HUNTERS OF THE RECENT PAST

Edited by
Leslie B. Davis and Brian O. K. Reeves

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Foreword

This book is one of a major series of more than 20 volumes resulting from the World Archaeological Congress held in Southampton, England, in September 1986. The series reflects the enormous academic impact of the Congress, which was attended by 850 people from more than 70 countries, and attracted many additional contributions from others who were unable to attend in person.

The *One World Archaeology* series is the result of a determined and highly successful attempt to bring together for the first time not only archaeologists and anthropologists from many different parts of the world, as well as academics from a host of contingent disciplines, but also nonacademics from a wide range of cultural backgrounds, who could lend their own expertise to the discussions at the Congress. Many of the latter, accustomed to being treated as the 'subjects' of archaeological and anthropological observation, had never before been admitted as equal participants in the discussion of their own (cultural) past or present, with their own particularly vital contribution to make toward global, cross-cultural understanding.

The Congress therefore really addressed world archaeology in its widest sense. Central to a world archaeological approach is the investigation not only of how people lived in the past but also of how, and why, changes took place resulting in the forms of society and culture which exist today. Contrary to popular belief, and the archaeology of some 20 years ago, world archaeology is much more than the mere recording of specific historical events, embracing as it does the study of social and cultural change in its entirety. All the books in the *One World Archaeology* series are the result of meetings and discussions which took place within a context that encouraged a feeling of self-criticism and humility in the participants about their own interpretations and concepts of the past. Many participants experienced a new self-awareness, as well as a degree of awe about past and present human endeavors, all of which is reflected in this unique series.

The Congress was organized around major themes. Several of these themes were based on the discussion of full-length papers which had been circulated some months previously to all who had indicated a special interest in them. Other sessions, including some dealing with areas of specialization defined by period or geographical region, were based on oral addresses, or a combination of precirculated papers and lectures. In all cases, the entire sessions were recorded on cassette, and all contributors were presented with the recordings of the discussion of their papers. A major part of the thinking behind the Congress was that such a meeting of

many hundreds of participants that did not leave behind a published record of its academic discussions would be little more than an exercise in tourism.

Thus, from the very beginning of the detailed planning for the World Archaeological Congress in 1982, the intention was to produce post-Congress books containing a selection only of the contributions, revised in the light of discussions during the sessions themselves as well as during subsequent consultations with the academic editors appointed for each book. From the outset, contributors to the Congress knew that if their papers were selected for publication they would have only a few months to revise them according to editorial specifications, and that they would become authors in an important academic volume scheduled to appear within a reasonable period following the Southampton meeting.

The publication of the series reflects the intense planning which took place before the Congress. Not only were all contributors aware of the subsequent production schedules, but also session organizers were already planning their books before and during the Congress. The editors were entitled to commission additional chapters for their books when they felt that there were significant gaps in the coverage of a topic during the Congress, or where discussions at the Congress indicated a need for additional contributions.

Hunters of the recent past results from discussions at the Congress on 'Communal Land Mammal Hunting and Butchering', which lasted for one and a half days. Discussions at the Congress itself were grouped topically by the types of animals hunted, including 'Mammoth and Bison' and 'Cervids and Antelope', as well as a final session on 'Patterns and Processes'. It is significant that the vision for this Congress meeting originated in a suggestion from Professor Reeves back in April 1983, and it has been the dedication and application of the specialists concerned that has resulted in this fascinating volume. The editors of this book reported that the discussion sessions were not only well attended, but also

> from the participants' view [the symposium] was extremely successful in bringing together for the first time at an international congress researchers from different countries and backgrounds interested in communal hunting strategies. Exchanges of views between participants in the symposium, as well as with and between members of the audience both formally and informally, were most productive and our view and understanding of the significance and problems associated with communal hunting strategies expanded. Particularly fruitful was the exchange between researchers from North and South America, who were dealing with patterns of the historic natives or those of the recent past, and European Mesolithic and Paleolithic specialists from both western and eastern Europe.
>
> The format of the symposium – prepublished papers and sufficient

> time for discussion – was extremely beneficial. In all, it was the best of the congresses we have attended. (Ucko 1987, pp. 183–4)

Unlike most of the books in the *One World Archaeology* series, the importance of *Hunters of the recent past* does not lie in any new thematic quality. Nor does it offer a wide range of Third and Fourth World views. The intrinsic value of this book is in the combined anthropological and archaeological approach presented in it.

It is perhaps symptomatic of the currently fragmented nature of archaeological inquiry that it was not until the occasion of the World Archaeological Congress in Britain in 1986, which brought together such a wide range of scholars in this field, that the vital questions of past hunting strategies could be discussed within a comparative, and widely international, framework. Many new insights are revealed within the pages of *Hunters of the recent past* and they are highlighted in the introduction. This publication will result in renewed concentration on the design of specific research questions and strategies which will, in their turn, produce future seminal comparative analyses.

P. J. Ucko
Southampton

Reference

Ucko, P. J. 1987. *Academic freedom and apartheid: the story of the World Archaeological Congress*. London: Duckworth.

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Preface

The impetus for the organization of a meeting entitled 'Communal Land Mammal Hunting and Butchering' for presentation at the World Archaeological Congress in Southampton in the autumn of 1986 was a conversation between Brian Reeves and Nanna Noe-Nygaard during the International Union of Prehistoric and Protohistoric Sciences conference held in 1982 in Mexico City. There, Reeves and Noe-Nygaard discussed the importance of understanding communal hunting and the essential nature of detailed studies of archaeological bone assemblages for inferring hunting strategies, including communal hunting, on various scales. The relatively extensive and intensive studies of prehistoric communal bison hunting on the North American Great Plains, to which Reeves had a long-term research commitment, provided a wealth of comparative data for such studies, but was restricted to a single species from one of the world's largest grasslands. The imperative of generalizing about the archaeological ability to recognize communal hunting, as contrasted with the results of single-hunter or small-group hunting strategies, and understanding the variability and importance of communal hunting on a broader geocultural scale were of obvious anthropological interest. Noe-Nygaard's experience with the Scandinavian Mesolithic and Neolithic suggested to her that parallels in the archaeological record of her country do exist, but that comparative data from elsewhere were sorely lacking. Much of the North American technology and study findings were not readily accessible, causing a lag in applications of those findings elsewhere. Because of their mutual recognition of and concern about this void, and the paucity and unavailability of independent but relatable studies, Reeves and Noe-Nygaard determined that this overall problem should be addressed on a large scale by convening interested scholars working on similar questions to prepare contributions for precirculation and presentation and discussion at the World Archaeological Congress.

Reeves later enlisted the aid of Leslie Davis who assisted in searching for and soliciting contributions from interested scholars and urged their participation. Of the 40 who initially expressed an interest in participating, the work of 18 was presented in 13 papers delivered at the Congress. Contributions by 5 scholars from the original list were submitted following the Congress. Because the importance of increasing the breadth and diversity of represented approaches was recognized, 4 other chapters were later commissioned. Subsequently, 10 of the Congress contributions and 9 others submitted after the Congress were selected for *Hunters of the recent past*. Two of the unpublished Congress papers are available in

the precirculated volume, 'Communal Land Mammal Butchering and Hunting' (mimeo, Allen & Unwin, 1986).

We are especially grateful for the efforts of those who directly participated in the World Archaeological Congress meeting on 'Communal Land Mammal Hunting and Butchering' and for their cooperation thereafter in completing post-Congress versions of their work for publication. We are also grateful to Mark Maltby for his valuable comments on the typescript.

Prepublication expenses associated with editing and persistent dialogue with authors were absorbed by author contributions and by grants from the Office of Research and Creativity and the Museum of the Rockies at Montana State University, the Archaeological Survey of Alberta, and the Department of Archaeology at Simon Fraser University. We are thankful for that essential support.

Clerical assistance and typing were provided by Diane Fuhrman and Terri Wolfgram, MSU Department of Sociology, Terry Dysart, MSU Personnel Services, and Gail Matis and Ornella Cavaliere, Department of Archaeology, University of Calgary.

