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MAYA ANIMAL PROTEIN PROCUREMENT AND UTILIZATION: AN ASSESSMENT OF THE ETHNOHISTORIC EVIDENCE

by

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THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

in the Department

of Archaeology

SIMON FRASER UNIVERSITY

September 1987

ISBN 0-315-42598-9

APPROVAL

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Degree: Doctor of Philosophy

Title of Thesis: Maya Animal Protein Procurement and Utilization: An Assessment of the Ethnohistoric Evidence

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Abstract

A model of Maya animal procurement and dietary uses of animal protein is presented, based upon data derived from a systematic examination of native Maya ethnohistoric documents and European literature of the Conquest and early Colonial periods. Hypotheses concerning resource exploitation patterns, preferred species, hunting strategies, restrictions on consumption, and possible conscious efforts to preserve game habitats were tested against the ethnohistoric record. Specific issues addressed from a general cultural ecological perspective included the possibility of specialized animal procurement occupations; animal management; the question of protein scarcity in a neotropical rainforest environment; cultural rules supporting differential access to available animal protein; and ways in which Maya ideology may have affected the dietary and economic uses of animals.

A systematic species list annotated with descriptions from the ethnohistoric literature, and similar material on hunting and fishing methods and techniques, are presented and compared with data derived from analysis of archaeological remains, and with ethnological data reported ~~for~~ Maya groups.

Species rankings based on averaged ranks derived from ethnohistoric, ethnological and archaeological

samples showed a primary preference for deer, canids and galliform birds as food species, followed by a group of terrestrial mammalian species. Species data from all three samples were generally in agreement, and data from the ethnohistoric sample tended to support a majority of the predictive hypotheses. A wide variety of faunal species, including insects, appear to have been utilized by the Maya for dietary purposes.

Possible sources of bias affecting these results, and the validity and limitations of ethnohistoric research methodology for addressing subsistence questions, are examined and evaluated.

DEDICATION

This study is dedicated, with gratitude,

to

Sharon de Roo,

without whose encouragement, support and

intervention it could not have been completed.

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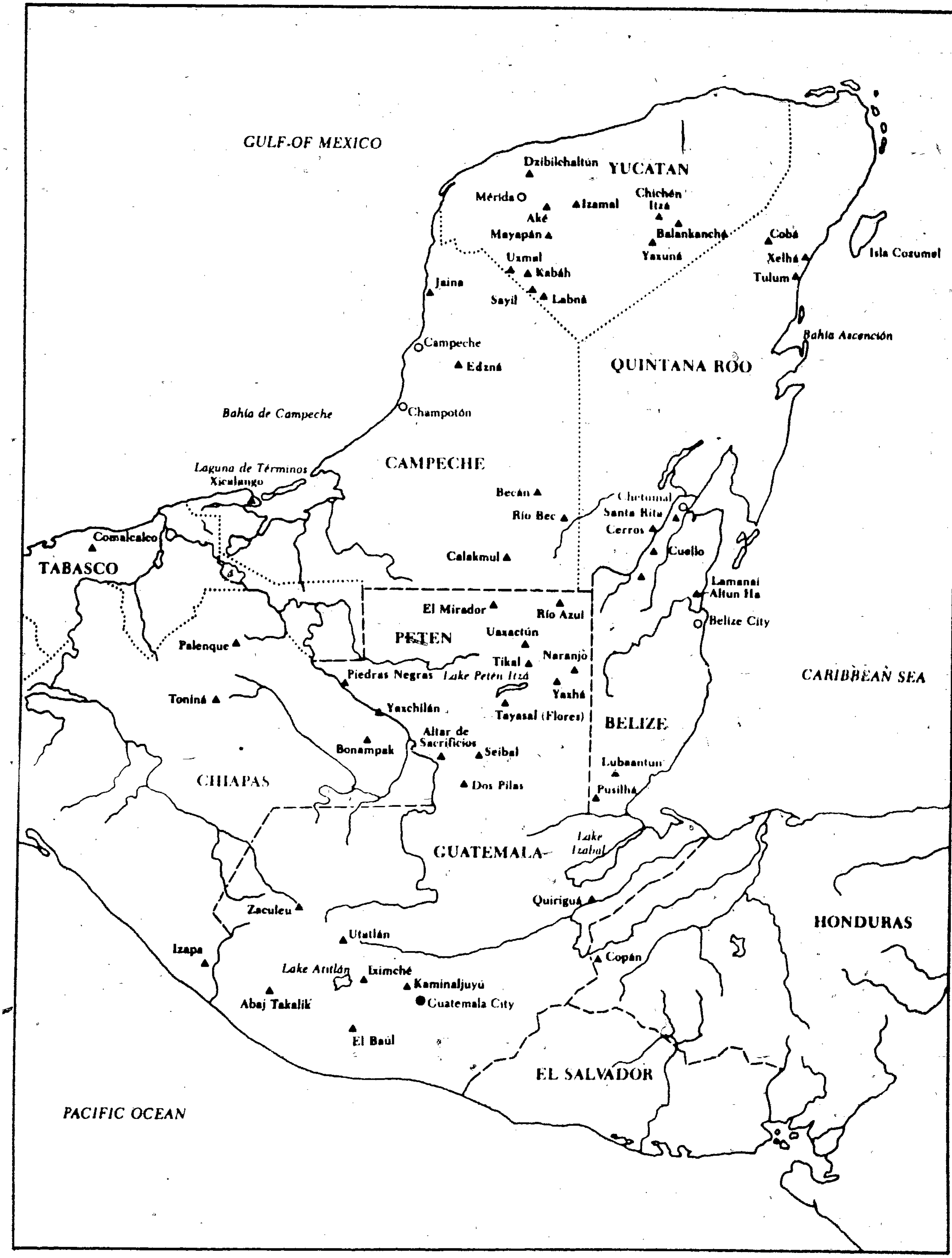

