers on distant continents have been seen as a source of evidence for the lifestyles of past populations (Orme 1981; Schrire 1984). There are many early accounts of hunter-gatherers as examples of our ancestors 'frozen in time' range (from Lubbock 1865; Pownall 1795; Wilson 1851 to Clark 1951 - quoted at the start of this chapter). Although most modern ethnographic studies no longer see recent hunter-gatherers as a direct parallel for past societies, ethnographic research still has a major impact on archaeological interpretations. Ethnographically recorded societies (such as the Selk'nam shown above, **figure 4.6**) continue to be used as an analogy for Palaeolithic and Mesolithic populations, either *directly* as 'piecemeal analogies' (Orme 1981), or through approaches such as general observations, applied models and extrapolations from statistics.

Modern hunter-gatherers provide us with a valuable record of a range of subsistence and settlement patterns of mobile foragers, and a means of structuring distinctions evident in archaeological evidence, but ethnographic analogies have to be used with care. The surviving record of hunter-gatherer groups is a very biased one, not only towards North America, but especially towards the most remote or inaccessible locations on that continent. In effect the areas with particularly extreme environments, especially those marginal for agricultural exploitation in the farthest west and north, and those where economic activities (such as trapping) allowed a later survival of hunting and gathering, were the last to be affected by European colonists. Those were thus the areas where most research has been possible. Kelly's (1995) survey of available data on hunter-gatherers, for example, drew on data from 129 societies, but of these 60 were from North America and 31 (a quarter of the total) from societies on the west coast of this region (the area which was colonised latest). Additionally, because of the history of colonial contact, assessments of population density (in the wake of diseases such as smallpox) and settlement patterns are thus very biased. Post-contact populations, in effect, are neither representative of past variations, nor can they be considered 'pristine' and uninfluenced by Western contact. Arguments thus arise over which aspects of activities have a long history and which relate to colonial impact. The short timespan of research also tends to present a very static picture of these societies (Jochim 1988) and research concentrated in specific regions tends to underestimate long distance influences and exchange (Wobst 1978). In fact, Wobst even refers to the problems of a dependence on biased ethnographic accounts emotively as the *'Tyranny of the ethnographic record in archaeology'*.

Unfortunately, the above biases are but rarely considered in the use of ethnographic analogies for Mesolithic societies. Not only that, but also the relevance of ethnographic analogies, (for example the similarity of present environments to those of the past) and the scope (or specificity) of ethnographic generalisations are often given little attention. Although a knowledge of ethnographically documented societies can make made a major contribution to our understanding of the period, it is possible to trace a growing acceptance of initially carefully voiced, but in many cases misleading, assumptions which are often based on simple analogies. These assumptions, which have grown to constrain our understanding of the Mesolithic, are here dubbed 'ethno-facts'. The development of approaches drawing on ethnographic analogies and the rise of such 'ethno-facts' are considered below for models of population and for models of settlement systems.

Whereas population estimates are the 'last phase' of ecological models, they are often a starting point for models of subsistence and settlement based on ethnographic analogies. As such they are considered first below.

POPULATION

As illustrated in chapter one, population has been seen for some time as a major structuring element in social systems, and population change as a prime mover for social change. Meiklejohn (1978: 68) comments that '*Of the variables that most control the social systems of any group, population size is the most important'*. Newell and Constandse-Westermann also note that '*Population density is directly related to the level of social organisation'* (1986a: 276), and further relate population density to technological complexity (1986b).

Observations of the population density of known hunter-gatherer groups are often used as a basis for suggested population densities in the Mesolithic, and also serve to support models of Mesolithic populations derived from other sources (typically resources or site-based evidence). Clark (1972: 28) was probably the first to make direct comparisons between ethnographic population densities and those in the Mesolithic when he used population densities of people in Tasmania (from the Chambers encyclopaedia, 1950: 473b) to estimate total population numbers in England in the Mesolithic (his estimates were between 4,133 and 10,455 people). He claimed that this was a 'reasonably good' (Clark 1972: 28) match with his figures derived from a dependency on deer (which ranged from 3,300 to 8,800 people).

Somewhat later, Meiklejohn (1978) also supported his population estimates by referring to ethnographic figures. His suggested that his estimates of Upper Palaeolithic populations in Northwest Europe (between 0.008 to 0.090/km^2) were reasonable as they were *'well within the range of densities known from modern hunter-gatherer populations'* (Meiklejohn 1978: 70). These figures were however derived from what we would now consider to be a very suspect source - the numbers of archaeological sites (after Bordes 1968). Meiklejohn further used a population growth rate of 0.004-0.01% per annum to calculate Mesolithic population based on these estimates - giving overall increases of between 27% and 332% (and population densities thus of 0.01-0.3/km^2).

'Ethnographically derived' figures for Mesolithic populations appear in a number of publications. However, in most cases apparently ethnographically derived figures are based on secondary sources (and Meiklejohn's (1978) Palaeolithic estimates have been particularly influential) with these figures being 'passed down' from publication to publication. Newell and Constandse-Westermann (1986a), for example, used Meiklejohn's Upper Palaeolithic population density figures, alongside unspecified growth rates, to suggest gradual increases in population throughout the Mesolithic. Smith used an *'ethnographically derived'* figure of 0.012 people per km^2 (Smith 1990: 16) to support his estimates of population density on the basis of available resources, and Simmons (1996) states that from 'analogies with near recent populations of hunter-gatherers' the range of population density in the Mesolithic would be 0.01-0.1 people per km^2 (Simmons 1996: 161).

The problem with using any records from ethnographically documented societies to estimate Mesolithic population numbers is that the range of variation in known hunter-gatherer population densities is very large - roughly a thousand-fold difference in densities is recorded. Thus, almost any figure can be within the range recorded, and moreover some society may be found to support almost any population estimate. Recorded densities are in any case problematic, with records of densities largely taken after warfare and diseases have affected indigenous population numbers. Also the issue is further complicated since we have no records of hunter-gathers in analogous environments today to use as an analogy for Mesolithic populations.

It would be tempting to believe that Mesolithic populations were really constrained by the densities defined. However, where surveys of hunter-gatherer densities have taken place, they illustrate the wide range of variability expressed, rather than the predictability. Thus the population densities documented in Newell and Constandse-Westermann's (1986a) analysis of population densities of 169 North American hunter-gatherer societies range between 0.002 and 63.096/km^2. More recently, Kelly (1995: 221) illustrated that for hunter-gatherer societies for which information is available (205), population densities are extremely variable (only 69 (34%) lie within the 0.01-0.1/km^2 range).

