Pitfalls and Problems in Analysing and Interpreting the Seasonality of Faunal Remains

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Seasonality studies are an important tool in archaeological research, as long as methods are correctly applied. This paper aims to highlight problems which arise in seasonality studies due to a lack of understanding by archaeologists of animal behaviour and biology, and from this, how erroneous archaeological interpretations are then formed. The first point will show how myths regarding animal behaviour can occur and become firmly entrenched in the literature and the minds of archaeologists. The second point will outline how false assumptions can be made concerning reasons for the exploitation of certain species.

Finally, it will be demonstrated that when using scientific

methods, such as analysis of incremental growth, a thorough understanding of the biology of the species in question is essential.

Introduction

Over the last couple of decades, seasonality has come to play an important role in the study of faunal remains. This is especially true for the Palaeolithic and Mesolithic periods where faunal remains may make up a large part of the data set and are often used to investigate various aspects of the culture in question. Some interpretations of seasonality are based on the presence of migratory species such as swans, barnacle goose, gannet and mackerel. Sometimes incremental analysis is performed on marine shells or fish otoliths and occasionally physiological features may be indicative of a season. Medullary bone deposits in bird bone, for example, are formed just before the breeding season and act as a calcium store used for the production of egg shells. Seasonality of faunal remains is obviously primarily used in an "economic" capacity to see *what* was being hunted, gathered or fished *when*, and questions may be concerned with preference for and ranking of species, and the function of sites.

Analysis does not stop here, however. The examination of faunal remains for evidence of seasonality has aided archaeologists in recognising sedentism or modeling mobility, and identifying patterns of procurement through space and time. Furthermore, ethnographic research has revealed that dispersion and aggregation of populations, settlement patterns, prestige, kin group ownership and belief systems may all be either affected by or tied intimately to seasonality and the availability of resources (Monks 1981). By investigating the seasonality of resource procurement we are therefore not just studying the time of year when a group hunted, gathered or fished a particular species and when it did not. The seasonal activities of a group of people are inextricably linked to all parts of their way of life.

If faunal remains are going to be used firstly to understand seasonal procurement of resources and secondly to provide a wider understanding of the lifeworld of a culture, then it is essential that methods for ascertaining seasonality are properly applied. One major problem, however, seems to be that animal behaviour is often not fully understood and assumptions are sometimes made as to why certain species were being exploited and when. Indeed, Francis Pryor (1997) makes the point that many "urban academics" care, or know, little about rural life and concludes by asking that, first:

> "archaeologists try to learn something about country life and practices (Fat chance!). Second, that a suburban profession should accept that rural folk have something important and relevant to teach archaeology."

In a similar vein, the three case studies below are an attempt to illustrate how necessary it is for archaeologists to realise the importance of fully understanding animal behaviour and biology, rather than leaving such matters solely to the "archaeo-zoologist".

Myths and Migrations

One way of assessing the seasonal procurement of resources is to look for the presence or absence of migratory species in the data set, certain species being a plentiful source of food at a particular point in the year. Perhaps the earliest attempt at this type of analysis was made for the Upper Palaeolithic sites of Meiendorf and Stellmoor in the Ahrensburg tunnel valley, North Germany, which were excavated by Rust (1937, 1943). At both sites large quantities of reindeer were found and it was thought that these sites were seasonally occupied and had been located at certain points in the valley expressly for the exploitation of the reindeer during their late summer/autumn migrations (Grønnow 1987).

Only a decade later Clark excavated the famous site of Star Carr in the Vale of Pickering, East Yorkshire (Clark 1954). The faunal remains were analysed by Fraser and King (1954) who thought that the large quantities of red deer antler and bone were thought to indicate that red deer was the most important resource at the site. Of the 106 red deer antlers found, 65 had been broken out of the skulls. The inference from this was that the occupation of the settlement occurred when the deer were carrying their antlers (September through to March). The other shed antlers suggested that the site had also been occupied in April, which is when red deer shed. The reason for this interpretation being restricted to April was due to the fact that red deer sometimes gnaw shed antlers to replenish their calcium intake and in order to stimulate antler re-growth. None of the antlers found at the site showed any evidence of gnawing, however, suggesting they had been immediately collected after shedding had taken place (Fraser and King 1954).

The conclusion therefore was made that Star Carr was occupied in winter/early spring.

