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## Of Game Keepers, Opportunism, and Conservation

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Published as chapter 17 in *The History and Environmental Impacts of Hunting Deities: Supernatural Gamekeepers and Animal Masters* (Richard J. Chacon, editor), pages 363–376. Cham, Switzerland: Springer. doi: 10.1007/978-3-031-37503-3\_17

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Published online November 1, 2023.

# Of Game Keepers, Opportunism, and Conservation

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## Abstract

In this collection, gamekeepers are supernatural entities that regulate wildlife hunting in a wide variety of ways. They assist the hunters in pursuit of their prey, ritual respect for the game, and the reincarnation of slain animals. In addition, broader considerations are described, such as the mutual moral obligations between hunters and the supernatural. Gamekeepers seem to be nearly universal in those societies that depend on game animals as an important part of their diet, making the topic interesting from an ideological perspective. Some of the chapters argue that gamekeepers play a role in the conservation of prey types. The major aim of this chapter is to argue against any ecological role gamekeepers play in the conservation of hunted animals by examining the widespread role of opportunistic hunting from the perspective of human behavioral ecology. I conclude that there is no evidence to support the claim that belief in gamekeepers promotes conservation. At the same time, the logic behind the widespread presence of gamekeepers and game taboos remains a mystery.

**Keywords:** hunting, gamekeepers, conservation, opportunism, belief systems, ritual, Amazonia, human behavioral ecology, sustainability

## Introduction

What gamekeepers or animal masters do is the focus of all the ethnographic chapters and indirectly through iconography in the archaeological contributions to this volume. Since I am an ethnographer and not well acquainted with archaeological approaches to iconography,

I will restrict my remarks to the ethnographic chapters. In this volume, gamekeepers are supernatural entities who control the reproduction or replenishment of game (Hitchcock; Tepfer), establish a set of moral and reciprocal obligations between humans and resources (Arnold), regulate the conduct of hunters through rewards or punishment depending on their comportment or ritual observances before or after hunting (Mykhailova; Dubey-Pathak; Dye; Hitchcock), proscribe taking game from sacred places (Århem), and allow hunters to kill particular species more easily (Mykhailova; Hitchcock). At a more general level, Chacon and Fernández-Llamazares summarize the gamekeeper literature among native Amazonians, and Arnold does so for a large number of Andean peoples. Most contributions and analyses focus on associated beliefs, rituals, and supernatural relationships from a culturological perspective. Some of the ethnographic papers seek to understand the ecological function, if any, of gamekeepers, a topic that will be my main focus here, especially as it relates to conservation and opportunism.

Given that hunting is a basic food production activity, perhaps one way to contextualize gamekeepers and their roles is to expand the focus to examine the presence or absence of spirits who supernaturally regulate the control of other major food sources such as fish, gathered plants, or crops. Unfortunately, the literature seems sparse for those societies that engage in extensive foraging alongside the agriculture typical of Amazonian peoples. Through a detailed account of garden spirits among the Aguaruna Jivaro, Brown and Van Bolt (1980) note that in Amazonia, magical horticultural rites are rarely reported compared to the literature on hunting, the theme of this volume. An exception outside of Amazonia may be found in Arnold's (in this volume) Andean survey documenting "mountain guardians" and supernatural masters and mistresses in a wide range of subsistence activities. Perhaps, following Arnold's lead, there is more to uncover in Amazonia in relation to non-hunting subsistence domains.