Clearly figures for absolute population densities and for changes in population have been substantiated through misleading ethnographic analogies. The idea that Mesolithic population densities can be taken to lie neatly within the 0.01-0.1/km^2 range is thus unfortunately an example of the development of an 'ethno-fact'. That is, an initial assumption which is taken as a 'given' by later authors and is replicated 'down the line' of later publications, in much the same way that Jochim's estimates of resource contributions took on the status of 'eco-fact' in the absence of contradictory (or supporting) evidence. Unfortunately, although equally (and perhaps more obviously) biased, models based on 'ethno-facts' have become more popular in recent years. This is at least in part because ecological 'resource-up' models have fallen out of favour, partly because of a lack of evidence for resource availability and exploitation patterns, but more particularly because mathematical and 'deterministic' approaches have become increasingly criticised. The development of these ethnographic models of settlement and the further rise of the 'ethno-fact' are discussed below.

SETTLEMENT SYSTEMS

A number of different 'ethno-facts' have had a major influence on reconstructions of subsistence and settlement patterns in the Mesolithic. Nonetheless, the origins and development of the 'ethno-facts' themselves is difficult to isolate. This is not least because from the earliest interpretations of prehistory, accounts of the lifestyles of living hunter-gatherers have coloured and structured interpretations of the past (Orme 1981). In some cases, with the use of direct analogy, the role of interpretations of ethnographic societies in structuring understandings of the Mesolithic are clear. However, ethnographically documented societies structure most interpretations of Mesolithic rather more subtly, through the use of a general model of hunter-gatherer settlement, in some cases explicitly defined, while in others being more of a 'taken for granted' preconception of hunter-gatherer existence.

Direct Analogies

One of the first explicit uses of ethnographic analogy to interpret evidence for Mesolithic economy and society was put forward by Price (1973). Price made a direct analogy between Canadian sub-Arctic groups, living in a boreal forest environment, and hunter-gatherers in Mesolithic Europe. He drew on evidence from three hunter-gatherer groups - the Mistassini Cree (Rogers 1963; Rogers and Rogers 1959), the Attawapiskat Cree (Honingmann 1956; 1961) and the Round Lake Ojibwa (Rogers 1962) whose 'procurement system' might serve as a model for the Mesolithic of Europe. Price outlined the relative contributions of the main groups of resources to their subsistence base as recorded by Rogers (1966; **table 4.4**). On the basis of the diets of these groups he suggested that *'there is no evidence to suggest that the collection of plant foods provided a significant proportion of the diet'* in Mesolithic Europe (1973: 472). However in contrast to Clark's (1972) predominant emphasis on large game, through analogy with boreal forest groups, he suggested, rather than purely a large game emphasis that *'Hunting of large and small game, fishing and some fowling seem to have provided the subsistence base'* (1973: 472).

Price (1973) remarked on the structure of the ethnographically recorded settlement pattern. He noted that in a densely forested environment with widely dispersed resources, the size of the *'subsistence units'* was small. Additionally he remarked that people were '*very mobile'*, never staying in one location for long but '*moving to where resources were available in a seasonal cycle'* (Price 1973: 467-72). He also noted that 'subsistence units' were part of a wider population which would gather together at some time in the seasonal cycle for as long as resources allowed.

	Mistassini Cree	Attawapiskat Cree	Round Lake Ojibwa
Fishing	26	39	26
Large Game Hunting	65	18	53
Small Game Hunting	5	12	16
Fowling	4	31	5

Table 4.4 Contributions of groups of resources to diet for Canadian boreal forest groups (Price 1973 after Rogers 1966).

Having assumed that boreal forest environments and resources were similar to those in Mesolithic Europe, Price (1973) also assumed that the means of exploitation of these resources would also have been similar. He remarked that *'Mesolithic populations must have been dispersed over the landscape in relatively small subsistence units*' and *'agglomeration should be expected to occur sometime in the yearly cycle when sufficient resources are available ... A cycle of seasonal activity is predicted'* (Price 1973: 472). Price suggested that the archaeological record be studied for information on group size and activity to illustrate these patterns.

Price's (1973) interpretations were clearly somewhat problematic, not only because Mesolithic environments were very different from those of the Canadian sub-Arctic (as discussed in chapter three and five) but also because such 'piecemeal analogy' (Orme 1981) is easily biased by the particular historical or social context of the group being studied. Nonetheless, Price did make some important points, particularly by drawing attention to the complexity and variability of ethnographically recorded settlement patterns. He noted that the Cree and Ojibwa used a series of different types of residential camps and short and long term occupations to exploit different resources during the suggested annual round for example. He also commented on changes in resource availability (in this case fluctuating rabbit populations) which affected settlement patterns, and the fact that procurement and settlement systems varied even between groups in apparently similar environments. The complexity of known hunter-gatherer settlement systems noted by Price is, in contrast, often overlooked in later studies.

A General Model of Hunter-Gatherer Settlement

More than direct analogies, the application of general concepts of hunter-gatherer settlement are one of the most common uses of ethnographic evidence. These models are supposedly drawn from a compilation of ethnographic sources. Rather than emphasising the causes of variability in patterns of hunter-gatherer subsistence and settlement systems however, models have been much influenced by the idea of a common structure to all hunting and gathering societies, a structure that can be directly applied to past situations. This supposed structure is often influenced by misplaced analogies used by earlier researchers, or a misreading of ethnographic evidence or interpretations. The ethnographic justification for the supposed common structure of Mesolithic settlement patterns has been a major influence on interpretations of Mesolithic societies.

The idea of a common structure to hunting and gathering societies was much influenced by the concept of the 'foraging adaptation' put forward at the 'Man the Hunter' symposium in Chicago in 1966. The common 'foraging adaptation' included characteristics such as small group size (25-50 individuals), separate male and female foraging patterns (with females providing the bulk of the subsistence

base) and generally low population densities (well below the carrying capacity of the environment). Many of these supposedly common elements were drawn heavily from Lee's research on the !Kung (Lee and deVore 1968; Lee 1979). However it was the concept of a definable and predictable set of behaviours characterising hunter-gatherer populations, rather than the details, which influenced models applied to the Mesolithic. The common model of Mesolithic settlement was in fact much more specific.

MODELS OF INLAND GROUPS

The idea of a definable set of hunter-gatherer behaviour was first taken up by Clark (1972). The most important common element of hunter-gatherer societies for Clark was the predictable seasonal round. This seasonal round in recorded hunter-gatherer groups would be geared towards exploiting resources where and when they were available and thus would be in theory *predictable* from basic environmental contrasts. In particular Clark was concerned with a possible simplification of this pattern into two main seasons, *winter* and *summer*, and two main phases, *aggregation* and *dispersal*.

On the basis of red deer ecology, Clark (1972), as noted previously, suggested that Mesolithic population would aggregate in the lowlands in winter and disperse to hunt red deer in the uplands in summer (tied to red deer concentrations). Archaeological evidence, particularly the idea that Star Carr was a winter base camp, also further appeared to support the idea of a complementary contrast between upland hunting camps (supposedly occupied in summer) and lowland base camps (supposedly occupied in winter). Although there have been changes in ideas about subsistence and the precise nature of settlement patterns, these contrasting elements continue to structure our understanding of the Mesolithic (**figure 4.7**), at least partly because, despite changes in specific interpretations, other authors have appeared to find similar evidence for the same basic two-fold contrasts elsewhere.