Furthermore, it was later suggested that the red deer would have migrated in the winter from the North Yorkshire Moors to the Vale of Pickering where Star Carr was situated (Clark 1972). This was based on the studies of Darling (1937) and Ingebrigtsen (1924), who had examined deer behaviour in Scotland and Norway respectively. Perhaps influenced by the work of Rust and the migrating reindeer of Ahrensburg, and other similar works (eg. Jarman 1972; Sturdy 1972) it was also proposed that the people at Star Carr would have moved in a similar fashion, following their food source (Clark 1972).

Three problems have since arisen concerning these interpretations. Firstly, red deer only gnaw their antlers for calcium when they inhabit marginal environments and are consequently in need of nutrition. This would probably not have been the case in the Vale of Pickering and therefore the shed antlers may have been collected at any time of the year, rather than specifically in April (Pitts 1979). Secondly, red deer antler should not have been used in this case for seasonality and subsistence studies. The large numbers of barbed points found at the site indicate that in fact red deer antler was a very important raw material. It is portable and may have been collected, stored and brought to the site at any time of the year (Pitts 1979). Thirdly, if antler is discounted from calculations for species representation, red deer then becomes a much less important resource and the model of seasonal transhumance no longer holds (Caulfield 1978). But perhaps more importantly, it has been shown that in a forested environment, as Star Carr would have been, red deer do not migrate and therefore the studies by Darling and Ingebrigtsen of deer in Scotland and Norway are not valid for this study area (Legge and Rowley-Conwy 1988). Red deer can tolerate a wide range of habitats including open moorland, mountains, deciduous forest, mixed forest and agricultural land. They do tend to behave differently in these various environments, however, and whereas in open country they are known to herd in large groups of 40 or more, in forested areas one hind and her young are a stable unit. When the deer are in larger groups they are known to migrate, but it is unlikely that animals in the Preboreal closed birch woodlands around Star Carr would have migrated or congregated around lake Pickering in the winter (Legge and Rowley-Conwy 1988).

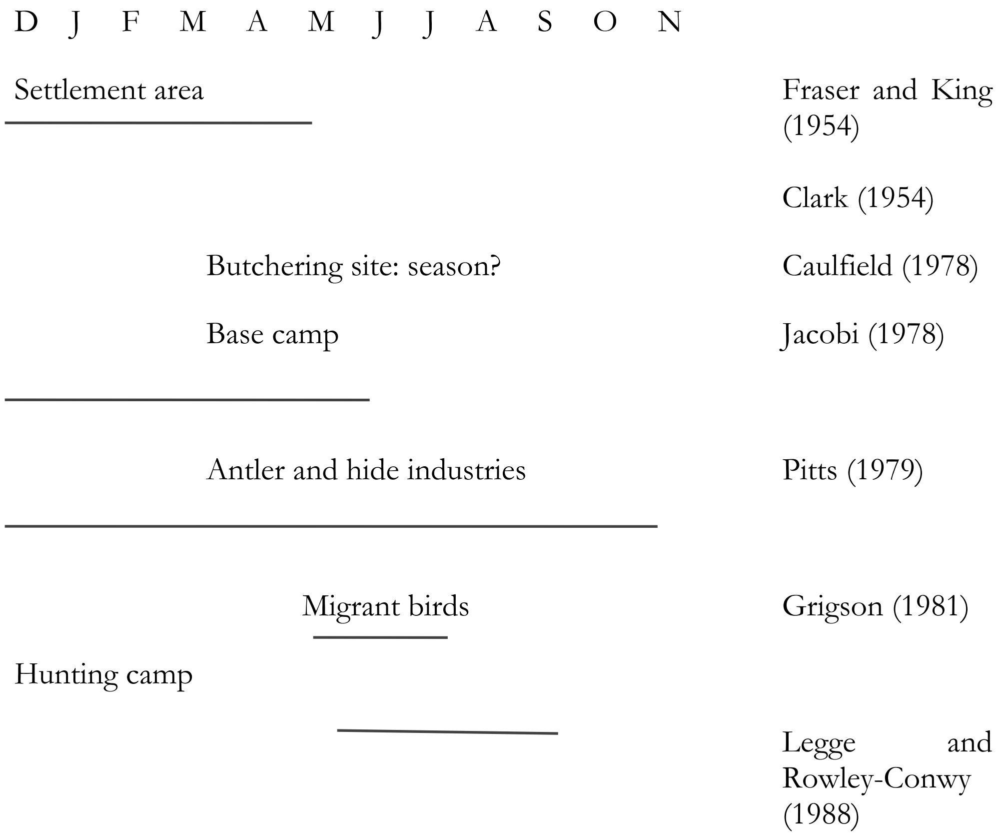

Figure 1: Some of the interpretations of seasonal occupation and function of Star Carr.