Finally, we appreciate the guidance and patience of Professor Peter Ucko during this stimulating but harried experience. It is our hope that this volume testifies to the enduring benefits of the 1986 World Archaeological Congress and justifies his many sacrifices in making that landmark conference an unmitigated success.

Leslie B. Davis
Bozeman
Brian O. K. Reeves
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Introduction

LESLIE B. DAVIS & BRIAN O. K. REEVES*

This book results from the first international meeting to address the worldwide phenomenon of archaeological evidence for different hunting strategies on an unprecedented geographic, temporal, cultural, and prey species scale. As a result of this comparative method, and the analysis of current viewpoints and a variety of existing technical and intellectual approaches, *Hunters of the recent past* should excite still more and better work through cross-fertilization and the emergence of new information-sharing relationships.

The following geographic and prey species are covered: European Upper Paleolithic bison, horse, reindeer, and wild cattle (Kehoe, Ch. 2); Circumpolar reindeer and caribou (Gordon, Ch. 14, Blehr, Ch. 15); North American mammoth (Hannus, Ch. 3, Jones, Ch. 4, Steele, Ch. 5, Olsen, Ch. 6), bison (Kehoe, Ch. 2, McCartney, Ch. 7, Landals, Ch. 8, Brink & Rollans, Ch. 9, Reeves, Ch. 10, Morris, Ch. 11), bighorn sheep (Morris, Ch. 11, Frison, Reher & Walker, Ch. 12), and pronghorn antelope (Davis & Fisher, Ch. 13); New Zealand moa (Kooyman, Ch. 16); and Argentine guanaco (Politis & Salemme, Ch. 17, Borrero, Ch. 18, Lanata, Ch. 19) and lesser prey species such as deer, seal, and sea lion (Politis & Salemme, Ch. 17, Lanata, Ch. 19).

Driver states in Chapter 1 that communal hunts on a worldwide scale were usually conducted during particular seasons. In temperate and arctic areas, hunts were timed to take advantage of prime meat and hide quality and animals were usually intercepted on migration routes. In lower latitudes, they were timed to avoid conflict with much more important subsistence activities such as agriculture and plant gathering. Communal hunts in all the areas sampled appear to have been initiated when animals were densely aggregated by various environmental factors. There appear to have been two advantages to communal hunts under aggregated prey conditions. First, the efficiency of hunting using simple technology is increased when animals in a group are attacked by a band of cooperating hunters. This view is supported by the ineffectiveness of introducing more efficient killing methods to societies that traditionally use communal techniques. Second, when animals are concentrated in groups, the rate of return per hunter per day is greater when hunters cooperate.

*The authors have incorporated liberally chapter abstracts provided by contributors into this introduction to preserve the flavor of the respective treatments and to minimize errors of interpretation.

In Chapter 2 on Upper Palaeolithic European cave art Kehoe focuses on representations of herd game, the more-or-less geometric figures that are associated with them, and the gathering of these animals into corrals. Kehoe's conclusion that communal hunting methods were used is drawn from excavations of analogous prehistoric bison pounds in the Northern Plains of North America and at the type site of Solutré in France, supplemented by inspection of cave paintings such as those at Lascaux and Altamira.

Although fewer than 30 localities in North America document human association with mammoths in the Clovis Period (*c.* 11100 BP) little is known concerning the systematics of this ancient big game hunting culture, according to Hannus in Chapter 3. Currently, working models for reconstructing this form of megafaunal procurement are of necessity predicated on ethnographic and experimental studies of extant Asian and African elephants and their hunters. Suppositions arising from this research, while invaluable, are difficult to confirm in the archaeological record. The Lange-Ferguson site in South Dakota expands knowledge of Clovis disarticulation and dismemberment strategies because of the recovery of heavy cleaving tools and flakes produced from portions of mammoth scapulae and long-bone shaft elements in direct association with a butchered mammoth. Taphonomic factors indicate that the skeletal remains of the adult and juvenile mammoths at the site represent a single instance of kill and butchering activity. The practicalities of systematically dismembering two mammoths, which represent at least 9000 lbs of procured meat, a process believed to have involved the use of some bone expediency tools, provide a basis for considering the possible communal nature of processing such a kill.

In Chapter 4, Jones uses evidence drawn from prehistoric mammoth kills in North America in an effort to explain factors that affected mammoth procurement. He specifies that optimal foraging theory provides a hierarchical approach to modeling the decision-making involved in the selection of game species by human hunters. Jochim's (1976) sequence of motives that determine prey selection by communal hunters identifies weight as the prime consideration, with density, aggregation size, mobility, fat, and nonfood byproducts as less important. Data from nine archaeological mammoth kill sites in North America were subjected to paleoecological and osteological examination using criteria drawn from studies of elephant behavior and ecology in Sri Lanka and East Africa. It is suggested that proboscidean biomass and fat content, not weight, were the most influential game selection factors for communal Paleoindian hunters. These hunters apparently favored solitary adult male mammoths when fat procurement was most desirable and female-dominated family groups when weight, that is, meat yield, was the main concern.

In Chapter 5, Steele brings out the difficulty and complexities involved in deducing underlying human behavior from the evidence of archaeo-

logical mammoth bones. He recognizes that, although the mammoth was one of the largest animals communally hunted by prehistoric North Americans, little is actually known of the techniques used to hunt it or process its remains. One of the reasons for this lack of information about mammoth procurement and processing strategies is that the recognition of North American sites containing man and mammoth remains has proved problematical in instances when stone artifacts are not found associated with the skeleton. However, many mammoth remains lacking associated lithics have been found that do show patterns of bone modification suggesting humans had killed and/or butchered the animals. Lines of evidence commonly utilized to infer human activities at such sites are: the particular bones that are preserved at the site, how the remaining bones are distributed in space, which bones had been broken, and what form of inferred force had broken the bones. While examination of bone modification can indicate human activity, the evidence may be equivocal since many bone altering agents create remarkably similar patterned modification. Consequently, lines of evidence in addition to patterned bone modification must be utilized in order to prove human activity at these sites. Determination that the remains are in primary taphonomic provenience, when used in conjunction with patterned bone modification, may help to establish whether such remains had been altered by humans. Remains are in primary taphonomic provenience when they remain in the location where initial disarticulation of the skeleton occurred. Chapter 5 develops the concept of taphonomic provenience and illustrates its utility in the analysis of North American mammoth remains.

In Chapter 6 Olsen disputes the conclusion that Paleoindian hunters were 'big game hunters.' As he sees it, there seems to be an annual increase in the scientific literature relating to man's role as a big game hunter in the North American Late Paleolithic. However, the evidence needed to support this theory does not seem to keep pace with these claims. Was man a specialized big game hunter or merely a hunter of big game as opportunities arose, living for the most part on more plentiful and more easily obtainable smaller game? The number of kill or butchering sites in no way indicates the mass slaughter of large animals, even if all known sites were contemporary (which they were not). That a number of the proboscidean finds attributed to hunting by humans are associated with bog deposits strongly suggests that the animals were trapped in marshy sediment when hunters arrived on the scene. Perhaps some were intentionally driven into such natural traps by groups of hunters and then dispatched. It seems highly unlikely that hunting groups would restrict themselves to large mammals, particularly when fossil assemblages indicate an abundance of contemporary bovids, cervids, and lagomorphs. One factor that accounts for this specialized big game theory is the way in which finds are made and reported. Many proboscidean skeletons have been uncovered by construction machinery working on pipe lines, drainage ditches, or other similar excavations. It is unlikely that a

mammoth femur would be missed by the blade of a bulldozer and thus escape notice by the driver. The bones of smaller mammals, on the other hand, even if buried in a concentrated assemblage, would be more likely to go unnoticed and therefore unreported. The total number of proboscideans found in a North American archaeological context does not support the 'overkill theory', which proposes human hunters as the major cause of their extinction at the close of the Pleistocene.