Fig. 1
THE MAYA REGION
Principal Archaeological Sites

I. INTRODUCTION AND BACKGROUND

A. Objectives of This Investigation

The overall objective of this investigation is to synthesize and evaluate data derived from a systematic examination of ethnohistoric documentary sources, as a basis for assessing the significance of animal products in prehistoric Maya diet and economy, and their relative contribution to subsistence. Some specific problems to be addressed are the following:

1. Whether it is possible to determine, from the various kinds of available evidence, how important a part animals played in Maya diet and economy at the time of European contact, relative to vegetable products derived from cultivated crops;

2. Whether animal protein was of sufficient dietary and economic significance to support a class of specialized hunters, fishermen, or other animal procurement specialists during the Classic and Postclassic periods of Maya civilization;

3. What species, besides the domesticated dog and turkey, appear to have been subject to human management and control at the time of Spanish contact, and to what extent;

4. How factors of social rank, class, and sex affected the consumption of animal protein among the Maya, and whether cultural rules or taboos existed that functioned to regulate animal protein consumption

according to these factors;

5. How ideology and world-view may have affected Maya decision-making with respect to which sources of animal protein were selected for exploitation, strategic planning for animal procurement, and scheduling of various procurement activities.

This study is relevant to the archaeology of the Maya area, where subsistence methods designed to support large urban populations have been a major focus of archaeological field research during the past several decades (Harrison and Turner 1978; Turner and Harrison 1983; Flannery 1982). Many such studies have emphasized agriculture, especially technological methods for intensifying maize cultivation. The role of animals in Maya subsistence has, however, been comparatively neglected.

The present study addresses this hitherto under-investigated area, utilizing the available body of documentary materials as a supplement to archaeological and ethnological data, in an effort to arrive at a more balanced and complete picture of Maya subsistence in the prehistoric period.

B. Geography and Ecology of the Maya Region

The region inhabited by the Maya extends about 850 km north to south and 500 km east to west, encompassing an area of approximately 350,000 square km lying entirely within the tropics (Hammond and Ashmore 1981:20).

Included within this area are the present Mexican states of Yucatan, Quintana Roo, Campeche, most of Chiapas and part of Tabasco; the independent state of Belize; much of Guatemala, including all of the Department of Peten; and the northeastern portion of Honduras (Figure 1). A good description of the climate and physical geography of the Maya area may be found in Pohl (1976:15-45).