Since Clark's (1954, 1972) original interpretation of Star Carr as a base camp, occupied in the winter by a hunting band and supported by culling red deer stags and hunting other game, the seasonality of site occupation, subsistence strategies and site function has been frequently debated and sometimes completely turned around (figure 1). Caulfield (1978) suggested red deer were less important in the diet than previously suggested. He showed that red deer antler was an important raw material and doubted the model of seasonal transhumance of deer and people. It was concluded that the bone representation showed the site as being a butchering station and possibly a kill site, but no interpretation was made as to the seasonality of occupation. Jacobi (1978) also expressed reservations about the seasonal movement of red deer. Looking at the evidence from unshed roe deer antler, occupation was argued to continue into the early summer and from an analysis of bone representation he suggested that the site was a base camp. Pitts (1979) saw the function of the site as largely for antler and hide tanning, which would have taken place in the summer but saw occupation as intermittent in most seasons. Grigson (1981) noted a further indicator of summer occupation in the form of the migrant species of bird, the crane and the white stork, although a minimum number of only 1 of each species was found. Legge and Rowley-Conwy (1988) reassessed the faunal remains, including roe deer and elk, in their analyses and proposed a spring/summer occupation from the neonatal specimens, tooth eruption and red deer skulls with recently shed antlers. The site was interpreted as being a hunting camp to which many short visits would have been made over the summer, with the possibility that the coast, which is less than 15kms away, may have been visited at other times.

These are only some of the analyses made since the original report, and the interpretations, which are often fairly complex and consider many aspects of the lives of the inhabitants of Star Carr, have simply been summarised here. Of course, with hindsight it is easy to criticise past problems in using zoological data for modelling seasonal transhumance at Star Carr. The reason for discussing this was not to condemn the original work but instead to point out that misconceptions of red deer behaviour still exist. Over the last three years I have attended three lectures and come across claims in archaeological literature where it was stated that red deer migrate (in similar forested environments to Star Carr), and human behaviour and seasonal movement had been modelled taking this into account.

The reason for this may be due to Star Carr's notoriety and therefore the concept that the people followed migrating red deer is perhaps a well known aspect of the site's interpretation. The fact that red deer antler are now not used in calculations of species representation and that more recent seasonality assessments are in favour of summer occupation, is perhaps perceived as being a reason for discounting seasonal movements of people and red deer, rather than an argument against red deer migration. And this is perhaps why the "myth" of seasonal migration has been perpetuated. It is all too easy to use past work as an analogy and sometimes even compare similar species, such as reindeer, roe deer and red deer, but it must be realised that animal behaviour and biology are complex and may well differ between species and ambient environments. As stated by Legge and Rowley-Conwy (1988, 38):

> "One to one analogies between present and past behavioural patterns may be as problematic in the zoological as the ethnographic field."

It has been demonstrated that the interpretation of the site may alter dramatically depending on the way the faunal remains are analysed and animal behaviour is understood. In order to avoid this, therefore, it is imperative that thorough research is undertaken which is pertinent to the species in question.

Fur and Food

Another category of fauna that is sometimes considered in seasonality assessments is "fur bearing animals" such as badger, fox, wolf, dog, wild cat, otter and pine marten. In many site reports or general studies of seasonal scheduling, it is assumed that these animals are more likely to have been procured at a particular point in the year because they are of greater value at this time. These animals are generally seen as indicators that the site was occupied in winter, as this is supposedly when the fur would be most needed and when the fur itself was in better condition (e.g., Andersen 1974; Andersen and Johansen 1986; Rowley-Conwy 1981). Although this may be a fair assumption, I shall argue that this should not always be assumed. To illustrate the point, the kitchen middens of the Ertebølle culture of the Late Mesolithic in Denmark will be used as a case study. These are large shell mounds found along much of the Danish coastline, which have a long history of comprehensive excavation. Their main component is usually oyster shell although many other shellfish, fish and mammalian remains are found alongside cultural artefacts. The Ertebølle sites are different to Star Carr as it is believed that their inhabitants were sedentary. This is largely due to the seasonality assessments performed on the fauna. Rowley-Conwy (1984), for instance, suggested that the resources that would have been available would have been able to sustain a sedentary existence for the Ertebølle people throughout the year.