In Chapter 7, McCartney, while dealing with and interpreting Plains Paleoindian bison hunting, accepts the conventional view that Paleoindians were big game hunters. Most of the evidence used for reconstructing Paleoindian bison procurement comes from sites to which large numbers of animals were collectively driven during late fall or early winter. The importance of smaller kills involving different hunting methods is considered on two levels: variability in Paleoindian hunting methods is assessed in terms of certain observed characteristics of bison kill sites, such as size, sex composition, and season of death of the bison population, and an interpretive framework is sought in a discussion of variables in bison and human ecology that may influence the selection of specific hunting strategies.

In Chapter 8, Landals emphasizes the importance of small-scale bison procurement methods using a post-Paleoindian North American example. She points out that the archaeological reconstruction of prehistoric bison procurement strategies in North America has emphasized large-scale communal kill sites. Thus, a biased view of prehistoric bison procurement exists. Small-scale or single-encounter hunting methods have been virtually ignored in most archaeological reconstructions of subsistence and settlement patterns. This contrasts markedly with the ethnographic record, which provides a wealth of information about the varied and ingenious methods used by historic native peoples to hunt bison in noncommunal contexts. She examines a small-scale bison kill at the Maple Leaf site in the Rocky Mountains of southwestern Alberta, Canada. Analysis of faunal remains from this site, in conjunction with the spatial patterning of bone, artifacts, and features, permits the reconstruction of specific small-scale hunting and meat-processing activities. The miring of bison in a small wetland feature is regarded as the result of a small-group bison hunting event. The interpretation of small bison kills such as the Maple Leaf site is of importance in the broader context of reconstructing the full spectrum of prehistoric hunting and subsistence strategies in the larger North American Great Plains area. The application of traditional analytic techniques developed from communal kill site studies, while important, is inadequate for interpreting small-scale bison kills because of the nature of the samples. The application of models developed from ethnoarchaeological research, however, is shown to be a valid and useful method for interpreting small-scale bison kills.

In Chapter 9, Brink & Rollans employ archaeological and ethnohistoric information to explain the use of drive lane systems at some Northern

Plains communal bison jumps. They are concerned that, despite many decades of intensive research at bison drive kill sites, almost no archaeological attention has been directed to the physical remains of the drive lane cairn systems themselves, although these are presumably a critical component of these communal kill features. They review ethnohistoric literature regarding the composition and function of drive lane cairns, and examine in detail the remains of drive lanes at a major bison kill site in the Northwestern Plains, the Head-Smashed-In Buffalo Jump in southern Alberta, Canada. Serious discrepancies are noted between the archaeological manifestations of drive lane cairns and eyewitness accounts of Historic Period communal hunts. Archaeological investigation of the drive lane cairns at Head-Smashed-In permits postulation of the method whereby cairns were utilized so as to direct bison movement. The rock cairns apparently served primarily as devices to anchor brush and were largely unmanned. At the same time, it is recognized that some variability does exist in rock cairn structures at different kill sites; this leaves open the possibility that cairn structure and function may have differed at other similar kinds of sites.

In Chapter 10 Reeves adopts a regional evolutionary perspective to describe and account for 10 000 years of cultural adaptations achieved by North American Great Plains bison hunters. In his view, the evolutionary perspective on organized communal bison driving in the Great Plains of North America, involving the close social and spiritual coordination of organized groups of hunters and herds of bison, is applicable by at least 10 000 years ago, if not earlier. During Early Holocene times, Paleoindians developed a sophisticated hunting and food storage technology based on dried meat. They lived in a grassland environment whose productivity began to decline around 8000 years ago. Bison hunting became increasingly restricted in geographic scope. During the mid-Holocene drought, a change from Paleoindian cultural patterns occurred. It is most evident in the loss of the sophisticated stone technology and stone trade patterns that had characterized Early Holocene cultures. By 3000 years ago, the number of bison kills in the Northern Plains had increased dramatically. Associated camps are characterized by bone grease preparation and use in pemmican production. Technology and social and spiritual aspects of bison hunting lifeways also changed markedly. Pemmican provided a new source of stored food that allowed both greater mobility and more specialization, resulting in a major change in sociocultural organization. The result, by 3000 years ago, was the emergence of a communal bison hunting culture quite different from that of Paleoindian times. Kill sites again increased around 1500 years ago, in connection with the arrival and adoption of the bow and arrow. Other cultural aspects became more elaborate, indicating that this new weapon had provided the final technological impetus in the evolution of the Northern Plains communal bison culture, which had, by this time, achieved the complexity usually associated only with Historic Plains tribes.

In Chapter 11, Morris discerns generalized game driving strategies for multiple prey species in those Rocky Mountains and High Plains areas of Colorado where prehistoric communal game drives have been recorded. Two low-elevation and two high-elevation game drives are described, and previously published game drives are summarized or referenced. Bison dominated the low-elevation bone assemblages. A bighorn sheep horn and a wapiti or deer antler have been found at tundra sites. The four sites date from the Middle Archaic through the various later Ceramic Period phases. Based upon ethnographic Arapaho and Ute tribe models, the high-elevation sites would have been used during the summer and fall. Faunal aging studies indicate that most low-elevation drives were used in the autumn. The low-elevation game drives involved small groups of people gently moving animals toward a cliff, arroyo, box canyon, snowbank, sand dune, or bog. High-elevation sites were probably utilized in the same way, with the exception that drive lines were used to funnel game close to hunting blinds.

In Chapter 12, Frison, Reher & Walker provide an in-depth study of bighorn sheep hunting in the North American Central Rocky Mountains of Wyoming. Rocky Mountain wild sheep remains found in archaeological sites in northwestern Wyoming and adjacent areas of Montana and Idaho date from the Late Paleoindian Period to the Early Historic Period and are located at elevations ranging from intermontane basins to above the timberline. The operation of Early Historic traps, reflecting well-organized communal operations, is understood because in many cases parts of the perishable wooden components are still intact. Older trapping complexes no longer retain the perishable components and consequently their operational details are difficult to interpret. The recovery of a net made from juniper bark, believed to have been designed for mountain sheep entrapment, dates to the Late Paleoindian Period. This net and the Early Historic traps provide evidence for two different procurement strategies, neither of which required use of lithic projectiles. The Early Historic traps utilized dead timber in their construction, and since these are almost exclusively found in locations of live trees, the dendrochronological dating of several traps has been possible. Since mountain sheep populations still occupy the same area, their behavior patterns have been observed. On that basis, traps could only be placed in certain kinds of topographic locations to be successful. Other trap locations can thus be much more easily predicted than formerly.

In Chapter 13, Davis & Fisher discuss the communal procurement of pronghorn antelope, a gregarious herd-game species widely adapted to the Great Plains of North America. Communal subsistence practices utilizing pronghorn antelope are best expressed ethnohistorically in the Columbia Plateau, Great Basin, California, and the Southwest, with a less persistent and pervasive presence in the Great Plains. Resultant pronghorn bone middens from prehistoric times are conspicuously lacking in the archaeological record from the primary pronghorn use areas. However,

small-group pronghorn procurement is better documented. Excavations at the Lost Terrace pronghorn meat- and hide-processing site on the Upper Missouri River in the north-central Montana High Plains have provided a much-needed example of pronghorn midden deposits that resemble the content and structure of bone middens at communal bison kills. The utility of faunal analytical methods for interpreting the critical biological part of the archaeological record is clear for understanding operative human behavior: butchering pattern reconstruction, food extraction and preparation practices, estimation of MNI (minimum number of pronghorns killed and utilized), age and sex composition of the killed cohort, kill seasonality, and estimation of obtained food values, along with implications for the numbers of humans supported.

In Chapter 14, Gordon provides a circumpolar perspective on the communal hunting of reindeer and asserts that *Rangifer* was communally hunted more than any other animal. Its corralling, concentration, and killing by organized hunters are similar in terms of man's reaction to herd behavior. The building and operating of devices used to assure hunting success was hierarchically arranged according to sex, age, past hunting success, band solidarity for territory protection, and activity and product sharing. Caribou and reindeer hunting is described and discussed from west to east, from north to south, and from prehistoric times to the present. Generally, tundra hunters emphasize water crossings, while forest hunters stress pole drive lanes and corrals.