Although most of this region is relatively low in elevation, mountainous areas are also found here. These include the Maya Mountains of Belize, the volcanic Guatemalan highlands, and highland Chiapas along the western periphery of the Maya region.

While its tropical climate and rainforest vegetation have been heavily emphasized, the Maya homeland is in actuality characterized by considerable geographic and physiographic variability, as well as a diversity of plant species and vegetation patterns associated with widely differing localized environments. Grassland and scrub vegetation abound in the northern Yucatan Peninsula, with a gradual transition in the southern portion of the peninsula to the tropical rainforest typical of Chiapas and the Peten. Elevation and relief increase as one moves southward and inland, rising to hills of about 130 meters in the northern Yucatan interior (West 1964). Still further south lie the precipitous volcanic mountains of highland Guatemala, providing the coolest climatic conditions, as well as the highest elevations occurring in the

Maya homeland. A large portion of the region consists of the lengthy coastlines of the Gulf of Mexico and Caribbean Sea, with estuarine areas providing natural refuges for many wildlife species. Coastal saltbeds furnished an important resource exploited for long-distance trade.

Because of its karstic nature, no surface streams occur in the northern Yucatan, making water resources very limited. Subterranean streams are present, however, and the peninsula is pitted with <u>cenotes</u>, (a Spanish corruption of the Maya <u>dzonot</u>), the natural sinkholes resulting from cave-ins of surface rock above underground stream channels, or from water seepage into the numerous limestone caves present in this area. These <u>cenotes</u> served as the major water source for Maya inhabitants from prehistoric until recent times.

In the highlands to the south, water resources are more varied and plentiful. Here, numerous streams provide habitats for fish, and several major river systems became avenues for inland trade.

Most of the lowland area is distinguished by hot tropical temperatures, reaching daily highs of 38 degrees Celsius in some locations. Humidity is also high, varying from around 88 percent in the rainy season, to a mininimum of 60-70 percent in the dry seasons. Maximum rainfall occurs between May and December, ranging from less than 500 mm in northwestern Yucatan, to over 3,000 mm in the mountains of Chiapas. Belize and the Peten receive about

2,000 mm annually) (Hammond and Ashmore 1981:23-24).

Although tropical rainforest has been considered the typical lowland vegetation pattern, a variety of mcro-environmental zones exist here. Along the coastline, salt playas, lagoons and estuarine areas, and mangrove swamps may be found, the latter gradually merging into tropical forest (Voorhies 1978). Areas of savanna occur in the Peten (U. Cowgill 1966; Rice and Rice 1979, 1980), and a series of large lakes provide a localized lacustrine environment. Other microenvironmental zones include river valleys and areas of fertile alluvial plain, as well as the cloud-shrouded mountain alpine meadows of highland Guatemala.

Terrestrial fauna are relatively uniform throughout the area, including many species common to both Central and South America (Stuart 1964). Mammals known to have been hunted by the Maya include the white-tail and brocket deer, two species of peccary, tapir, monkey, and jaguar, as well as such smaller species as rabbit, agouti, and paca. Birds used as food included doves, parrots and especially the *chachalaca* (grouse), as well as both wild and domesticated turkeys. Edible reptiles hunted were the iguana, crocodile, turtle, and several varieties of lizard (Wing 1974, 1978, 1981).

Marine species were undoubtedly of economic importance to the Maya, and the coastal waters surrounding the Yucatan Peninsula supply nutrients supporting a variety of forms (Collier 1964; Lange 1971). Fishes, crustaceans, molluscs, marine turtles and sea mammals live in these waters. The manatee was used as a source of both meat and oil, especially by island populations, and sharks may have been hunted for their livers (Borhegyi 1961). Marine resources were quite variable, however, depending upon seasonal and climatic factors. The _nortes_ that occur periodically along the upper Gulf coast can lower water temperatures suddenly and drastically, with drops of as much as 40 degrees F. in as little as four hours, resulting in massive fish kills (Gunter 1941:204, cited in Collier 1964:141-142). Although such extremes as this are rarely observed in the southern Gulf or in the Caribbean, variability in marine resources due to water temperature changes, as well as periodic infestations of toxic organisms producing the phenomenon known as "red tide" (Collier 1964:142), and fluctuations in salinity during seasonal flooding that affects abundances of estuarine species (Wing 1978:29), may have been instrumental in inducing the Maya to exploit a wide variety of resources from a multiplicity of microenvironments for their subsistence.