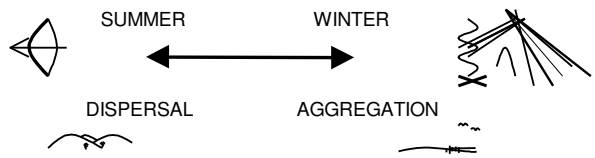

Figure 4.7 The accepted structure to Mesolithic settlement.

Perhaps the clearest support for the upland hunting site / lowland base camp contrast came from Mellars' (1976) analysis of the functional components of upland and lowland assemblages. Mellars' interpretations were also based on a context of ethnographic and environmental evidence which was used to set up a model of expectations of Mesolithic settlement systems. Like Clark (1972) Mellars suggested that populations would aggregate or concentrate where resources were concentrated, drawing on ethnographic records of seasonal rounds, after Birdsell (1968). Similarly, Mellars suggested that populations would be expected to aggregate in winter in the lowlands where herd animals aggregated. Here long term base camps would also provide protection from predators and allow groups to share food. Again like Clark, Mellars also suggested that the uplands would be occupied by small dispersed hunting groups. Mellars (1976) however addressed the archaeological evidence for these activities by exploring the patterning of site size and assemblage diversity (of the retouched tool component) between upland and lowland sites in Mesolithic Britain. Having identified a

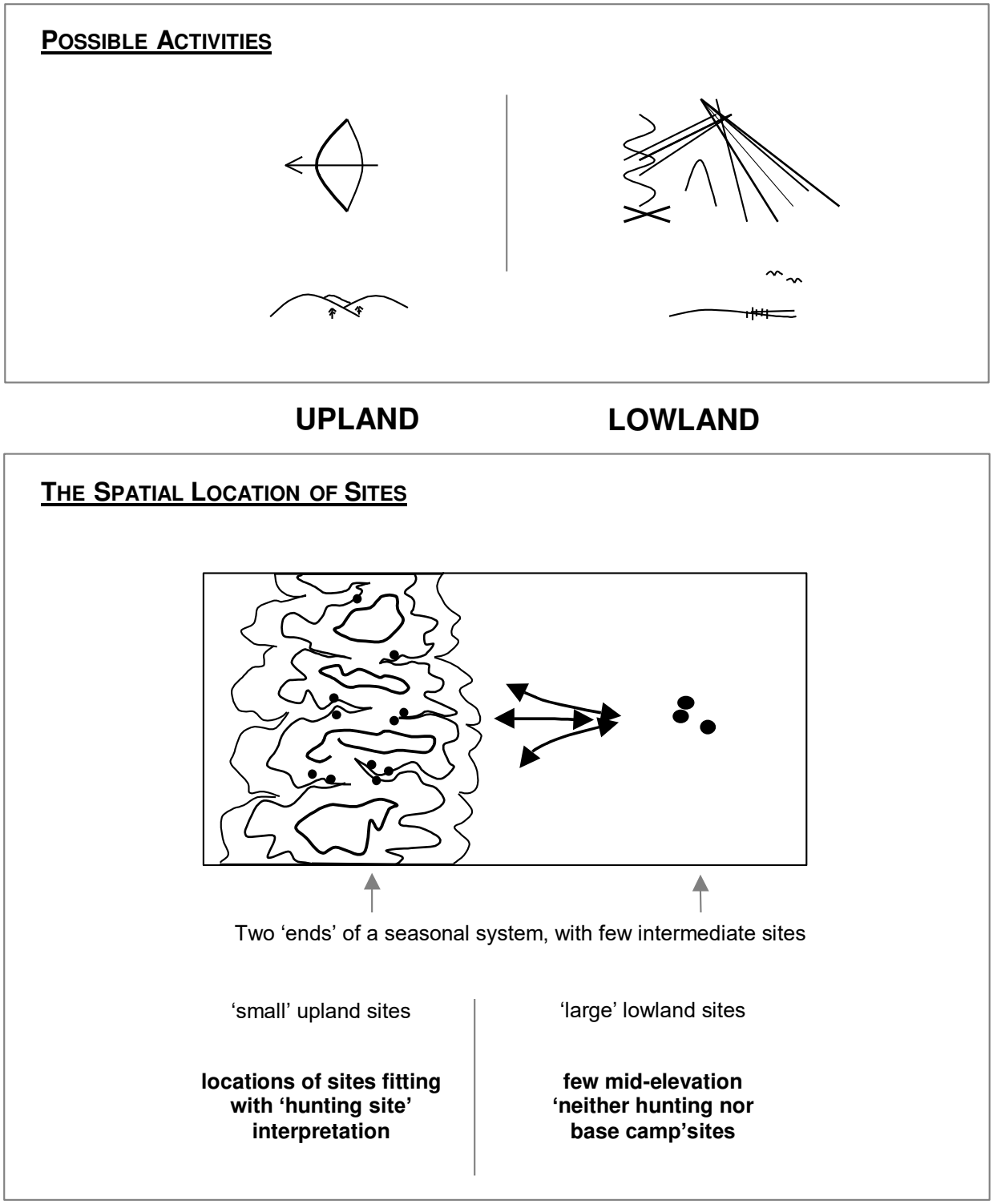

Figure 4.8 Archaeological evidence for Mesolithic settlement patterns.

prominent division between large lowland sites either with 'balanced' assemblages (type B sites) or assemblages dominated by scrapers (type C sites), and small upland sites dominated by microliths (typically seen as hunting implements) (type A assemblages), Mellars interpreted the former as base camps and the latter as hunting camps.

The idea of a functional contrast between upland and lowland sites has remained an important element in interpretations of Mesolithic sites since Mellars' article. For one thing, the concept of a large game hunting phase to subsistence, noted in chapter two, has been important. For another, both the distributions of Mesolithic sites in clear upland and lowland settings (discussed in chapter two) and the work of other authors on assemblage components also highlighted functional contrasts between upland and lowland sites. Jacobi (1978: 320), for example notes the lack of burins on upland sites in the North York Moors compared to many burins found at lowland Star Carr, seeing the latter as clearly a 'domestic' site and the former as 'hunting sites'. Simmons (1979: 112-113) even commented that considering the retouched tool component on sites:

'where only microliths are found, most workers have assumed that they are examining a 'hunting camp'... by contrast, where the microlith: scraper ratio is more nearly equal then a longer period of settlement with other economic and purely social activities is postulated'.

Although, since Clark's model, the seasonality of 'base camps' *has* taken on a broader meaning, with some lowland sites being seen as 'summer base camps' - the lowland 'bases' for upland hunting parties - potential summer base camps are still seen as a less permanent occupation than winter base camps (Jacobi 1978; Myers 1986; Simmons 1996). In fact, though interpretations of the location of specific base camps and hunting camps vary, in all interpretations of Mesolithic settlement - from Myers (1986; 1989) to Smith (1992), Spratt (1993) and Simmons (1996) - the idea of upland hunting and lowland base camps has remained a strong structural principle.