It is possible that there may be rich but underreported belief systems about domesticated or wild plants among many native peoples. Be that as it may, Brown and Van Bolt (1980) cite Carneiro (1970), who speculated that the presence of the supernatural in hunting may be a function of hunting's risky and anxiety-producing nature, a relationship Malinowski (1954) noted long ago with respect to Trobriand fishing. There is psychological literature on anxiety in relation to uncertainty and risk and how it sometimes leads to ritualized behavior or culturally prescribed rituals when success in a task is beyond an individual's complete control (Hobson et al. 2018; Lang et al. 2015). This literature shows that rituals give individuals a sense of control and efficacy. This may be especially useful in hunting when the game can sense a human's presence as a predator and have behavioral repertoires designed to defeat a predator's goal. Compared to hunting, garden crops are under the surer control of humans as they carefully engage in all manner of expert cultivation and care based on their traditional horticultural knowledge, and unlike game plants, plants are unable to devise counter-strategies to prevent their demise. Of course, catastrophic climatic events, insect infestations, and other unpredictable calamities can harm production and lead to uncertainty and ritual precautions. Nevertheless, most of the time, when one visits a garden to harvest, there is little doubt about the result. In contrast, given their vast ethnobotanical knowledge of wild plants that are well-adapted to the

environment, their locations, and their lack of mobility, anxiety seems not to be an issue for gathering.

### **What Gamekeepers Do**

Gamekeepers and congeners such as animal masters, guardian animals, or masters of animals (Dye, this volume) and their interactions with hunters are the main subjects of this collection. Many of these beliefs focus on a hunter's ability to successfully take the game, the automatic reincarnation of the game taken by hunters through the agency of game masters, and how shamans communicate with gamekeepers to maintain their goodwill and continually make game available.

In a review of Near Eastern iconography, Stein (in this volume) argues that gamekeepers guide hunters to game or withhold game if proper rituals are not employed. Proper killing and associated rituals are also present in North America (Dye, this volume) as well. Replenishment or rejuvenation of the game is a common task of gamekeepers, as shown in the chapters by Chacon, Tepher, Stein, Garfinkel, and especially Dye. Dye describes the reincarnation beliefs that were widespread in North American hunting cultures and their close connection with shamanism noted in other chapters (Tiley, Hitchcock; Fernández-Llamazares and Virtanen 2020; Mykhailova and Garfinkel, all this volume). Dye, however, notes that overharvesting led to the near extinction of white-tailed deer and beaver in the Northeast during the fur trade, even though native peoples continued to believe in their immediate reincarnation, as do contemporary dugong hunters described by Tiley (in this volume). Like Dye, Tiley associates extreme dugong (*Dugong dugong*) depletion as a direct consequence of external demand brought on by globalization and trade.

Århem's contribution presents a unique geographical perspective, absent from others in this volume, by extensively documenting the existence of "spirit areas or forests" among the Katuic-speaking people of Laos. It is believed that certain areas are ruled by local spirits who strongly circumscribe human activities, which leads Århem to document greater biodiversity in those areas. The recognition of sacred places where extractive activities are spiritually regulated is practiced elsewhere in Southeast Asia (Sponsel 2016). Consequently, some areas may not be farmed or have restrictions on foraging activities. According to Århem, each village has several spirit forests that encompass anywhere from 15% to 30% of their territory. Many of these areas are old-growth forests with high biodiversity, apparently maintained through use restrictions. This may parallel what conservation biologists refer to as sink-source dynamics (Novaro et al. 2000), as noted by Chacon (in this volume). That is, distant areas or sources (also called refugia) can replenish hunted or sink areas. In his contribution to this volume, Århem states that these areas act as a conservation regime, a local patchwork of nature reserves. And further states that the set of beliefs and practices associated with these spirit forests constitutes an ethical code. As I detail below, having territorial control over an area, which seems to be the situation in Århem's case studies, is an important precondition for conservation.

## Theoretical Perspectives

How gamekeepers may relate to ecological and economic theories of hunting is complex. With respect to the impact of native hunting on game populations, I suggest there are two camps, even though my division is a bit of an oversimplification. The conservation camp (Traditional Ecological Knowledge [TEK] perspective noted by Chacon, in this volume) believes that native practices and beliefs lead to the conservation of game species, and this view is most forcefully argued by Fernandez-Llamazares et al. and Århem (in this volume). Contrastingly, the opportunistic camp championed by Chacon, Tiley, and Dye (in this volume) argues that hunters are interested in maximizing their rates of return while foraging without concern for the future. I have written on this topic (Hames 1987, 2007) and concluded that conservation in small-scale egalitarian societies rarely occurs. However, it certainly exists in some chiefdom-level societies, as I describe below. In the following section, I review the broader conservationist and opportunist literature.