An important consideration is that the "fur bearing" animals may have been procured for meat as well as, or instead of, for fur. Charles (1997) documents several examples where evidence from cut marks shows that fur bearing mammals such as foxs, badgers and beavers were exploited for food and possibly bait. These animals may seem unpalatable to many of us but, in fact, badgers are considered a delicacy in Denmark today and dogs and rodents are eaten in other parts of the world (Bratlund 1991). To determine whether they were eaten or not, the cut marks on the bone may be analysed. This was done for the fur bearing animals from the well preserved underwater site of Tybrind Vig by Trolle-Lassen (1987). Although it was found that the pine martens and polecat were only killed for their pelts, the cut marks on otters and wild cats indicated that meat, as well as fur, had been exploited.

The seasonality of pine marten procurement was determined from the age structure of the archaeological populations and it was suggested that they had been killed between September and November. By the same method of analysis the polecat appeared to have been killed during the autumn and winter. It was not possible to assess the season of procurement for the otter and wild cats. The important point, however, is that even if the otter had been exploited solely for fur, rather than food as well, otter fur is in fact valuable regardless of season as shedding of hair is not restricted to a short time period (Trolle-Lassen 1987). Therefore, theoretically, otter may have been exploited at any time of the year.

At Bjørnsholm there is also evidence that fur bearing animals were not always killed solely in the autumn and winter. A minimum number of two pine martens were identified, but one of these appeared to be only a few months old, suggesting a summer kill (Bratlund 1991).

Clearly, if assumptions are made without any detailed investigation, in a similar manner to the red deer migration myth, then again interpretation of the data may be erroneous, especially as the minimum number of individuals (MNI) is often fairly small. At Bjørnsholm the MNI for all the other species of fur bearing animals was only 1, and there were no indicators of season of death. Even so, albeit with “due caution”, the suggestion was made that these animals were being collected for furs and may perhaps indicate autumn or winter activities (Bratlund 1991, 101). At many of these kitchenmiddens there is little other evidence for winter occupation. At Bjørnsholm, for instance, migratory birds such as the whooper swan, barnacle goose, gannet and blackthroated diver were found, and these, assuming their patterns of migration were similar to those of today, would have been available between October and April. All of these, however, also had a MNI of 1 except swan, where the count was 2 (Bratlund 1991). There is also the possibility that some of these birds may have been the result of natural deaths on the edge of the estuary. The bird data, together with the fur bearing animals, are the only evidence for winter occupation. Although absence of evidence is of course not evidence of absence, Bratlund (1991) is cautious and states that the site may have been used in the autumn and winter but "positive evidence is needed". The excavator, Andersen (1991), also states that it would be premature to argue that there was permanent, year-round occupation, and in fact holds the same view for two other kitchenmiddens, Ertebølle and Norsminde (Andersen and Johansen 1986; Andersen 1989).

As seasonality assessments from these sites are intergrated into broader syntheses, it becomes imperative that they are carefully analysed. They are certainly used as a key foundation in the argument for sedentism, and while it is extremely likely that they were sedentary, at many of these sites there may also have been a greater degree of movement within a territory during certain times of the year. This clearly would affect both economic and social aspects of the lifeworld including the social organisation, territoriality, labour organisation, technology and exchange within and between groups. From a long term point of view, a possible decline of year-round availability of food resources, especially marine fauna, at the time of the environmental change from the Atlantic to the Sub-Boreal, has sometimes been used to explain the late adoption of agriculture in Denmark (e.g., Rowley-Conwy 1984; Larsson 1986; Zvelebil and Rowley-Conwy 1984). Again, the seasonality of food procurement in both the late Mesolithic and early Neolithic plays a major role in formulating such views.

The Application of Science

Over the last couple of decades there has been an increase in the use of scientific techniques for assessing seasonality. This includes the investigation of incremental structures of various living organisms. These are usually found in teeth, shells or otoliths, where increments of material such as enamel, cementum or calcite are added to previous growth. The technique demands a thorough understanding of growth and biology, as it is dependent on identifying seasonal events in the structure. In the case of shellfish an "annual line" is often formed every winter when growth slows down due to a drop in water temperature and food availability. The shellfish resumes growth in the spring and starts depositing shell material on the shell margin. Therefore, the amount of growth between the last band and the growing edge gives an indication as to the season of harvest. In some shells micro-lines are formed between the annual lines and a modern control sample is needed to understand their periodicity. Other lines may also form due to disturbance events such as storms or predator attacks but where a thorough understanding of shell growth is lacking these can easily be mistaken as periodic lines.