Several authors have attempted to identify the specific *ends* of a *seasonal round* - the *location* of winter base camps and summer sites on the basis of archaeological evidence. Jacobi (1976; 1978) and Myers (1986) thus used raw material sources and common assemblage characteristics to suggest that the wintering camps for Early Mesolithic hunting groups in the Pennines would have been on the Lincolnshire Wolds (discussed in chapter two). Myers (1986) does however alter the model somewhat by suggesting that the exploitation of upland game would have occurred in autumn, prior to a winter time of scarcity. Both authors suggest however that, since raw materials are dominantly derived from local sources in the Late Mesolithic, the settlement pattern would have been more localised at this time (with territory sizes reducing as population densities in contrast increased).
The apparent archaeological evidence for lowland base camps and upland hunting camps, and furthermore for distinct 'ends' of a seasonal settlement system have provided substantial support for the two season model of settlement behaviour. This evidence, derived from raw material sources (in the Early Mesolithic) and contrasts in upland and lowlands site sizes and assemblages, is summarised in **figure 4.8** (and described in detail in chapter two).

Some authors have even applied the model where archaeological evidence is more ambiguous, with apparent support from ethnographic sources. Simmons (1975; 1979; Simmons *et al.* 1981; 1993), suggests that for the North York Moors, winter base camps would have been on the coast, (with summer hunting in the uplands) - a pattern also maintained in his later (1996) model. Simmons (1979) however also suggests spring and autumn occupation of sites near salmon runs (not included in the later model), an addition partly derived from ethnographic analogies. He comments that:

'An annual round involving summer hunting on the upland, winter strand-looping, and passing through the intermediate sites twice... has parallels among groups of recent and near recent food collectors' (Simmons 1975: 9).

The structure of inland settlement at least, thus appears simple and clear-cut. But what about the coast? From the

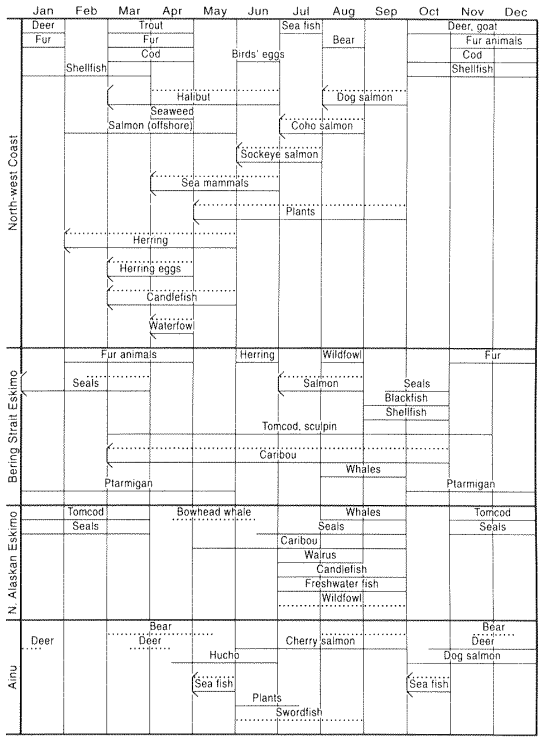

Figure 4.9 Resource availability for maritime hunter-gatherers (Rowley-Conwy 1986).

mid 1980s onwards, coastal hunter-gatherers began to take on a new importance, beginning to be seen as a 'special case' requiring a specific model of resource exploitation and settlement.

COASTAL COMPLEXITY MODELS

A 'new model' of hunter-gatherer societies emerged in the mid 1980s in contrast to 'the foraging adaptation' (Whitelaw 1990). This new model was inspired by ethnographic records of 'complex' coastal hunter-gatherers, particularly those of the north-west coast of North America, who, living in large permanent or semi-permanent groups failed to comply with the idea of 'simple' hunter-gatherers. The wealth of year-round coastal resources which these societies exploit has been a major focus of attention (Price and Brown 1985; Keeley 1988; Rowley-Conwy 1986, **figure 4.9**). Marine resources in particular are supposedly the key to the emergence of social complexity in coastal zones. Perlmann (1980), for example, proposes that they hold a unique capacity to support dense populations without agriculture.

Very little is known about now-submerged coastal sites or the use of coastal resources in England, especially in contrast to those in Scandinavia (which were uplifted in the early Holocene). The only surviving information in England comes from some Late Mesolithic coastal sites in the extreme west and a few sites in the north-east from the same period. Far from all coastal locations with abundant resources worldwide support 'complex' societies and the exact relationship between resources and complexity is still a major issue. Even if the potential for year-round resources at coastal sites existed (which was not necessarily the case),

there is remarkably little evidence for either sedentism or complexity in these locations.

In the wake of ideas about coastal complex societies, some authors *have* nonetheless suggested the presence of sedentary communities, however none of the arguments are convincing. In southern England, Palmer (1980: 439) proposed year-round occupation of Culver Well on the Isle of Portland on the basis of abundant marine resources, however the only support for this notion was that a large shell midden at this site overlying limestone slabs and a cooking pit apparently give the 'appearance of stability' (Palmer 1980: 439). Jacobi (1987: 165) even proposed that across the south-west Peninsula, sedentary communities would have existed where oysters and seals may have filled the winter 'resource gap' (though such sites remain undiscovered). Likewise, though Bonsall (1981: 466) demonstrated the potential for sedentary communities in north-west England, constructing a year-round seasonal resource use schedule for the Eskmeals area of Cumbria, (**figure 4.5**), there is no clear evidence for sedentary or complex societies at this site. Even where Late Mesolithic coastal sites do exist in some numbers, such as on the western coasts and islands of Scotland, their interpretation is remarkably difficult. Though Obanian shell middens exist at coastal locations and appear to be distinct from inland microlith-dominated assemblages (Woodman 1989), few would suggest that there is any evidence for sedentism or complexity at these sites. Coastal resources are clearly an important component of any model, but any evidence put forward for a model of coastal complexity remains unconvincing.

LIMITATIONS TO CURRENT ETHNOGRAPHIC MODELS OF SUBSISTENCE AND SETTLEMENT

The application of general models of hunter-gatherer behaviour to societies in Mesolithic Britain has largely taken the form of a 'general model' of settlement (illustrated in **figure 4.7**). This model, in which hunter-gatherers aggregate in the lowlands at base camps in winter and disperse to upland hunting sites in summer has its origins in Clark's settlement model. A second 'model', that of sedentary complex hunter-gatherers at coastal locations (where marine and terrestrial resources contribute to year-round resource availability) has been less influential, largely contributing rather more to the vague idea that coastal resources were potentially important.