### *Conservationists*

Conservationists generally claim that native peoples live in harmony with the environment, and any deviation from harmony is usually a consequence of outside influences by colonial powers or commercial interests. The connection between gamekeepers and conservation in the recent past could be said to have begun with historian Calvin Martin in his widely cited “Keepers of the Game” (1978), wherein he claimed that prior to European colonization and invasion, native North Americans lived in harmony with game populations. This generalization resonated widely among conservation groups such as the Sierra Club. It also resonated with early cultural ecologists such as Rappaport (1983), who argued that human cultural ecological systems were self-regulating through ritual practices so that they did not overshoot the carrying capacity of the environment. Martin argued that many aboriginal North American groups believed that gamekeepers would maintain the supply of animals if rules of etiquette, restraint, and ritual were followed. Conversely, if such requirements were not followed, then gamekeepers could cause disease, starvation, and other forms of retribution on hunters, their families, and even their villages. The ethnographic contributions to this volume describe in great detail these practices and the negative and positive consequences should the rules be broken or followed. Martin then argued that native peoples blamed diseases and starvation initiated by expanding European invaders on their supernatural gamekeepers who had broken their agreement with native people to keep them supplied with the game and to prevent catastrophic events such as epidemics and starvation so long as appropriate rituals were practiced. In turn, this led native hunters to wage a vengeful “war on animals,” which ultimately led to overhunting and the local extinction of game in the context of the fur trade. In response to Martin’s widely heralded monograph, Krech (1981) organized an edited volume critiquing Martin’s work and followed it with a (1999) monograph broadly examining the evidence that Native North Americans lived in harmony with the environment. In conservation biology, Kent Redford (1991) extended the critique using the ironic phrase “The Ecologically Noble Savage.”

In Amazonia, belief in supernatural gamekeepers and their role in conservation through reincarnation and proper rituals and taboos was widely theorized by earlier researchers such as Reichel-Dolmatoff (1976), McDonald (1977), and Ross (1978). In this volume, Fernández-Llamazares et al. and Chacon review some of the comparative Amazonian research on this topic. Historically, the work of Reichel-Dolmatoff (1976) on the Tukano has been particularly influential. The Tukano have a large number of complex requirements based on sexual behavior, reproductive condition, and diet that must be followed by hunters to enjoy the blessings of the “Master of Animals.” Breaking his rules leads to a variety of dire consequences. Even though his culturological emphasis is on spiritual harmony, Reichel-Dolmatoff veers toward the mundane ecological when he states, “The three aspects I have mentioned—population growth, the exploitation of the physical environment, and the control of aggression—can be reduced to one single problem, that is, the maintenance of a balanced ecosystem” (1976:314).

With respect to this concept of balance or conservation, contributions by Fernández-Llamazares et al. and Århem (in this volume) use the synonymous term management without a clear definition other than that certain species or land areas are taboo or hunters follow a variety of appropriate rituals when taking the game to maintain positive social relations with game masters. It seems to me that tabooed areas in Århem’s study of the Katuic-speaking people of Laos may serve to maintain local biodiversity and may be designed to do so as a form of management. I find it significant that villages corporately own protected areas (even though Århem notes the government does not recognize such ownership), which, as I have noted, is a requirement for conservation (Hames, 1987; and below). I hope Århem continues his research with an emphasis on measures of biological diversity and human use. Fernández-Llamazares et al. also mention the existence of “spirit sites,” which require circumspect behavior by Tsimane who enter these areas, but their extent and role in management are not elucidated. More to the point, Fernández-Llamazares et al. claim that the Tsimane engages in sustainable management by following procedures enforced by gamekeepers through their shamans. At the same time, they note that young Tsimane no longer follows traditional game taboos because of consumption needs in the face of game scarcity, even though their elders explain scarcity in terms of breaking the traditional relationship between hunters and game masters by not following associated rituals. Thus, current scarcity is a consequence of ignoring the commandments set down by game masters.