One of the first archaeological applications of incremental growth analysis was the work by Coutts (1970) on the New Zealand cockle, *Chione stutchburyi*. Coutts used the work on the common British cockle, *Cerastoderma edule* , by geologists House and Farrow (1968). This work had shown that lines seen on the surface of the shells (macro-lines) were the result of winter growth recession. Micro-lines, observed from photomicrographed cross-sections of the shells, had previously been interpreted as daily bands. Coutts analysed modern samples of the New Zealand cockle and found that there was a mean of 358 micro-lines a year. Again the interpretation was that one line formed daily and it was shown that, provided the approximate date for the formation of macro-lines is known, the date of death of individual shellfish could be estimated by counting the number of daily growth lines between the edge of the shell and the last macro-line (Coutts 1970).

The interpretation that the formation of micro-lines in cockles was a daily phenomenon was used in the following years (Farrow 1971; 1972). It was later noted by Coutts (1974; 1975), however, that growth patterns did not appear to follow a logical or easily interpretable sequence and it was concluded that a great deal more work on modern specimens was needed before seasonal dating of more than a relative kind could be attempted on the cockle. This problem was resolved when it was discovered by marine biologists Richardson et al. (1979) that in fact the number of growth bands deposited in the common British cockle coincided with the number of tidal emersions (i.e. two lines formed daily). This information, together with independent modern control samples, was later used by Deith (1983) in order to interpret seasonal collections of cockles from the Mesolithic site of Morton, Fife. Sampling modern cockles showed that the macro-lines formed during a period of growth recession in the colder winter months and the tidal micro-lines were shown to form from about late April to late September. For these 5 months the seasonal resolution was thought to be fairly accurate, but for the remaining 7 months of the year a blanket category of "winter collection" was used (Deith 1983).

Despite the clear importance of using large modern control samples, many studies do not use them fully and assumptions are made as to when lines form and why. However, further problems may arise resulting from how the seasonality results are analysed. Averaging and standardising growth line data in seasonality studies has been shown to be normative and liable to produce erroneous results (Claassen 1991). Basic assumptions about shell growth are shown to influence the prediction of the season of harvest. Large growth controls show firstly that shells do not respond to growth stimuli identically and secondly, that the timing of these stimuli is not predictable each year. The mean of the growth data does, however, form a pattern and such standardised yearly growth patterns are often used in assigning a harvest time to individual shells. Claassen (ibid: 275) claims that:

> "because variation is present in growth records in a population, researchers who assign death times to individual shells find at least 2 seasons"

For example, suppose a number of modern cockles are analysed and the date at which they resumed growth is averaged to 1st April (figure 2). In addition, imagine that most of the shells did resume growth around the 1st April but there was a tail either side and the total range of dates was spread between 16th March and the 31st May. If all these shells had in fact been collected on the same day, 1st June, then the number of lines between the last annual line and the growing edge will be vastly different. Shell A, which started growing on the 16th March, would have 154 tidal lines (=77 days) but shell B which resumed growth as late as the 31st May would only have 2 tidal lines (=1 day). If these numbers are added onto the average of 1st April the first shell would appear to have been collected on 16th June and the second shell on 2nd April. It might seem unlikely that these shells had been collected on the same day if the range of the growing season is not taken into account.

	Shell A	Shell B
Expected date of growth resumption	1st April	1st April
Actual date of growth resumption	16th March	31st May
Actual date of collection	1st June	1st June
Lines between annual line and edge (= days)	154 (= 77 days)	2 (= 1 day)
Expected date of collection (1st April + N days)	16th June	2nd April

Figure 2: Table to show hypothetical growth data for a sample of cockles, illustrating how two very different dates of gathering can be calculated from shells which were in fact gathered on the same day.

The discovery of two seasons of shellgathering in the year, rather than one, is obviously going to affect the archaeological interpretation quite considerably, especially if the site is relatively small and considered to be visited for the purpose of collecting shellfish. Therefore, not only do any misunderstandings of the structure lead to problems and mistakes when archaeological interpretations are made, but the way in which the data is interpreted is equally important.