Both models appear to have a firm basis in ethnographically documented societies. However in reality this is far from the case. Apart from the simplified use of ethnographic evidence, there are other fundamental problems with models of hunter-gatherer behaviour. These have largely arisen from misunderstandings of ethnographic sources or misplaced analogies, perpetuated by apparent archaeological support. The models used also place constraints on archaeological interpretations by portraying a very static model of hunter-gatherer settlement, which fails to take into account either short or long-term changes. In fact, particularly for interpretations of inland sites, supposedly ethnographically documented models could be argued to have done more to cloud the issue of Mesolithic settlement than to reveal it.

Limitations to the 'inland' model, and to the 'coastal complexity' model, are considered in turn, followed by a discussion of some of the fundamental problems which unite models derived from ethnographic sources.

Seasonal Aggregation and Dispersal

The idea of seasonal aggregation and dispersal patterns of hunter-gatherers has clearly had a major influence on models of Mesolithic settlement with Clark (1972) and later Mellars (1976) proposing that groups would have over-wintered at large lowland base camps. Of course, Clark and Mellars based their concept of aggregation on the idea that red deer would concentrate in the lowlands in winter and provide a vital resource. It now seems more likely that red deer lived in relatively small herds (Rowley-Conwy and Legge 1988; 1989) and moreover contributed only a part of Mesolithic subsistence resources (as discussed in chapter three). The idea of long-term occupation of winter base camps has perpetuated however, partly because of ethnographic accounts of long-term sites (such as those occupied by the boreal hunters which Price (1973) and Jochim (1976) considered in detail), and possibly also because if our own concepts of being less mobile in harsh winter weather.

The idea of aggregation and long term occupation at winter base camps in the Mesolithic is problematic. As noted in chapter two, the apparent evidence for two 'ends' of a seasonal settlement system in northern England was most probably a 'false pattern' created by a series of biases

affecting the recovery of sites. In any case, the seasonal availability of resources (discussed in chapter three) and of recorded hunter-gatherer exploitation is much more complex than any two-seasonal model. For another, in the highly seasonal environment of temperate Europe the winter is a period of scarcity (Rowley-Conwy and Zvelebil 1989) with fewer resources for long term occupation available than at any other time. Longer term occupation of winter camps is unlikely to have been possible without using stored food, in fact it is only the availability of stored foods that allows boreal groups (such as the Cree, Tanner 1979) to spend the winter in long-term camps. Storage is certainly a possibility for inland Mesolithic groups (Rowley-Conwy and Zvelebil 1989) but it is rarely considered, and has certainly not been a component of the two season model.

Even if long-term occupation of winter camps was made possible through the use of stored foods however long term occupation and aggregation are separate issues. Ethnographically documented hunter-gatherer groups aggregate (to maintain wider contacts than the normal co-resident group) only at times and places where natural resources are particularly abundant - perhaps the salmon runs mentioned in Simmons (1979) model - and even then rarely for long periods. The boreal hunter-gatherers studied by Price (1973) occupied separate long-term winter sites and short-term aggregation sites in spring when resources were plentiful. The potential distinction at 'large' archaeological sites (interpreted as 'base camps') between long-term occupation and occupation by a larger group is one that is rarely highlighted, although it is clearly very significant. Any 'ideal' model of Mesolithic settlement ought, if an 'ideal' model is even an appropriate tool to use, to incorporate distinctions between aggregation sites and long-term occupation sites as well as a more realistic seasonal separation than that simply between summer and winter occupation. More appropriate means of classifying archaeological sites to relate to ethnographically recorded activities than by the traditional 'base camp' / 'hunting camp' divide would also be vital.

'Base Camps' and 'Hunting Camps'

The base camps/hunting camps distinction in fact bears little relationship to ethnographically documented settlement patterns. As well as longer-term occupation sites and aggregation sites, ethnographically documented hunter-gatherers use different seasonal and task specific sites as well as sites occupied by different members of a co-resident group (which may include all female as well as all-male overnight camps) (Whitelaw 1990). Ethnographic studies (such as those cited by Price (1973) or those of Binford (1978)) emphasise a *diversity* of site types - for example, large group aggregation sites, short and long term residential camps, specialist exploitation camps for specific resources (such as salmon) as well as hunting 'blinds', short term hunting camps, kill sites and butchery sites. It has been a misreading of ethnographic interpretations, a reliance on interpretations of hunting of large game animals as the subsistence staple (discussed in chapter three) as well supposed evidence for two distinct types of sites in the archaeological record (discussed in chapter two) which has perpetuated the base camp / hunting camp divide.

The nearest to an ethnographic basis for the suggestion of only two types of sites is Binford's (1980) discussion of 'forager' and 'collector' settlement systems. Binford essentially described 'foragers' as mapping onto resources, with residential moves linked to where and when resources were available, whilst 'collectors' would minimise groups movements through planning ahead and making use of storage facilities. He suggested that 'foragers' would leave fewer distinct site types than 'collectors' (that is mainly base camps, extraction camps and aggregation sites). Binford *clearly did* summarise one type of settlement pattern into three (although not two) types of sites. However, Binford also clearly envisaged the two types of foraging and mobility strategies as a continuum rather than as two distinct patterns that would characterise all hunter-gatherers, past and present and also his 'extraction sites' cover many different activities, far more than any concept of a 'hunting camp'. 'Forager' and 'collector' models were meant to be used as a means of understanding variability in recorded settlement patterns, rather than as a 'blanket model' for past settlement.

Whilst ethnographically documented evidence does not support the idea of two site types, aside from the distributions of sites (addressed in chapter two) the archaeological evidence for differences in assemblage characteristics in contrast certainly appears to be suggestive. The idea of lowland winter base camps and upland summer hunting camps is actually supported by several factors - both differences in assemblage constituents (the microlith : scraper ratio) and diversity between the two zones, and also by the relative size of sites (Mellars 1976). All these distinctions are nevertheless problematic. The most obvious limitation is that any distinction between only two tool types (microliths and scrapers) will tend to oversimplify assemblages into two types regardless of other variations. As well as this, changes in the use of these tools through time is another potential problem. Myers (1987) notes that microliths appear to have been used somewhat differently from the Early to the Late Mesolithic (there are more microliths in each haft in the latter period and thus a higher proportion of microliths expected to be discarded and

preserved in the archaeological record). The use of scrapers also appears to change through time. Though frequent in Early Mesolithic assemblages, scrapers are rare on *any* recorded Late Mesolithic sites (at March Hill cores have frequently been used as scrapers, and it is not unreasonable to suggest that in more general terms Late Mesolithic cores may also have partly taken over the functions of earlier scrapers). The relative percentages of microliths and scrapers are clearly a poor index of site function given that the use of both (and their relative contributions to assemblages) changes through the period.