C. Taphononomic Factors Affecting the Study of Maya Subsistence

The role of taphonomic processes in producing the archaeological record of the Maya has not often been explicitly considered, although the effects of such processes are a subject of frequent discussion in the bio-archaeological literature. While remains recovered from Maya sites have been affected by many of the same depositional and transformational events, both natural and cultural, as affect archaeological materials in other parts of the world, including the effects of soil conditions, erosion, faunal activity, and especially the activities of later human populations, a particular configuration of taphonomic processes may be unique to this area, interacting to produce an archaeological record presenting some singular problems.

The effects of torrential rains during a large portion of each year, and such related hydrographic events as sudden rises in lake and river levels, have produced repeated inundations of prehistoric Maya agricultural field systems, destroying the remains of many subsistence activities (Miksicek 1983; Bloom 1983). Soil acidity, as well as humidity and high temperatures, have prevented the preservation of significant amounts of organic material in a most archaeological sites. The tropical environment encourages the growth of lush vegetation, including large tree species whose root systems destroy buildings, and dense undergrowth obscuring entire settlements. The effects of human destruction, through prehistoric and historic looting activities, deliberate destruction of sites by vandals, and the longstanding Maya habit of quarrying old buildings for construction materials, have further contributed to the perturbation of archaeological deposits.

On the other hand, some processes affecting archaeological site formation in other parts of the world do not affect the Maya area, notably the effects of frost, freezing and thawing, which are virtually unknown at lowland elevations and of limited significance even at the highest elevations. Their absence is, however, offset by the above-mentioned processes peculiar to the Maya region. In addition, climatic and soil factors have combined to destroy organic materials, with the result that faunal and human skeletal remains tend to be preserved only in small quantities, and often in relatively poor condition.

D. Summary of Maya Culture History

Although archaeological evidence indicates the Maya region has been occupied for more than 10,000 years (MacNeish, Wilkerson and Nelken-Turner 1980; MacNeish 1981, 1982; MacNeish and Nelken-Turner 1983; Zeitlin 1984), genetic links between the earliest inhabitants and the lowland Maya who produced the civilization of the Classic period have not been established.

Most of the archaeological material documenting the Archaic period has been recovered in Belize, during the four seasons of intensive survey conducted by the Belize

Archaic Archaeological Reconnaissance. This project, under the direction of Richard MacNeish, between 1980 and 1984 located over 150 sites that were designated "preceramic". Six phases have been tentatively identified, one attributed to a late Paleo-Indian occupation, the others to a series of Archaic occupations, although the dating of the deposits characterized as "Archaic" is far from certain. The Paleo-Indian Lowe-Ha Phase (9000-7500 BC) is characterized by Plainview and fishtail projectile points, snubnosed scrapers, blades and choppers. The fishtail points resemble those recovered in South America, where they were presumably utilized by similar groups of late Paleo-Indian nomadic hunters.

The Archaic Period

The Archaic period begins with the earliest evidence of a post-Pleistocene readaptation following extinction of the Ice Age fauna, marked by a shift to new subsistence strategies based upon the utilization of several microenvironments on a seasonal basis, including the marine resources of coastal zones. Ground stone implements make their first appearance here, indicative of the increasing use of seed and plant foods in the diet. Large temporary settlements, perhaps seasonal macroband encampments, tend to occur at the intersection of two or microenvironmental zones, suggesting the earliest beginnings of a later sedentary lifeway in permanently settled villages. This transition appears to have been associated with the occupation of fertile alluvium suitable for food production. The transformation in subsistence this implies appears in Belize, as in other parts of the world, to have been accompanied by the appearance of pottery manufacture. Earliest Maya ceramic wares, the hallmark of the beginning of the Proclassic, or Formative, period, appear in the Swasey phase at the site of Cuello, Belize, about 2000 B.C. (Hammond et al 1979), and in the Pacific coastal area (Barra and Ocos complexes) at about the same time (Morley 1983:367).