In Chapter 15, Blehr provides a detailed look at reindeer procurement practices in northern latitudes. He argues that archaeologists as well as anthropologists generally believe the caribou or wild reindeer (*Rangifer tarandus*) is easy to kill. The striking success of hunters using communal drives, and later guns, has largely obscured the fact that, when other hunting techniques became necessary, this species could be quite difficult to kill. On the basis of his fieldwork in areas once used by prehistoric Norwegians, Norse Greenlanders, and Inuits, and from the ethnographic literature of the circumpolar area, as well as his own research and that of others on tarandus behavior, he discusses and evaluates the efficiency of different traditional hunting techniques. He concludes that a hunting society could only become dependent on this species as a subsistence resource when its members had mastered the communal drive technique. Noncommunal hunting techniques simply did not yield the required number of animals. Finally, the implications of his findings for archaeological research in regions where tarandus has been a potential food resource are discussed briefly.

Shifting attention from the Northern to the Southern Hemisphere, and from ungulates to terrestrial birds, Kooyman (Ch. 16) asks whether moa were hunted communally in New Zealand. Now extinct, the moa were large, flightless birds once native to New Zealand. These birds were hunted prehistorically, and it has long been assumed that hunting was communal. It has also been assumed, at least for the interior region of the

South Island of New Zealand, that such hunting was intended to obtain meat that was preserved for later consumption at permanent coastal settlements. However, examination of lithic and faunal remains from five interior South Island sites indicates that moa hunting was instead an individual pursuit that probably provided meat for immediate consumption.

In Chapter 17, Politis and Salemme review archaeological, paleontological, and historical data available on the exploitation of land mammals in the eastern Pampa subregion of Argentina and discuss the hunting strategies employed during the Late Pleistocene and Holocene periods. Three basic patterns of mammal exploitation are proposed, for all of which the guanaco was the primary food resource. The absence in the subregion of evidence for cooperative hunting in the form of mass-kill sites is discussed. Among the different hunting strategies postulated are cooperative hunting for guanaco and large extinct megamammals and individual hunting for Pampean deer and armadillo. Finally, the weapons used by Pampean hunter-gatherers are reviewed and discussed within the context of these hunting strategies.

In Chapter 18 Borrero points out that the possibility of the communal hunting of guanaco has never been systematically tested for Fuego-Patagonia. A review of guanaco bone assemblages from several cave and open-air sites in Patagonia and Tierra del Fuego reveals that guanaco were never hunted by more than a few hunters. Thus, the effect of these small-group hunting episodes on the evolution of social networks appears limited when compared with other areas of the world where mass kills are reported.

In Chapter 19, Lanata discusses the relationship between men and terrestrial and sea mammals in Tierra del Fuego. One little-known group of Tierra del Fuego aborigines, the 'Haush', have been located by several travelers at the southern tip of the Isla Grande in Península Mitre. Ethnographic data regarding their material culture, subsistence, and settlement patterns are lacking. In 1984 the Museo Territorial del Fin del Jundo sponsored a variety of investigations, including archaeology, in that area. Lanata proposes an exploitation model for a terrestrial mammal, guanaco, and a sea mammal, seal lion, which are considered key prey species. Base camps were located near the coast (no more than 5 km distant) during autumn and winter and on the coast during spring and summer. These site location patterns may reflect different movements between specific activity loci and base camps as a function of a small catchment area radius. The model takes into account the ethology of the mammals and different procurement strategies.

This book considers prehistoric and more recent manifestations of human hunting behavior on worldwide, regional, and local scales, with a general emphasis upon communal hunting. Ten major terrestrial and other lesser terrestrial and marine food prey species utilized by man are represented from four continents. The book demonstrates that the

combination of archaeological, ethnographic, and ethnohistorical approaches effectively provides a comprehensively researched basis for consideration of the topic. It includes theoretical and methodological issues within a unique context of original inquiry data and discussion.

The cultural manifestations of communal hunting, as they have been recorded in the ethnographic and ethnohistoric records, irrespective of particular species, were discussed by Driver (Ch. 1) in an effort to discern the characteristics that distinguish communal hunting behavior from that involved in alternative hunting strategies.

Discerning these alternative strategies in the archaeological record poses many problems, as pointed out by Olsen (Ch. 6) and Steele (Ch. 5) in their discussions of whether the concept of Paleoindians as specialized big game hunters in North America is even valid (Olsen) and whether mammoth bone assemblages necessarily or occasionally are the products of Paleoindian hunting or scavenging behavior (Steele). Threshold problems in discerning human involvement in some altered bone assemblages certainly exist. The likelihood of confidently distinguishing small group versus communal hunting as characteristic mammoth predation behavior by early humans is clouded and complicated at the level of basic evidence for this species, as it is for others in the more recent archaeological record, such as is illustrated by Landals (Ch. 8) and Davis & Fisher (Ch. 13) for, respectively, bison and pronghorn antelope.

The degree to which prehistoric communal hunting behavior approximated that of known communal, small-group, or individual hunting patterns is an ongoing concern for students of communal hunting. The archaeological analogs of such behavior are not always clear and require detailed field studies, particular analytical methods, and innovative interpretive frameworks to elicit possibilities from the typically incomplete and moot archaeological record.

Although the majority of chapters in this book focus on hunters of the recent past, they also provide food for thought regarding the cultural evolution of mankind. Many scholars consider the development of communal hunting and associated meat-processing technologies to be the major underpinning of the Upper Paleolithic cultural revolution. While there is as yet little hard evidence of communal kills from Eurasia, Kehoe's interpretation (Ch. 2) of Upper Paleolithic cave art certainly suggests that communal hunting was an integral component of its inhabitants' adaptive strategies those many millennia ago. Indeed, it would appear that the basic structural integrative sociocultural elements found in complex communal hunting societies in much more recent times were in place by the late Upper Paleolithic, as they were at the close of the last Ice Age in early Paleoindian times in North America. Did the communal hunting traditions of these early Native Americans develop from, or in parallel with, those of western Eurasia, or do they both stem from a common source, perhaps the steppes of eastern Eurasia during the early stages of the last glaciation?

Such questions need to be answered and much remains to be studied and analyzed before a thorough understanding of the role, importance, and development of communal hunting throughout human history, and its implications for the evolution of humankind, can be gained. However, it is clear that human groups have successfully procured essential meat and associated byproducts since at least Upper Paleolithic times, using communal, small-group, and single-hunter stalking and ambush techniques. Their food procurement repertoires were well suited to prey behavior, effective technology, seasonality, and food supply needs. They hunted, killed, and processed game according to traditional proscriptions and taboos and left distinctive residues of their successes on varied landscapes, many vestiges of which have been destroyed or are buried, some beyond recovery.

It is apparent that hunters the world over were as effective, ingenious, tenacious, and innovative as sometimes somewhat destabilizing conditions demanded, most often relying on the time-tested, proven ways of their ancestors. It is readily apparent that archaeologists and other scholars have a long and circuitous trail ahead in working out the nuances of widely variable hunting behavior and fully apprehending the implications of communal hunting for human biosocial evolution.

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1 *Meat in due season: the timing of communal hunts*

JONATHAN C. DRIVER

Introduction

In order to understand the ways in which prehistoric peoples utilized the environment it is necessary, in most parts of the world, to consider the effects of seasonally changing conditions on subsistence strategies. In some cases the impact of seasonality is fairly obvious – timing of spring planting on agriculturalists; the effect of ice break-up on Arctic hunting. In other cases the effects of seasonality may be more difficult to detect for an outside observer – the quality of animal hides at different seasons or the likelihood of finding game at a particular location. Since Flannery's (1968) paper, archaeologists have considered human subsistence in terms of scheduling and seasonality, concepts that have been incorporated as major aspects of archaeological and anthropological applications of optimal foraging theory and linear programming (Keene 1981, Winterhalder & Smith 1981).