As well as assemblage composition, the contrast in site size between the uplands and the lowlands is also open to debate. It was demonstrated in chapter two that the nature of upland environments and excavations probably limits the recorded size of upland sites, plus site size is expected to relate to both group size *and* frequency of reoccupation, which may not be related factors. The base camp / hunting camp distinction is certainly not clearly supported by the archaeological evidence since all the key factors, from assemblage diversity and composition to site sizes, are problematic.

The effects of these biases in 'eroding' our apparently clear record of seasonal base camps and hunting camps is shown in **figure 4.10**.

More than being just an oversimplification of the evidence, the use of contrasting ratios of these two tool types may be hiding differences in settlement structure through time and obscuring much diversity *within* upland assemblages. Myers (1987) demonstrated that Mesolithic assemblage types were actually divided into more complex categories than the basic groups defined by Mellars (1976), with a series of different assemblage types crossing upland-lowland boundaries. Moreover, Finlayson and Edwards (1997) note that in Scotland, microliths are dominant in all Late Mesolithic 'narrow blade' assemblages regardless of their location (and thus all sites are, strictly speaking, 'hunting camps'). This anomaly is likely to be a function of the rise of microliths (and drop in scrapers) from the Early to the Late Mesolithic, making microliths much more likely to be dominant on Late Mesolithic sites. The lack of any sites which could be interpreted as Late Mesolithic 'base camps' in northern England (although several potential such Early Mesolithic sites exist) may also be explained by the later dominance of microliths amongst retouched tools, with almost all Late Mesolithic sites in this region effectively already having been classified as 'hunting sites' for some time.

Aside from changes in tooluse, differences in assemblage diversity between uplands and lowlands can also be affected by sample size, with more apparently 'diverse' assemblages a natural consequence of a larger number of artefacts.

Though a rigid division into 'base camps' and 'hunting camps' is not supported by archaeological evidence, or substantiated by ethnographic research it is only recently, particularly as other functions for microliths have been determined (Woodman 1985b; Finlayson 1990a; 1990b; Mithen *et al.* 1992; Finlayson *et al.* 1996), that other types of site have been suggested. Healy *et al.* (1992: 58) for example, suggested that although the assemblage at Thatcham is dominated by microliths, since use wear evidence dominantly represents the use of plant sources, activities at Thatcham may have concentrated on the exploitation of vegetable resources. Simmons (1996) suggests an alternative use of upland sites in the Late Mesolithic by groups clearing and managing upland woodland rather than explicitly hunting, although how these can be differentiated archaeologically is not clear. Further careful excavations and analyses may provide more answers. Detailed excavation of a series of Late Mesolithic sites in the Central Pennines (Spikins 1994; 1995b; 1996a) *has* revealed that although assemblages *were* dominated by microliths, a variety of different activities seemed to have taken place; five clearly defined hearths appeared to have been constructed very differently and apparently served different functions. Nonetheless, although new evidence and interpretations are starting to challenge the traditional interpretations, the concept of two basic site types has proved 'hard to shake' influencing both ideas of change through time and limiting explorations of the differences between long-term occupation and repeated use.

Unlike the 'inland model', the lack of archaeological evidence for coastal sites has made the coastal complexity model somewhat insecure from the outset.

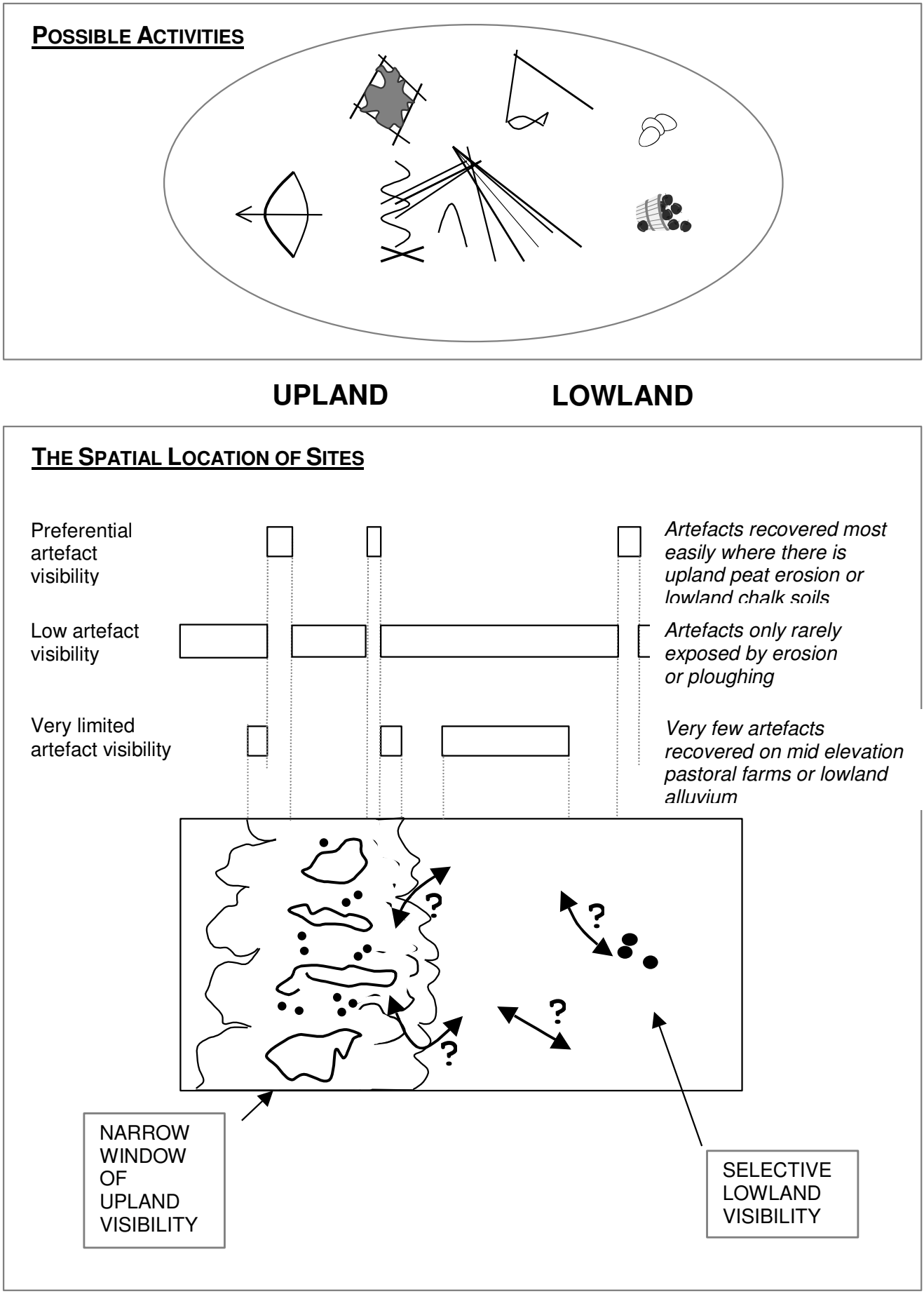

Figure 4.10 A 'better explanation' for patterns in recorded sites?