In making their case, Fernandez-Llamazares et al., cite Vickers’ 10-year study of the Siona-Secoya as an example of sustainability. Vickers’ research (1988, 1995) is very important because, at 10 years, it is the only long-term study documenting levels of yearly game depletion. However, Vickers reports the depletion of three species in core hunting areas, and he points out that the sustainable harvesting of other species stems from the fact that “. . . most men are hunting less because of their greater involvement in cash-earning activities . . .” (Vickers 1995:330). He also notes, “The data also suggest that they have hunted with a strategy of maximizing short-term yields in order to provision their households with meat, an important component of their daily diet. The available evidence suggests that the Siona and Secoya do *not* purposefully limit their kills to insure the long-term sustainability of game animals” (Vickers 1995 :309, emphasis added).

As noted earlier, proponents of conservation and related concepts have not defined and operationalized the closely related concepts of conservation, stewardship, and management to determine whether they are realized by the practices of native peoples. A widely used definition of conservation in human ecology comes from Smith and Wishnie (2000: 501), who state that a conservation practice or action “. . . should (a) prevent or mitigate resource depletion, species extirpation, or habitat degradation, and (b) be designed to do so.” Following Hunn (1982), the design criterion is crucial. If a group exploits game resources without causing depletion, it is not necessarily evidence of conservation, rather, it could be the result of low harvest rates as a consequence of low demand or inefficient technology. When low levels of depletion occur without design, Hunn named this a side effect or epiphenomenal conservation. In requiring design, one needs to demonstrate that one reduces short-term harvesting for the long-term goal of keeping the resource around for future benefit. For example, design elements found in modern conservation regulations are based on counts of a particular species, with the goal of setting quotas on a yearly or seasonal basis. Such regulations may include not killing females or young, setting bag limits and size limits, and prohibiting hunting in certain areas. These regulations are designed to limit short-term, indiscriminate extraction, leading to the long-term persistence of game populations.

Sustainability and management are used most explicitly in the applied literature. Sustainability is derived from the concept of maximum sustainable yield (MSY) in wildlife biology and is defined as the “. . . highest average catch that can be continuously taken from an exploited population . . . under average environmental conditions” (Tsikliras and Froese 2019:109). Included in this definition are regulations or practices, as noted earlier, designed to achieve such an end. Management is a yet broader term to characterize anything from regulations on the taking of species to broad-scale environmental modification through burning and other means to enhance the environment in terms of human economic goals. It is defined as “. . . all those policies and practices that effectively sustain ecosystem composition, structure, productivity, and integrity” (Burton 2005:306).

The concept of management may be problematic as it relates to conservation or sustainability. For example, researchers have long noted that native peoples burn large tracts of land in order to create an ecosystem beneficial to humans and use the term management to characterize this activity (Lewis 1982). But burning may prevent or interrupt natural ecological successions to maintain grasslands by preventing forest succession, which has both positive and negative implications for a variety of game species as well as broader implications for biodiversity. In this case, management through burning is done for the benefit of humans and may harm or destroy other living components of the ecosystem. This burning by hunter-gatherers is called “cultural burning” or fire-stick farming, and it is found worldwide (Lewis 1982; Long et al. 2021), and evidence for it may date from as early as 50,000 years ago (Hunt et al. 2007). An excellent recent study is Bird et al.’s (2005) detailed research on Martu hunter-gatherers in Australia. Despite their meticulous research on burned areas, they note that it is unclear whether the benefits are long or short term as far as Martu subsistence is concerned (Bird et al. 2005 :457).