In this chapter, I isolate seasonality as a factor in the organization of communal hunting strategies and explore the extent to which seasonality plays a role in determining whether a communal hunt will take place. In addition, by studying seasonality as a factor in communal hunting, it may be possible to isolate regularities in systems of communal hunting; such regularities may help explain why communal hunting is practiced.

Because seasonality of kills can be determined in the archaeological record, this topic is of more than theoretical interest to archaeology. If one can demonstrate regularities in the seasonality of communal hunting for modern societies, one may be able to explain why certain archaeologically known communal hunts were conducted at particular times of the year. Furthermore, communal hunting is not a universal trait of hunter-gatherer or agricultural societies, and analysis of why and when the method is used will contribute to our understanding of human ecology.

Communal hunting

For the purposes of this chapter, I consider communal hunting to be characterized by the following traits:

(a) Participation by more than two hunters (usually many more than this).
(b) Active cooperation between hunters such that they work together, as opposed to passive cooperation in which hunters agree not to interfere with each other's activities.
(c) A system of hunting that requires all hunters to participate in a previously conceived plan.

Documenting the presence of communal hunting in the archaeological record is difficult. The best indicators of the method are the structures associated with animal entrapment, such as those known for a variety of species from the Northwestern Plains of North America (Frison 1978, Brink & Rollans, Ch. 9, this volume), although dense concentrations of animal bones in natural 'traps' or at the base of 'jumps' are also good indicators. However, many communal hunts known from the ethnographic period were achieved without the use of structures that would survive archaeologically and animal bones might not be deposited in locations conducive to their preservation. For this reason, direct archaeological evidence for communal hunting is generally rare. Another possible indicator could be faunal assemblages at habitation sites that exhibit kill-off patterns typical of catastrophic, rather than attritional, mortality, but such assemblages are only indirect evidence for communal hunting.

It should be noted that communal hunting is not defined by the numbers of animals hunted or killed. Communal hunting for moose among the Kutchin is directed towards a single animal (Nelson 1973), as were communal whale hunts in many areas. Conversely, an individual salmon fisherman could net dozens of salmon, while a modern boreal forest trapper may obtain hundreds of animals throughout the winter. Communal hunting is distinguished by the organization of hunters into groups that are often larger than normal hunting parties and often involve the temporary aggregation of groups of people much larger than normally seen. Communal hunting was widespread throughout the world before European influence extensively modified subsistence strategies (Forbis 1978). Communal hunting was not restricted to hunter-gatherers; it was not confined to any particular types of environment, although it may have been a more common strategy in regions where meat was of major dietary importance and where resource diversity was low (Hayden 1981, p. 368). Surveys of hunting methods (e.g. Anell 1969, Forbis 1978) show that a wide range of techniques was used. These included driving game towards hunters, traps, snares, corrals, nets, water, and jumps; surrounding them with beaters, horsemen, or fire; and ambushes in a variety of natural culs de sac. Communal hunting was not usually a year-round pursuit. Instead, it was often confined to a particular season or seasons.

Seasonality: general considerations

Human behavior used to obtain meat seems to depend on three variables: the organization of the humans, the nature of the prey, and variables in the environment external to humans and prey. None of these variables remains constant, mainly because of annual cyclical patterns of natural events. These patterns are not inevitable, but, in the long run, they are regular and expectable and related to the Earth's tilt. In virtually all areas of the world human and animal physiology and behavior have a seasonal component; thus, in the complex relationship that hunting entails, the effect of seasonality cannot be neglected.

Humans are affected seasonally in various ways. Group size tends to vary seasonally in hunter-gatherer societies since groups split into nuclear families when resources are scattered and aggregate when resources are clumped. Group size can even vary in agricultural or pastoral societies, for example, if the village splits into smaller groups for the purposes of transhumance or to spend extended periods at remote fields. Because different foods become available seasonally, scheduling decisions to exploit one resource may preclude exploitation of a second resource. As communal hunting requires relatively large numbers of hunters (and sometimes entire populations), it is likely that other activities would sometimes stand in the way of organizing a communal hunt.

Communal hunting also requires that the prey species exhibit certain characteristics for the hunt to stand a chance of being successful. Frequently, it is desirable that the location of animals be predictable, that animal behavior dictate certain hunting techniques and that the physiological condition of the animal make communal hunting worthwhile. Many of the larger game animals display pronounced seasonal variations in habitat, migration, population density, meat quality, and social behavior. All these factors affect the ability of a group of hunters to secure an adequate return for the large expenditure of energy that frequently accompanies communal hunts.

Finally, one should note that factors external to humans and prey may vary seasonally. For example, weather conditions will certainly affect the outcome of a hunt and, away from the equator, changes in length of day may have a similar effect.

Seasonality in large mammals

A review of the very extensive literature on large mammal ecology is not possible here. However, it demonstrates that most large mammals display seasonal variations in behavior and physiology. For hunters, the most important variation must rest in those factors that make animals easier or harder to procure, or in the palatability and nutritional qualities of the meat. I will emphasize these factors here.

Seasonal changes in animal condition affect meat quality. As has been stressed by a number of researchers, fat content is important in terms of the nutritional quality of meat, and also in terms of palatability (Speth & Spielmann 1983). The cycle of fat production in mammals of temperate and arctic areas of the Northern Hemisphere is attested by many studies. Generally, all animals enter the summer with very little fat as a result of low-quality forage in the winter, although males are sometimes in better condition than females. During the summer males tend to accumulate fat faster than females. However, during the rut in late summer or fall, males lose much of the fat accumulated in summer, while females continue to add fat. Generally, females enter the winter in better condition than breeding males, but these reserves are soon depleted in pregnant females, which sometimes end the winter in worse condition than males. This pattern has been documented for most temperate and arctic mammals, including caribou (Kelsall 1968, p. 41), elk (Flook 1970, pp. 41–2), bison (Speth 1983, pp. 104–5), and saiga (Bannikov *et al.* 1961, pp. 128–30). The pattern is less pronounced in animals living closer to the equator, but fat cycles can be seen in some species, such as wildebeest (Sinclair 1977, pp. 188–91).

Another major seasonal characteristic of many large game animals is migration. This is also more common in temperate and arctic large mammals than in species living in the tropics. Migration is generally undertaken in response to food or water availability, although sheltering conditions may also be sought in extreme environments. Particularly well-known migrations are those of caribou and reindeer (Kelsall 1968), but migrations also occur in most other higher latitude species, including bison (Chisholm *et al.* 1986), elk (Adams 1982), and mountain sheep (Geist 1971). In lower latitudes migratory behavior is less pronounced. For example, the very diverse herbivore population of sub-Saharan Africa includes species that undertake major predictable migrations, such as wildebeest and zebra in Serengeti, and species that do not make major annual movements of any distance, such as buffalo (Leuthold 1977, Sinclair 1977). In tropical forests, migratory behavior appears to be very rare indeed. One important aspect of migration is that it tends to concentrate animals for short times in relatively high densities. As will be seen, this behavior is often cited as a reason for undertaking communal hunts.

Many other aspects of the behavior and physiology of large mammals are seasonally variable. In the majority of species, reproduction is seasonally controlled, although this is not always the case in tropical species such as the giraffe (Dagg & Foster 1976, p. 132) or some impala (Leuthold 1977, p. 230). Breeding behavior may affect the size of herds and the vulnerability of herds to predation. Seasonal reproduction also means that certain animals (e.g. mature males) are in their prime condition at approximately the same time. Some higher latitude species develop

summer and winter coats that exhibit different characteristics. Social behavior also varies seasonally, as does group size and composition.

In summary, we would expect seasonal variation in animal behavior and physiology to affect the time at which a species was hunted and how it was hunted. This should be more pronounced in northerly latitudes where seasons are better defined and where winter is a period of critical food shortage. However, any environment with marked seasonality in climate is likely to include large mammals with seasonal cycles.