Coastal Complexity

The lack of archaeological evidence to support the coastal complexity model is probably one of the main reasons why this model has not been widely applied in northern England or in Britain more generally. The lack of evidence for coastal complex economies is perhaps not surprising given that coastal sites have been largely submerged. Nonetheless, many authors do anticipate finding future evidence for such settlements and what sites do survive at the coast seem incongruous given this expectation. There are essentially two reasons why, although complex coastal economies *may* have existed, the *necessary* emergence of complex economies at coastal sites with abundant marine resources this may not be a reliable inference.

First, the year-round availability of resources need not necessarily lead to sedentary societies. Kelly (1995) discussed the transformation from mobile to sedentary societies in some detail. He noted that sedentism is far from an easy option for mobile groups, as resources, particularly terrestrial resources, are easily and quickly overexploited. He also stressed that the longer any location is occupied, the more time has to be spent looking for resources, making it 'easier' to move than to remain in the same location year round, even where *sufficient* resources are available (Kelly 1995: 151). Kelly concludes that it is not resource *abundance* but *local abundance in a context of regional scarcity* that should encourage sedentism (Kelly 1995: 152). As noted in chapter three, the intensification of resources will always be a strategy adopted or avoided depending on the historical context.

One further obvious problem is that sedentism and complexity are rarely considered as separate developments. In particular, the focus of arguments about both sedentism and complexity has been very clearly based on the marine component and the year-round availability of resources. However, sedentism and complexity are themselves different issues, with known hunter-gatherers in some cases exhibiting one but not the other[1]. Schalk (1981) demonstrated that for populations of north-west coast of America, the nature of the *terrestrial* environment, rather than the marine environment is a crucial determinant of complexity. The availability of year-round resources (including terrestrial resources within a balanced subsistence of fishing, hunting and gathering) allows the Yorok, Karok and Wiyot to be sedentary, and yet household sizes are actually low and these groups show few of the traits of complex societies. It is the coastal areas to the north of this region where aquatic resources are equally as abundant, but terrestrial resources are much more scarce, where the true 'complex' hunter-gatherers are found (though these groups actually shifting residence between two and five times a year) (Schalk 1981: 63). Effectively, as subsistence becomes more *dependant* on aquatic resources, groups have to depend on storage and need to organise subsistence logistically and co-operate within a large group.

Both sedentism and complexity are much more complex issues than they might at first seem from the simplistic models based on ethnographically documented Northwest coast groups. Given the archaeological evidence for rising complexity in coastal Mesolithic societies in Scandinavia (such as at Skateholm, Larsson 1989), the presence of year-round resources and the rising use of storage mechanisms are useful explanatory tools. However the rise of coastal complexity is not yet as predictable as it might appear. Evidently, even if resources were available year-round along the Mesolithic coasts of northern England, populations need not necessarily have been either 'complex' or 'sedentary'. More than this, different populations might potentially have adopted different strategies, given the, often unappreciated, variability in ethnographically documented societies.

[1]Definitions of both sedentism and complexity vary, sedentism is typically taken to imply that at least a majority of any group remained at the same settlement year round, and complexity that societies display many of a number of characteristics, such as stored food, sedentism, storage, social stratification, cemeteries and exchange networks (Price and Brown 1985).

Variability in Settlement Systems

One fundamental problem with existing ethnographic models is their *static* and *normative* reconstruction of subsistence and settlement patterns (as discussed in the previous section on ecological approaches). A static reconstruction of 'the' settlement pattern, supposed derived from ethnographic models, is in sharp contrast to evidence for variability in ethnographically documented behaviour and moreover to substantial environmental variability in the Mesolithic in both the long and short-term (as discussed in chapter three). Ethnographically documented settlement patterns can vary widely over a number of scales, This variability can include marked differences in subsistence and settlement patterns over quite small regions and within years or decades, even over a single year members of a group may follow different patterns. Although evidence for short and long-term variability in hunter-gatherer settlement has always existed, in fact it is only in relatively recently that this variability has been appreciated, possibly because ethnographic analysis, carried out over short time spans, frequently present only a 'freeze-frame' approach to the societies studied. Recent authors have also drawn attention to long-term changes in settlement and adaptations of hunter-gatherer groups which have in the past being overlooked (Schrire 1984).

A good example of small scale spatial variability is provided in the Great Basin of North America where Thomas documents the existence of three very different settlement systems amongst the Shoshone (recorded by Steward 1933; 1938; 1941), only 150km apart (Thomas 1981: 36). The Kawich Mountain Shoshone were *'almost classic foragers in Binford's sense'* (Thomas 1981: 35), moving frequently to 'map onto' available resources, whilst the Owen's Valley Pauite, only about 100 miles away, were more typical of 'collectors' with semi-permanent settlements relying on stored resources. The adjacent Reese River Shoshone used a mixture of the two strategies. Thomas attributes the differences to the structure of the water systems and the availability of important plants such as the piñon pine and summer seed crops. He also records substantial temporal variability in settlement systems - the Reese River Shoshone sometimes stayed in the settlement all year if the summer seed crops were abundant enough, but in lean years dispersed to collect seeds on the valley floor and roots and berries in the uplands.

A further illustration is provided by historic hunter-gatherer groups of Tierra del Fuego Bridges (1948), Gusinde (1982, 1986). Different groups in this region have very different settlement systems, varying from a dependence on guanaco by the very mobile Selk'nam (who only exploit marine resources at certain times) to a dominance of marine resources for the more sedentary Yanama, with the Haush somewhat intermediate, with the three systems found within an area of about 150km by 100km. Different subsistence resources play markedly different roles even among the Ona with the relative dependance on guanaco, marine resources and small rodents varying markedly.

Jochim (1991) provides a potential explanation for the contrast between a common concept of 'static' settlement patterns across time and space and the evidence from detailed ethnography. He notes that most archaeological models of settlement have failed to consider that ethnographic interpretations of seasonal rounds were a *simplification* of the actual activities of hunter-gatherers. Jochim observes that even in any given year (let alone longer timescales) all members of a group may not follow the same seasonal pattern, he remarks that (1991: 310):

'In their attempts to portray the broad patterns of behaviour many ethnographers describe seasonal rounds, giving little attention to differences among individuals or families. Such normative descriptions have shaped archaeological expectations... We often expect to determine the *winter base camp, without giving consideration to the possibility that there may be many different patterns simultaneously expressed.'*

Jochim highlights evidence for considerable variability in activities within any supposed 'settlement system' as recorded in the ethnographic literature. In fact he has even suggested that *'Archaeologists should not expect to follow ethnographies in reconstructing the 'seasonal round'. It may not exist'* (1991: 315). It is ironic that Price (1973) as one of the earliest authors drawing on ethnographic evidence, did in fact note substantial variability in settlement among the boreal hunter-gatherers, although it was his general comments about the settlement patterns of boreal hunter-gatherers, rather than the variability, which influenced later interpretations.