There are reports of wild plant management and agroforestry in the Amazon contained in the edited volume by Posey and Balee (1989). Following swidden abandonment, there

is the creation of an anthropogenic forest dominated by valuable plants such as Brazil nut trees or moriche palms. The degree to which this is by design needs further investigation, as evidenced in the debate around the Kayapó *apêtê* or managed forest (Parker 1992; Posey 1992).

I must emphasize that the factors of low population density leading to low local demand and a lack of external markets show that native Amazonians rarely deplete game populations. A wide-scale study by de Paula et al. (2022:1) on 30 Amazonian communities studied over 63 months shows that “These findings reflect the exceptionally low human population density and continuous forest cover of the study landscape, and long-term hunting sustainability and local protein acquisition will depend on maintaining these social and environmental settings.” This represents yet another example of sustainability as a side effect of low demand created by low human population density. A similar point is made by Shepard (2002) for the Matsigenka of Peru. It is also important to note that lands inhabited by small-scale native peoples have the greatest biodiversity anywhere on the planet (Fletcher et al. 2021; Schuster et al. 2019). However, I will argue below that there is little empirical evidence that native practices are *designed* to maintain or enhance biodiversity but are rather a side effect of inefficient technology and low demand.

### *Opportunists*

Those in the opportunist camp generally stress that hunters will attempt to maximize their net rate of return while hunting, which is a fundamental prediction of optimal foraging theory (Pyke et al. 1977), whether one is a time minimizer or an energy maximizer. In this perspective, individuals attempt to achieve their goals as efficiently as possible without regard to the future. Rates of return are optimized for time minimizers because hunting as efficiently as possible allows hunters to engage in other crucial fitness behaviors such as childcare, rest, and maintenance of social ties. Optimal foraging allows energy maximizers to gain as much food as possible, especially in impoverished environments or when food must be preserved for future use when resources, for example, become seasonally unavailable. Optimization models occupy a wide literature, from evolutionary biology and paleontology to conservation biology and anthropology.

One important but indirect application of opportunism in paleontology comes from Martin (1966), who argues that the disappearance of megafauna (mammals greater than about 46 kg) in the New World was a consequence of opportunistic human hunting. He holds that as hunter-gatherers moved into the New World, prey animals encountered new super predators (i.e., humans) with whom they had no previous experience, making them easy targets. Megafauna were especially targeted because of their high rates of return, as loosely predicted by the diet breadth model (Pyke et al. 1977). Given these two facts, Martin claimed that human hunting caused their extinction. In the New World, at least, the overkill hypothesis may be problematic for several reasons. The empirical issue revolves around the timing of humans’ entrance into the New World and the subsequent extinction of megafauna. Meltzer (2021) shows that of the 38 genera of megafauna living during the Pleistocene, 20 had become extinct before the arrival of humans. This suggests a long-term trend of megafauna decline as perhaps a consequence of environmental change (see also Grayson and Meltzer 2003). While there are some 16 megafaunal kill or scavenging sites



attributed to humans, there are hundreds of modern bison kill sites where hundreds to thousands of animals were killed, yet bison at the time of contact were plentiful. The paucity of extinct megafauna kill sites suggests that the megafauna at those kill sites were already on their way to extinction. However, Grayson and Meltzer (2003 ) admit that the relatively recent extinction of some New World island fauna (e.g., Hansford et al. 2018 ) was likely a consequence of humans.

Martin's overkill model has been extended to cover the disappearance of megafauna worldwide during the late Pleistocene (Dembitzer et al. 2022; Sandom et al. 2014). The issue is far from resolved. Nagaoka et al. (2018) note that there has been little interaction between archaeologists, ecologists, and paleontologists to resolve this issue. Their survey of researchers shows that paleontologists and ecologists strongly support the overkill hypothesis, while archaeologists largely believe megafaunal extinction may be a combination of overkill and environmental change.