Discussion

This paper was written in order to demonstrate how simply errors may be made in seasonality studies, and how these may then significantly affect an archaeological interpretation. Three case studies have been used, but there are of course many other circumstances and methods where such problems may arise. It is all too easy to use past methodologies or approaches when analysing faunal remains but these may not always be applicable and cross-biological studies do not tend to work, even between animals that may appear to be very similar due to different environmental conditions or biology. Some aspects of seasonality studies, such as growth line analysis, may appear to be "scientific", and because of this there is perhaps the inclination to believe that the method has been scientifically tried and tested and must be legitimate. Archaeologists may not always be involved in such work directly, but before immediately believing the science, it is essential for them to look out for certain points such as the sample sizes used for both the modern and archaeological samples.

This paper could be seen to be painting a very bleak picture of seasonality studies but again I wish to emphasise that such work can be very insightful into a group of people's way of life. How some animals were procured at only certain points in the year has a bearing on a multitude of issues, including hunting customs, labour organisation, consumption practices, movement of peoples and so on. It is interesting to see, for example, how different analyses of Star Carr, combined with other faunal, cultural or locational aspects of the site, have resulted in a vast number of differing economic and social scenarios for the inhabitants of the site. The example from Star Carr has perhaps shown that the more data there is, the more difficult it is to make a simple or agreed interpretation. More data make interpretation more complicated because it exposes previously unrecognised assumptions about accuracy of techniques and the behaviour of people or animals. The development of seasonality studies over the past two decades is a good illustration of this and as a result new techniques are constantly being developed. For instance, cut mark analysis and population structures, such as those performed by Trolle-Lassen (1987), enable a better understanding of the seasonality and use of different species, and research into incremental growth of certain organisms continues in an attempt to gain greater resolution. In conclusion, seasonality studies can make a valuable contribution to archaeological research providing archaeologists are aware of the potential pitfalls.

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Bibliography

Andersen, S.H. 1974 'Ringkloster: en jysk inlandsboplads med Ertebøllekultur (English summary)', *Kuml* 1973-74, 11-108.

Andersen, S.H. & E. Johansen 1986 'Ertebølle revisited', *Journal of Danish Archaeology* 5, 31-61.

Andersen, S.H. 1989 'Norsminde, a "Køkkenmødding" with Late Mesolithic and Early Neolithic occupation', *Journal of Danish Archaeology* 8, 13-40.

Andersen, S.H. 1991 'Bjørnsholm. A stratified Køkkenmødding on the central Limfjord, North Jutland', *Journal of Danish Archaeology* 10, 59-96.

Bratlund, B. 1991 'The bone remains of mammals and birds from the Bjørnsholm Shell-Mound', *Journal of Danish Archaeology* 10, 97-104.

Caulfield, S. 1978 'Star Carr - an alternative view', *Irish Archaeological Research Forum* 5, 15-22.

Charles, R. 1997 'The exploitation of carnivores and other fur-bearing mammals during the North-Western European Late Upper Palaeolithic and Mesolithic', *Oxford Journal of Archaeology*, 16:3, 253-277.

Claassen, C. 1991 'Normative thinking and shell bearing sites in archaeology', in Schiffer, M.B. (ed.) *Archaeology Method and Theory* 3. London: Academic Press, 249-298.

Clark, J.G.D. 1954 *Excavations at Star Carr: An Early Mesolithic Site at Seamer Carr near Scarborough, Yorkshire*. Cambridge: Cambridge University Press.

Clark, J.G.D. 1972 *Star Carr: A Case Study in Bioarchaeology*. Addison-Wesley module in Anthropology 10.

Coutts, P.J.F. 1970 'Bivalve-growth patterning as a method for seasonal dating in archaeology', *Nature* 226, 874.

Coutts, P.J.F. 1974 'Growth characteristics of the Bivalve Chione stutchburyi', *New Zealand Journal of Marine and Freshwater Research* 8, 333-339.

Coutts, P.J.F. 1975 'The Seasonal perspective of marine-orientated Prehistoric Hunter-Gatherers', in Rosenberg, G. & S. Runcorn (eds.) *Growth Rhythms and the History of the Earth's Rotation*. London: Wiley, 243-252.

Darling, F. 1937 *A Herd of Red Deer*. Oxford: Oxford University Press.