Ethnographic data

Since communal hunting methods were widespread, this chapter does not attempt to cover all the literature on the subject. Many subsistence-oriented economies practiced some form of communal hunting (at least before the introduction of modern firearms and game control regulations), although this was not always hunting for large land mammals, the subject of this book. Unfortunately, ethnographies are often uninformative about seasonality of communal hunting, and are even less informative about why hunts are organized at certain times of the year. Table 1.1 presents data for seasonality of communal hunting episodes from a sample of societies derived from a wide range of latitudes. While the sample is not representative, an attempt was made to cover as wide a range of latitudes as possible because of observations that hunter-gatherer subsistence patterns vary latitudinally (Lee 1968). It should be noted that many of the societies selected are not hunter-gatherers, and that some hunter-gatherer societies included in Table 1.1 do not rely primarily on communal hunting of large mammals for subsistence.

Analysis of hunting practices in relation to broad latitudinal zones (Table 1.2) demonstrates some regularities in the season of the hunt and in reasons for selecting a particular season. In latitudes away from the equator (farther than 40° N or S), the three major reasons for seasonality of communal hunting are to take advantage of animals concentrated during migration, to utilize animals when fat content is highest, and to obtain high-quality hides for clothing and shelter. In latitudes closer to the equator (less than 40° N or S), the two major factors are prey density and scheduling (defined here as a decision to undertake a subsistence activity other than communal hunting). Environmental circumstances is a less important third reason, which is cited most frequently for those societies living very close to the equator where seasonal differences are likely to be less pronounced. While there is some overlap between these two latitudinal zones, the separation is quite good. In higher latitudes, fall is the major season for communal hunting. In lower latitudes, no single season predominates.

Migrations are common in large mammals, particularly those in

Table 1.1 Seasonality of communal hunting episodes arranged by latitude.

Group	Lat.	Prey	Season	Reasons	Ref.
Nunamiut	A	Caribou	FSp	Migrations Male fat level	Gubser 1965
Kutchin	A	Moose	W	Frozen rivers	Nelson 1973
Chukchi	A	Reindeer	Su	Concentrations at river crossings	Bogoras 1909
Copper Eskimo	A	Caribou	F	Hide and fat quality	Damas 1972
Chipewyan	A	Caribou	F	Migrations	Anell 1969
Plains Cree	B	Bison	Su	Concentrations at river crossings	Mandelbaum 1979
Medieval UK	B	Deer	Su	Males fat	Baillie-Grohman & Baillie Grohman 1909
			F	Females fat	
Koryak	B	Sheep	F	Meat and wool quality	Jochelson 1908
Northern Plains Indians	B	Bison	FW	Hide and fat quality	Arthur 1975
Tlingit	B	Deer and mountain goat	(Su)F	Hide and fat quality Out of salmon season	Oberg 1973
Tuvinian	B	Various	SpF	Scheduling	Vainshtein 1980
Huron	C	Deer	Sp	Deer concentrated in 'yards'	Heidenreich 1971
			F	Deer at feeding areas	
Gros Ventres	C	Bison	Sp	Migration, hides	Flannery 1953
			F	Fat, hides	
Comanches	C	Bison	Su	Hide quality	Wallace & Hoebel 1952
			F	Hide and fat quality	
Ainu	C	Deer	Sp	Migration	Watanabe 1972
			F	Hide and fat quality	

Eastern Plains Indians	C	Bison	SuF	Scheduling	Arthur 1975
Santa Clara	D	Deer	F	Fat, scheduling	Hill 1982
Jemez Pueblo	D	Bison	SuF	Scheduling	Sando 1979
Navaho	D	Antelope	W	Scheduling	Hill 1938
Paiute	D	Antelope, sheep, deer	FW	Humans assemble for seed gathering	Steward 1934
Paiute	D	Antelope	FW	Herd size	Kelly 1932
Paiute	D	Antelope	WSp	Herd size	Steward 1938
Southeastern Indians	D	Deer	FW	Forests good for burning, combined with field clearance	Swanton 1946
		Bear	FW	Fat	
Caddo	D	Bear	FW	Fat	Swanton 1942
Sema Naga	E	Various	W	Scheduling	Hutton 1968
Ao Naga	E	Pigs	S	Herd size	Mills 1973
Akwe-Shavante	F	Various	D	Grass dry for firing Scheduling	Mayburg-Lewis 1967
Apinaye	G	Various	D	Grass dry for firing	Nimuendaju 1939
Tenetehara	G	Peccary	We	Game trapped on dry land in floods	Wagley & Galvao 1969
Dahomeans	G	Various	jf	Scheduling	Herskovits 1967
Gbaya	G	Various	D	Grass too high in rainy season	Burnham 1980
Kolepan	G	Kangaroo	We	Herds concentrate in dry areas	Serpenti 1965
Jokea and Sipoi	G	Wallaby	D	Grass dry for firing	Holmes 1924
Sandawe	G	Various	We	Game abundant and concentrated	Newman 1970

Notes: F: fall, Sp: spring, Su: summer, W: winter, We: wet season, D: dry season, jf: January and February. Parentheses denote that communal hunting is of minor importance in the season enclosed. Latitude codes: A = 60–69°, B = 50–59°, C = 40–49°, D = 30–39°, E = 20–29°, F = 10–19°, G = 0–9°.

Table 1.2 Major reasons for conducting communal hunts.

Latitude	Migration	Fat	Hide	Prey density	Scheduling	Environment
A	4	3	1			1
B	1	6	4		2	
C	2	3	5	2	2	
D		3		4	6	1
E				1	2	
F						1
G				2	1	3

Source: Data from Table 1.1.

temperate and arctic regions. Many migrations concentrate animals on well-defined routes, and in some areas bottlenecks are created that further increase density. In many areas humans take advantage of these concentrations, using communal techniques to kill large numbers of animals. Examples include large encampments of Plains Cree along the South Sakatchewan River in summer (Mandelbaum 1979, p. 52), the use of deer fences along migration routes by the Thompson Indians of interior British Columbia (Teit 1900, p. 246), and the selection by the Chukchi of river crossings to hunt caribou in late summer at the beginning of their migrations (Bogoras 1909, p. 133). Numerous other examples could be cited. Because the major effect of migration is to concentrate prey, the category 'migration' in northern areas is probably the equivalent of 'prey density' for lower latitudes. However, in lower latitudes, high prey density is not necessarily correlated with migration.

The importance of fat, especially in the diet of peoples who rely primarily on meat for subsistence, has been stressed by a number of anthropologists and archaeologists. Not only does fat provide energy in the absence of carbohydrates, it also assists in protein metabolism, synthesizes lipoproteins, and facilitates absorption of fat-soluble vitamins (see Hayden 1981, Speth 1983, Speth & Spielmann 1983). Although there is little doubt that fat is of crucial importance to human nutrition in temperate environments, it is worth citing certain ethnographic data to emphasize this point. Copper Eskimo did not hunt caribou during the spring because fat levels were very low (Damas 1972, p. 13). For the Takelma of southwest Oregon, a 'choice portion of the deer meat was considered the fat' (Sapir 1907, p. 260). In Chukchi late summer reindeer hunts, fat bucks were preserved for human use, while other animals were kept only for dog food (Bogoras 1909, p. 134). In medieval England, 'grease time' was when deer were fat and best for killing. Hunting seasons for male and female deer were often separated because they reach maximum fat levels at different seasons (Baillie-Grohman & Baillie-Grohman 1909, pp. 253–5). Gubser (1965) provides considerable detail regarding the importance of fat among Nunamiut caribou hunters. For

example, 'Calves, yearlings, very young cows and bulls, and stunted or diseased caribou are very rarely fat in any season. The tongue of any caribou in any condition is said always to have enough fat for one good meal' (Gubser 1965, p. 249); mature bulls were eaten in spring and early fall, while cows were best in fall and winter (Gubser 1965, pp. 300–1). The Ainu did not hunt deer in summer because they were not 'greasy' enough (Watanabe 1972, p. 35). Many of the references to waste among communal hunters can probably be attributed to lack of fat in the prey (see Kelsall 1968, pp. 216–18 for a number of examples).