In our contemporary scene, one needs quantitative data on game offtakes over time to demonstrate whether following the rules and practices required by supernatural game masters leads to conservation. Unfortunately, those who claim conservation practices are mediated by supernatural gamekeepers do not present quantitative data on game harvesting. In contrast, those who characterize native peoples as opportunists have extensively measured game harvesting and tested conservation hypotheses among native Amazonians (Alvard 1993, 1994; Chacon 2012, this volume; Hames 1991; Smith 2001; Stearman 1994; Vickers 1988). In all cases, they have shown that native Amazonians are opportunists and not conservationists. Nevertheless, a significant problem in most of these studies is that they have sampled for only 1–2 years. To convincingly demonstrate conservation or opportunism, we need greater time depth. Vickers' (1988) research (noted above) is the best we have, and as mentioned above, he finds opportunism and not conservation.

### **Conditions for Conservation**

There is clear evidence that native peoples can engage in conservation. In 1987, I (Hames) identified the set of conditions that would have to exist for conservation. They are as follows: territoriality to prevent outsiders from spoiling the conservation efforts of locals; internal checks to prevent cheaters within the territorial unit from spoiling the restraint of those who conserve; and a lack of external markets for production beyond limited local consumption. Later, Rogers (1991) added another condition revolving around the long-term reproductive consequences of prodigious versus conservative resource use.

When I began writing on conservation, I wish I had read the excellent survey by Johannes (1978) on Pacific island fishing conservation. In it, he provides compelling evidence of traditional conservation practices that meet my above-stated requirements for the evolution of conservation. Many of these societies have powerful chiefs who have territorial control over reefs, lagoons, and sometimes distant offshore fishing locations. Control may also extend to terrestrial resources such as tortoise and bird nesting sites. Such powerful leaders are absent in small-scale Amazonian societies. Externally, Pacific island chiefs can prevent individuals outside of their territorial domain from fishing, thus reserving it for their own people. Internally, chiefs may also fine or otherwise punish locals for breaking

fishing regulations. For example, within a chief's domain, he can establish catch limits, prevent off-season fishing, and specify which family groups can fish. Individuals who break such rules are fined and/or shamed (see Johannes 1978:353, Table 1, for a long list of conservation measures). In addition, chiefs would take punitive measures against outsiders who fished in their territories (Johannes 1978).

Johannes (1978) describes how these sustainable systems began to break down when colonial officials and western-educated local leaders encouraged commercial export fishing to satisfy external demand in order to raise money for development (see Dye and Tiley, in this volume). In the process, local fishermen were able to bypass the power of traditional chiefs, whose aim was to ensure local demand was met. He specifically noted sharing practices that aligned chiefly regulations with the moral economy (Johannes 1978:356).

Prior to Western contact it was customary in most of Oceania to share one's catch with one's fellow villagers and to receive products of their labor in return. It is difficult to convey the fundamental importance of this custom to Westerners whose most basic assumptions about the distribution of goods and services are firmly rooted in a money economy.

As chiefly control diminished through colonial takeover and later native governments bent on modernization to export fish for profit, widespread depletion of fishing stocks rapidly occurred. In this volume, Tiley's contribution demonstrates the role of external markets in leading to the depletion of dugong numbers in the Torres Straits. The drastic plunge in dugong numbers was also abetted by the introduction of nets. Mirroring the findings of Johannes (1978), Tiley also notes how the loss of dugong sharing rent social relations between families and diminished the culturally valued roles of shamans who could maintain stocks and the status of superior dugong hunters. Notably, Nobel laureate economist Elinor Ostrom (1990) used the Polynesian data as an example of how commons are managed for sustainability and conservation.

### **Dietary Game Taboos**

It is rather surprising to me that game taboos per se are not addressed or linked in this collection, as early arguments about conservation and sustainability in Amazonia focused on this topic. I would note, however, that Arnold (in this volume), for Andean peoples, documents "alimentary exogamy," which is similar to a fairly common Amazonian taboo prohibiting hunters from eating their own kills. By game taboos, I mean the prohibition on consuming and sometimes killing particular animals. Following Ross (1978) in his comprehensive examination of Amazonian game taboos, when applied to the entire population, they are called "general taboos," and when applied to a specific age, sex, ritual, reproductive status, etc., they are called specific taboos. In an earlier comparative study of 11 Amazonian societies, McDonald (1977) argued that game taboos in Amazonia serve as a "Primitive Environmental Protection Agency." Like Ross, he details taboos on the consumption of game animals (but not always killing) that are restricted to a particular age, sex, reproductive status (pregnant or lactating), or parenting status (parents of very young offspring).