Deith, M. 1983 'Molluscan calendars: the use of growth-line analysis to establish seasonality of Shellfish collection at the Mesolithic Site of Morton, Fife', *Journal of Archaeological Science* 10, 423-440.

Farrow, G.E, 1971 'Periodicity structures in the Bivalve Shell: experiments to establish growth controls in *Cerastoderma edule* from the Thames Estuary', *Paleontology* 14:4, 571-588.

Farrow, G.E, 1972 'Periodicity structures from the Bivalve Shell: analysis of stunting in *Cerastoderma edule* from the Bury Inlet (South Wales)', *Paleontology* 15:1, 61-72.

Fraser, F. & J. King 1954 'Faunal remains', in Clark, J. (ed.) *Excavations at Star Carr*. Cambridge: University Press, 70-95.

Grigson, C. 1981 'Fauna' in Simmons, I. & M. Tooley (eds.) *The Environment in British Prehistory*. London: Duckworth, 110-124.

Grønnow, B. 1987 (for 1985) 'Meiendorf and Stellmoor revisited. An analysis of Late Palaeolithic reindeer exploitation', *Acta Archaeologia* 56, 131-166.

House, M. & G. Farrow 1968 'Daily growth banding in the shell of the Cockle, *Cardium edule*', *Nature* 219, 1384-1386.

Ingebrigsten, O. 1924 *Hjortens Utbredelse i Norge*. Bergen: Naturvidenskabelige rekke no. 6.

Jacobi, R. 1978 'Northern England in the Eighth Millenium BC: an essay', in Mellars, P. (ed.) *The Early Postglacial Settlement of Northern Europe*. London: Duckworth.

Jarman, M. 1972 'European Deer economies and the advent of the Neolithic', in Higgs, E. (ed.) *Papers in Economic Prehistory*. Cambridge: Cambridge University Press, 125-148.

Larsson, M. 1986 'Neolithization in Scania - a Funnel Beaker perspective', *Journal of Danish Archaeology* 5, 244-7.

Legge A. & P. Rowley-Conwy 1988 *Star Carr Revisited: A Re-analysis of the Large Mammals*. London: Centre for Extra-Mural Studies, Birbeck College.

Monks, G. 1981 'Seasonality studies' in Schiffer, M. (ed.) *Advances in Archaeological Method and Theory* 4. New York: Academic Press, 177-240.

Pitts, M. 1979 'Hides and antlers: a new look at the gatherer-hunter site at Star Carr, North Yorkshire, England', *World Archaeology* 11:1, 32-42.

Price, T. & J. Brown 1985 'Aspects of hunter-gatherer complexity', in Price, T. & J. Brown (eds.) *Prehistoric Hunter-Gatherers. The Emergence of Cultural Complexity*. London: Academic Press, 3-20.

Pryor, F. 1997 'Urban diggers and rural prehistory', *British Archaeology* 23 (April), 14.

Richardson, C.; Crisp, D. & Runham, N. 1979 'Tidally deposited growth bands in the shell of the common cockle, *Cerastoderma edule* (L.)', *Malacologia* 18, 277-290.

Rowley-Conwy, P. 1981 'Mesolithic Danish bacon: permanent and temporary Sites in the Danish Mesolithic', in Sheridan, A. & G. Bailey (eds.) *Economic Archaeology*. BAR (IS) 96, 51-55.

Rowley-Conwy, P. 1984 'The laziness of the short-distance hunter: The origins of agriculture in Western Denmark', *Journal of Anthropological Archaeology* 3, 300-324.

Rust, A. 1937 *Das altsteinzeitliche Rentierjägerlager Meiendorf*. Neumünster.

Rust, A. 1943 *Die alt-und mittelsteinzeitlichen Funde von Stellmoor*. Neumünster.

Sturdy, D. 1972 'The exploitation patterns of a modern reindeer economy in West Greenland', in Higgs, E. (ed.) *Papers in Economic Prehistory*. Cambridge: Cambridge University Press, 161-168.

Trolle-Lassen, T. 1987 'Human exploitation of fur animals in Mesolithic Denmark - a case study', *Archaeozoologia* 12, 85-102.

Zvelebil, M. & P. Rowley-Conwy 1984 'Transition to farming in Northern Europe: A Hunter-Gatherer perspective', *Norwegian Archaeological Review* 17:2, 104-127.