Even for groups closer to the equator references to fat quality may be found. The Bisa of Zambia are aware of fat cycles and prefer large fat animals (Marks 1976, pp. 105, 205). The Pitjandara of Australia might abandon lean kangaroos, and animals were often checked for their fat content after killing (Tindale 1972, p. 248).

Hide quality was an important factor for communal hunters away from the equator. Many societies distinguished between animals killed during the summer when they had lost their winter coats and animals killed in the fall when the new winter coat was at its best. The Gros Ventre spring hunt of migrating bison was aimed to obtain hides as well as meat (Flannery 1953, pp. 53–4). The Ainu recognized that deer hides with good insulating properties could be obtained in the fall (Watanabe 1972, p. 35). Among the Nunamiut, summer skins were valued for objects that required softer and more flexible material, while fall hides were thicker and used for heavier items (Gubser 1965, pp. 299–300). Nunamiut and Copper Eskimo avoided hides from spring-killed caribou because warble-fly infestations left holes in the skins (Gubser 1965, pp. 299–300, Damas 1972, p. 23). The summer bison hunts of the Plains equestrian hunters had good-quality hides as a major goal (Wallace & Hoebel 1952).

Societies near the equator seem to have different reasons for undertaking communal hunts. Fat and hide quality is rarely mentioned as a determining factor for groups closer than 40° N or S of the equator. Prey density, scheduling decisions, and, to some extent, environmental conditions are more important. Heidenreich (1971, p. 206) suggests that Huron deer drives were held during those seasons when deer were concentrated in feeding areas of acorns and chestnuts, or when deer were forced into concentrations by snow conditions. He notes that deer hunting in the fall apparently took advantage of the relative immobility of feeding herds, while avoiding the much more mobile rutting herds. The Ao Nagas held communal pig hunts in the summer because pigs formed dense herds at this time (Mills 1973, pp. 137–8). Inhabitants of Kolepam take advantage of kangaroo concentrations in small dry areas during the rainy season (Serpenti 1965, pp. 54–5), but the nearby Jokea and Sipoi hunt communally during the dry season because grasslands can be fired easily (Holmes 1924, pp. 246–7). The Tenetehara of Brazil hunt peccary concentrated on islands during the rains (Wagley and Galvao 1969, p. 57). According to a Paiute informant, 'in the winter the antelope are in big

herds and that's the time to kill them' (Kelly 1932, p. 85). A number of references refer to winter antelope concentrations as the reason for communal hunting in the Great Basin (Steward 1936), and Navaho probably hunted antelope in the winter for the same reason (Hill 1938).

Scheduling decisions also play a more important role among societies closer to the equator, presumably because the range of foods available is much higher. Most agricultural or horticultural societies place care of fields and gardens ahead of communal hunting, even if hunting is a prestigious activity. Pueblo Indians held communal hunts in the fall and winter after the major harvests (e.g. Hill 1982), as did the Navaho (Hill 1938). Among the Semas Nagas, communal hunting is curbed when crops are growing and during harvest (Hutton 1968, p. 76). In Dahomey (modern Republic of Benin) communal hunting took place between harvest and planting (Herskovits 1967, p. 35). The horticultural Plains Indians timed the major communal hunts to avoid periods of intense activity in fields and gardens (Arthur 1975, p. 97). This does not help to explain why communal hunting should occur but it does demonstrate that the decision to hunt communally must take into account other subsistence activities.

Scheduling decisions are not confined to agriculturalists and horticulturalists. In hunter-gatherer societies, the communal hunting of large land animals sometimes took second place to other activities. For example, the Tlingit stopped hunting deer and mountain goat during the fall salmon run, even though they hunted before and afterward (Oberg 1973, pp. 65–78). The Ainu also scheduled activities in this way (Watanabe 1972). The Paiute and Shoshone relied on gathered plant foods, particularly piñon nuts, and communal hunts were not held during periods when important plant foods could be obtained (Kelly 1932, Steward 1938).

Environmental conditions seem to control the timing of communal hunts more frequently in lower latitudes. Firing of grasslands during the dry season to aid communal hunting is seen in the Akwe-Shavante (Mayburg-Lewis 1967, p. 42), Apinaye (Nimuendaju 1939), and Gbaya (Burnham 1980, pp. 154–5), and firing of fallen leaves was practiced by Southeastern Indians (Swanton 1946, pp. 317–20). In a rare northern example of environmental conditions controlling communal hunts, the Alaskan Kutchin practice communal hunts of moose on islands in frozen rivers, a technique possible only during freeze-up (Nelson 1973, p. 107).

Although the sample of communal hunters studied is neither comprehensive nor randomly selected, certain important trends are nonetheless evident. First, in higher latitudes, quality of meat and hides is of major importance in the decision to hunt communally, whereas in lower latitudes the nutritional quality of the meat and the properties of the hide are rarely stressed. Second, animal density is of major importance, although in higher latitudes animals tend to occur in dense groups during migrations, whereas in lower latitudes the prey density may be attributed to a variety of factors. Third, there are fewer resource options available in

many higher latitude environments, and large mammal hunting by communal techniques is often a major subsistence strategy. Fourth, when scheduling decisions are made, communal hunting appears to rank as relatively undesirable when compared to agriculture, horticulture, seed gathering, and fishing.

From an archaeological point of view, we can predict with a high degree of certainty that communal hunts in high latitudes should occur most frequently in the fall, and we would expect this pattern to be maintained in many regions (e.g. Late Pleistocene Europe) where plant foods were of relatively little importance in the diet, or where animal fat and hides were of critical importance. One might also expect that in some low-latitude environments with relatively high animal biomass, such as tropical savanna (Foley 1982), well-defined seasonal communal hunts would be conducted. The closer one moves to the equator, the more difficult it becomes to predict seasonality. This is because animal condition is not a major determinant in deciding when it should be hunted communally. Instead, we find that local environmental factors, scheduling of other subsistence activities, and the aggregation behavior of individual species affect the decision to hunt communally. Furthermore, many societies close to the equator either engage in communal hunting very rarely or not at all. For example, few of the better-known tropical hunter-gatherers of the 20th century undertook communal hunts (Woodburn 1968, Lee 1979, Silberbauer 1981), which is also true for many agricultural and horticultural societies.

Why communal hunting?

Having identified some seasonal regularities in communal hunts, we now ask whether such data provide clues as to why any communal hunting occurs. Hayden (1981) has suggested that communal hunting probably yields lower meat returns per unit of energy invested than individual hunting. However, the widespread use of communal hunting in a range of environments by a range of societies suggests that good economic reasons may underlie why such hunts occur. Hayden (1981, p. 368) proposed that communal hunting was opted for because it was reliable (i.e. risk-reducing) for people who depended on meat as 'an absolute survival necessity.' Ethnographic data presented in this chapter show that communal hunts occur among groups where meat is probably not this essential, although it must be admitted that communal hunting was more common in northern areas where meat was very important. For example, one might note that virtually all chapters in this book concerned with communal hunts refer to temperate or arctic environments.

It is difficult to assess the relative efficiency or reliability of communal hunting as opposed to individual hunting for two reasons. First, few studies of the energetics of groups that engage in both forms of hunting

exist. Second, communal hunts and individual hunts may be utilized under different sets of conditions, and each may be 'efficient' given local circumstances. One of the few societies where these problems do not seem to apply is the Mbuti, who are divided into net hunters and bow and arrow hunters, for apparently no good ecological reason (Harako 1981). Among the Mbuti, communal net hunting yields more meat per person per day than other hunting methods (Harako 1981, Table 13.12). Although this behavior suggests that it is not only more reliable but also more efficient, one should note that the meat is divided amongst the entire band. Communal net hunting involves large numbers of people, whereas other forms of hunting are less intensive. The actual meat yield per hour of hunting activity is higher for bow and arrow and spear hunting, but, since such hunts are undertaken by relatively fewer people, the overall meat yield to the band is lower. However, people not employed in individual hunting can contribute to group nutrition by foraging for other foods. Data from the Mbuti apparently support Hayden's statements that communal hunting is reliable, but costly. Ichikawa (1983) has pointed out that Mbuti net hunting rarely fails to yield something. In a cross-cultural study of African net hunters and bow and arrow hunters, Ichikawa shows that net hunting is consistently more reliable than bow and arrow hunting (Ichikawa 1983, Table 2).