Ross, in contrast, argues that general game taboos are designed to maximize hunting efficiency. That is, certain game animals are proscribed because pursuing them would lower a hunter's overall rate of return. In short, Ross uses an opportunistic approach to explain game taboos, while MacDonald argues for conservation.

Game taboo theories based on conservation or efficiency are problematic for a number of reasons. First, even though a hunter or family member may not be able to consume a game animal, a hunter can give it to others who are not restricted (Arnold, in this volume). McDonald (1977) seems to assume that game tabooed for a successful hunter or his family is not widely shared among co-residents. However, the sharing of games outside of one's family, especially large games, is common in Amazonia (Hames 2000) and elsewhere (Gurven 2004). By sharing, successful hunters gain prestige and status, and through reciprocity, may expect the return of a game animal they or their families can consume. Second, if the taboo is general, this only puts increased hunting pressure on non-tabooed game animals. Third, certain species, most prominently big game such as tapir, capybara, and deer, are generally or completely taboo, according to Ross' survey (1978): they cannot be killed or consumed by anyone. If these taboos were designed for conservation, one would predict that they would perhaps be switched on or off depending on game levels. But no such evidence is provided by Ross or MacDonald.

In my own research among the Yanomamö, I found that brocket deer (*Mazama americana*) and capybara (*Hydrochoerus hydrochaeris*) may be generally tabooed in some areas but freely hunted and consumed in others. At a specific level, teenagers, pregnant women, and those in certain ritual states are proscribed from eating a large number of common game animals (Lizot 1991:73, 76, 165). I have no explanation other than a purely cultural one. On the other hand, all carrion-eating birds are tabooed by the Yanomamö, which may be a consequence of them carrying infectious pathogens and therefore is adaptive.

It seems to me that prohibition on large games from either conservation or opportunistic perspectives presents an interesting problem given the variation we see from culture to culture or within cultures. From an opportunistic perspective, it may be the case that heavily predated games exhibit what is known as behavioral depression (Charnov et al. 1976). In such cases, the game may become nocturnal, more alert to predators, or relocate to inaccessible zones (e.g., thickets or swamps), lowering their rate of return upon encounter and thus placing them outside of the optimal diet breadth. If this speculation is correct, then some general game taboos make sense in terms of the diet breadth model, but there is no good empirical evidence for this being the case. Alternatively, but along similar lines, Carneiro (commentary in Ross 1978) hypothesizes that the blanket taboo on all terrestrial game animals among many of the Upper Xingu (e.g., Kalapalo, Kuikuro, and Mehinaku) societies may be a consequence of the abundance of fish and their apparent high rate of return per unit effort compared to terrestrial game. In these societies, the game is regarded as unfit for human consumption for a variety of supernatural reasons. In these instances, game taboos may be an adaptive rule to maximize foraging success in the quest for high-quality protein, but only in fish-dependent people.

## Conclusion

How do we explain the presence of gamekeepers and their similarities in so many societies? From a materialistic and behavioral ecological perspective, I can see no adaptive rationale for these beliefs and practices in terms of foraging efficiently or conserving or maintaining biodiversity. From my limited perspective, the only potential for a comprehensive theoretical approach is Malinowski's (1954) ideas about uncertainty in regard to risky and uncertain economic activities, which are to some extent endorsed by Carneiro (1970). That is, ritual and associated beliefs develop when the outcome of a subsistence activity is uncertain or risky. The roles of supernatural gamekeepers are deeply rooted in the belief systems of the people surveyed, which are so richly documented in the ethnographic contributions to this volume.

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