Rather than an exception, substantial variability in settlement patterns over time and space may be something we should expect to find in Mesolithic Europe. Rowley-Conwy and Zvelebil (1989) note that hunter-gatherers in the highly variable environments which characterise Northern Europe choose from a number of possible strategies to cope with the variability, with potential options including high levels of mobility and flexibility as well as other options such as organised storage of resources. The former strategy might be expected to involve a high level of variability in settlement patterns, which Jochim (1991) suggests should leave distinct archaeological traces. Indirect evidence, not only for the latter strategy - storage of resources (Rowley-Conwy and Zvelebil 1989) but also the former may even exist in the record of Mesolithic Europe although not necessarily recognised as such. Detailed palynological reconstructions, such as Simmons, Turner and Innes (1989) and Day and Mellars (1994) for example, provide evidence for a high level of variability in the intensity and frequency of clearance events at particular sites. The nature and causes of this variability, rather than any single 'settlement pattern', may be a more interesting and rewarding area of study.

Long-Term Changes in Settlement

Finally there is the issue of long-term changes in settlement patterns, which has been surprisingly under-explored in studies of the Mesolithic, perhaps at least in part because well-documented changes in ethnographic examples of changing settlement through time are limited. Hunter-gatherers are often portrayed as living in a timeless past, a common preconception which may even have been influenced by political motivations (Trigger 1989). However, although because of the short time frames of ethnographic studies there is only limited evidence for long-term changes in ethnographically recorded societies, there is still some evidence that these changes have taken place. Schrire (1984) for example documents the example of the Caribou Eskimo in Hudson's Bay recorded by the 1824 Thule expedition. These groups were interpreted in the 19th and early 20th century as having a lifestyle which stretched back for millennia. Schrire suggests that in reality the occupation of this area by the groups concerned dates back only 200-300 years, with an earlier occupation by a different population separated from the later. Clearly there is only limited evidence for long term changes, however potential evidence for considerable past changes in subsistence and settlement is often overlooked in favour of a long-term continuity model of hunter-gatherer society.

Long-term changes in settlement are rarely considered in the Mesolithic (in any case after initial colonisation has been shown to have taken place), even where distinctive changes in technology take place. However environmental changes, as well as social changes, can be strong motivations for changing adaptations and even for movements of populations. For Mesolithic northern England, Myers (1986; 1989) does argue for a change through time, *within the uplands*, from large and more typologically diverse Early Mesolithic sites to smaller Late Mesolithic sites with apparently less evidence for repeated occupation (although this is not demonstrated). He interprets these distinctions in terms of *upland hunting techniques*, specifically a change from Early Mesolithic intercept hunting of migrating herds (and a planned 'collector' type strategy) to Late Mesolithic encounter hunting of dispersed animal populations (and a 'forager' strategy). As a serious consideration of the nature of long-term changes in settlement, Myers' discussion is rare and provokes further work (although his model is based on changes in migration patterns of red deer which now seem less likely to have taken place). However, the static concept of settlement is still clearly influential and Myers' model is still firmly framed within the upland hunting camp model, rather than incorporating any consideration for more fundamental changes in settlement.

As can be seen, the past history of the use of ethnographic evidence has been problematic across several scales, from the identification of activities at sites (such as base camps and hunting camps) to the identification of settlement patterns, to interpretations of long term changes. *Piecemeal analogies* are obviously problematic, given the variability in recorded hunter-gatherer behaviour patterns even in similar environments, and the limitation that no directly analogous environments exist for Mesolithic Europe. Limitations to the use of *ethnographic models* are more subtle but can be seen at two levels. First, although the models initially appear to fit archaeological evidence, expectations can easily influence the way in which the evidence is viewed. In reality there is little in the archaeological record to support the key concepts, such as that of clear distinction between upland hunting camps and lowland base camps throughout the Mesolithic, or a predictable winter-summer settlement pattern. Secondly, archaeologists expect ethnographic models to fit reality, despite extreme simplification. Whilst ethnographic observations and models have provided much insight into the relationship between hunter-gatherers and their environment, their static and normative nature can easily underplay important issues of variability and change.

Even if ethnographic sources are limited, the nature of the ethnographic evidence should not in principle constrain the questions which are approached in studies of the Mesolithic. Ethnographically documented hunter-gatherers are a useful source of comparative evidence, and more dynamic models may provide more dynamic reconstructions of past changes, however present societies are clearly not the 'blueprint' for Mesolithic societies that they have been taken to represent.

CONCLUSIONS

A review of interpretations of Mesolithic population, subsistence and settlement, reveals that a number of fundamental concepts, supposedly derived from ecological and ethnographic analogies, have actually very little basis. These concepts have been dubbed 'eco-facts' and 'ethno-facts'.

The influence of both eco-facts and ethno-facts is worsened by a poor knowledge of past environments. One crucial 'eco-fact' for example, which derived from early ecological studies and analogies with boreal forest hunter-gatherers, has been that Mesolithic subsistence was necessarily dominated by large game exploitation. Thus various authors have developed interpretations of population densities and settlement systems on the basis of large game (particularly red deer) ecology. In fact, boreal forest groups are a poor analogy for Mesolithic Britain and a number of different resources could have played a major role in subsistence (as discussed in chapter three). Nevertheless, the large game analogy has been widely influential, and combined with the 'ethno-fact' of simple settlement patterns and restricted site types, has perpetuated concepts such as that of a long term continuity of use of upland hunting sites and lowland base camp sites throughout the Mesolithic.

Thus, Mesolithic subsistence and settlement are often taken to be well understood, even though the site-based evidence (chapter two) and the evidence for subsistence practices (chapter three) are scanty and biased. Ironically, a common complacency about Mesolithic subsistence and settlement patterns has contributed to the 'dull' image of the period, as discussed in chapter one. A reliance on eco- and ethno-facts for interpreting the evidence for Mesolithic occupation means that our knowledge of Mesolithic subsistence and settlement is much poorer than a survey of the literature might conclude. For example, though interpretations stress a continuity of use of upland hunting and lowland base camps throughout the Mesolithic, both the concept of a distinct division and the means of analysing these sites may hide substantial changes in the use and the relationship between uplands and lowlands through time.

An accurate reconstruction of the many different subsistence and settlement patterns which characterised the Mesolithic, if any are even possible to define, may never be within our grasp. It appears however that more pertinent, or more interesting questions can be asked of Mesolithic societies. With an understanding of past ecology, and an appreciation of the potentially dynamic and highly variable nature of past hunter-gatherers, what might be accessible is a *better understanding* of how environments and the structure of resources may have changed, and the way in which this may have affected hunter-gatherer settlement. Ways of approaching this better understanding are addressed in the following two chapters (chapter five and chapter six).