Note, however, that the African data are derived from societies in which the concentration of prey species does not seem to initiate communal hunts. Net hunting involves the flushing out of game from undergrowth, usually in situations in which prey density or even the number of species present is unknown before the hunt starts. Under conditions in which prey density is known, it is possible that communal hunting is more efficient in terms of meat yield per person than is individual hunting.

One way to investigate why communal hunting occurs in spite of apparently lower efficiency is to search for regularities in the ethnographic data on hunting. Considering the data presented in Tables 1.1 and 1.2, prey density (or migrations resulting in increased prey density) is a commonly cited reason for initiating communal hunts in all latitudes. Optimal foraging theory predicts that clumped, mobile resources are most efficiently exploited by aggregated foragers (Winterhalder 1981). Heffley's (1981) analysis of group size and resource distribution among Athapaskans strongly supports this general proposition. However, that does not explain why communal hunting should occur. Concentrations of animals may indeed attract concentrations of predators, but not all predators hunt communally. In view of the widespread use of communal hunting when prey is aggregated, we would expect communal hunting to confer some sort of advantage on human hunters. The following hypotheses will be examined:

(a) The technology of communal hunting is more efficient (i.e.,

produces more meat per person or more energy per person per unit of energy expended) than the individual hunting of aggregated prey, under certain conditions;

(b) Communal hunting produces a surplus during times of plenty, which is crucial for maintenance of human populations in 'lean' periods following communal hunts; and

(c) Communal hunting decreases search time, by concentrating on dense aggregations of animals, and the decrease in search time compensates for any loss of efficiency.

Technology of communal hunting

Most communal hunts begin in response to a high density of animals, and the effect of the hunt is to produce an extremely high local density of prey, such that killing is made relatively easy. Good examples of this process include the bison pound; caribou, deer, and sheep fences; pronghorn antelope corrals; and circles of burning grass and scrub. In such situations, the technology of killing is relatively unimportant since animals are usually at very close range and are frequently confined by some sort of pen, fence, or trap. Although effective organization is needed to trap animals, they are easily dispatched once trapped. One reason why communal hunting is often dependent on highly aggregated prey is that it is very difficult to force scattered animals into a small area. There are many reasons for this difficulty. Solitary individuals may be more wary than animals in herds, and some herd animals (although not all) can be driven as a group even when they are aware that humans are near. The more concentrated a herd before a communal hunt, the fewer people are needed to force the animals into a very small area. The importance of keeping animals in a herd is seen best in the practices of the Historic Period Plains Indians, who punished individuals who disturbed a bison herd before a communal hunt (McHugh 1972, pp. 58–9).

However, this still does not provide an adequate explanation for the use of communal hunts. Groups of animals might split up if hunted individually, but the regional prey density would still be high, making individual hunting profitable. The widespread use of communal hunting in association with concentrated groups of animals suggests that the relative ease of killing may have been an important factor. Some ethnographic evidence supports this idea. It is obviously difficult to find examples of societies in which different technologies coexist, but, by studying societies where technology has changed through time, a similar 'experiment' can be run. For example, in northern Canada and Alaska, the introduction of modern firearms has reduced the frequency of the communal fall caribou hunt. Although modern Nunamiut and Copper Eskimo still hunt caribou during the fall migration, communal techniques have been replaced by individual hunting using firearms (Gubser 1965, Damas 1972). Ewers (1955, pp. 304–6) suggests that communal hunts

decreased in frequency when the Blackfoot acquired the horse, because individual hunting on fast ponies was a more reliable and rapid method of obtaining meat. In this case, a new technology reduced the time required to position a hunter for a kill as well as increasing the likelihood that a kill would be made. Moving much closer to the equator, modern Bisa of Zambia hunt almost exclusively by stalking with firearms, but there is evidence that they utilized communal techniques for some prey species before the introduction of modern weapons (Marks 1976).

Thus, when animals are concentrated, communal hunting provides a good method for insuring that kills are made. For societies lacking certain technologies, communal hunting reduces the risk that a kill will not be made. Technological innovations that increase the chance of making kills by individual hunting reduce the incidence of communal methods even when animals are densely concentrated.

Production of surplus

The concept that communal hunting produces a storable surplus of meat is widespread in the anthropology of temperate and arctic groups. However, sufficient examples are available from areas nearer the tropics to demonstrate that production of a surplus is not a universal reason for communal hunting. Nevertheless, the widespread use of communal hunts (particularly during the fall) in more northerly areas as a method for acquiring surplus food should be considered as a factor in the organization of communal hunts in many societies. Again, one must ask why communal hunts are required for this purpose when individual hunting could also be undertaken.

If we accept that communal hunting is more reliable, but individual hunting is more efficient, it is possible that reliability is of greater concern than efficiency. Utilizing an efficient hunting method is of interest only if its use releases other members of a group for other productive tasks. In many northern environments the late fall/early winter period when meat is in its prime has little to offer in the way of alternative resources. In such cases, individual hunting confers few benefits, because 'unemployed' members of the group have relatively few tasks to perform. At the same time, it may be crucial to obtain a supply of meat and fat for the winter, and a reliable hunting method may be more desirable than a method that is efficient, but unpredictable in outcome.

Another factor that should be considered in northern regions is that communal hunting, which is most successful when animals are densely concentrated, will probably take place when animals migrate. In order to secure prime condition meat and fat for winter use, a hunting method that slaughters large numbers of animals at a single location is desirable for a number of reasons. First, it reduces travel time searching for scattered resources. Second, it reduces the need to move quantities of meat and fat over great distances to a winter camp. Third, because it is more reliable, it

insures that some meat and fat will be stored for the winter. While individual hunting might produce large amounts of meat one year, stored supplies that last much beyond the winter will be relatively useless since they will be difficult to store and transport during the following summer. On the other hand, a disastrous period of individual hunting in the fall will probably result in starvation. In many animals, high winter mortality results from lack of winter food (Fretwell 1972, p. 53). Because humans have a relatively low rate of reproduction and a long maturation period, populations depleted in one bad year will have a hard time making up their losses. Use of a more reliable subsistence strategy reduces the chances of experiencing bad years.

Search time

As has been noted before, communal hunting occurs frequently when animals exhibit a clumped distributon. It has also been suggested that humans should aggregate when animals are clumped and disperse when animals are scattered. These observations suggest that communal hunting may confer an advantage when hunting takes place under certain conditions. The possibility that communal hunting is a more efficient method of killing has already been explored. We can now turn to another important aspect of hunting: search time. A considerable proportion of a hunt is spent in searching for prey. When prey is scattered (i.e., when it consists of small groups or individuals scattered over an area), search time should be low. Conversely, when prey is clumped (i.e., in relatively rare large groups), search time should be greater (Winterhalder 1981). Since communal hunting occurs when prey is clumped, one should investigate whether this method of hunting compensates for increased search time necessary to locate prey.

The number of animals killed per hunter per day depends upon the following parameters:

(a) density of prey groups, a group of prey containing from a single individual to many animals;
(b) the search time required to find a prey group;
(c) the number of prey individuals in a group that can be killed after a sighting is made;
(d) the success rate of making a kill or kills once a sighting has been made; and
(e) the number of times a day a hunter can search, find, successfully hunt, and process the prey.

To model the general kill rate for communal versus individual hunting under different conditions of prey aggregation a number of the above parameters must either be held constant or ignored. First, regional prey density is held constant, such that, as the number of animals in a group