The Preclassic (Formative) Period

The Preclassic, or Formative, is usually defined as beginning with the appearance of ceramics in sedentary farming communities, and ending when the first dated and inscribed stone monuments erected by the lowland Maya. The period is subdivided into Early, Middle and Late phases, originally defined by relative dating based on ceramic seriation, and more recently confirmed by a series of radiocarbon dates. A full discussion of the various phases of Maya culture history may be found in Morley (1983:19-186).

The Preclassic was first defined at the site of Uaxactun in the Peten by Robert Smith. Gordon Willey's work in the Belize Valley during the 1950's (Willey et al 1965) extended archaeological documentation of the Preclassic back into the eighth century BC. Lowland sites of earlier date were not discovered until excavations in Belize during the 1970's. The site of Cuello, excavated by Norman Hammond, revealed a stratified sequence of Early Preclassic through Late Classic deposits, and yielded some 20 radiocarbon dates, corroborating the stratigraphic sequence and extending knowledge of the Early Preclassic back to about 2000 BC (Hammond 1982).

Flotation of carbonized botanical remains from Cuello demonstrated the early cultivation of maize and squash. Root crops appear here in the late Preclassic, and cotton cultivation also began at about this time.

Other sites in Belize--e.g., Colha--have produced Middle Preclassic material (Hester 1982). The Late Preclassic is well documented in Belize, especially in the north at such sites as Cerros, where evidence of dense habitation and elaborate architecture have been found--(Freidel 1978); and Lamanai, where a temple-pyramid 33 meters high was erected in the Late Preclassic. Temples of similar dimensions dating to this period have been discovered at only two other lowland sites, Tikal and El Mirador, both located in the Guatemala Peten.

The Late Preclassic was a period of technological innovation, when the first signs of agricultural intensification began to appear in the form of raised channelized field systems, featuring irrigation canals that may also have been used for fish culture (Thompson 1974; Siemens and Puleston 1972; Siemens 1982).

The late Preclassic also produced considerable development of specialized crafts, including ceramics, jade-working and architectural sculpture. Long-distance trade networks were well developed by this time, as were dense populations and increasingly nucleated settlement patterns that imply the beginnings of urbanism. With the appearance of written records, the transition to civilized life typical of the Classic Period begins; this is usually dated to about A.D. 250.

The Classic Period

The Classic Period was the 700-800 years when high civilization flourished in the Maya lowlands, an era of considerable archaeological interest since the middle of the 19th century. This period produced most of the monumental architecture and art and other typical features of Maya civilization, including a highly accurate calendar, mathematics, astronomy, and hieroglyphic writing.

The period of Classic florescence was not uniform throughout the Maya region. Some settlements actually experienced a cultural decline in the early Classic, contrasting with earlier phases of florescence in the Late Preclassic, while others reached their greatest development in the Early, Middle or Late Classic. Some Maya cities appear to have achieved their peak of development in the Preclassic, and were subsequently abandoned, sometimes remaining unoccupied throughout the Classic Period. Two notable examples are the small city of Cerros (Friedel 1978), and the great city of El Mirador in the northern Peten (Matheny 1987). A similar phenomenon may be observed during the Postclassic, when some cities continued to flourish, while many others were abandoned (Chase and Rice 1985).

The archaeology of the Classic Maya has undergone its own historical cycle, marked by a change of emphasis from the investigation of monumental art and architecture in its earlier years, to a greater attention to settlement patterns, demography, and subsistence during the past two or three decades (Marcus 1983; Ashmore 1981; Vogt and Leventhal 1983). Another important shift, beginning in the late 1950's, has been from concentration on calendric and numerical data in the surviving Maya codices, to the current focus on decipherment of historical information contained in the hieroglyphic inscriptions, many of which can now be read. Readings of inscribed monuments have revealed a series of dynastic records at a number of lowland population centers, and suggested possible political relationships between them (Berlin 1958, 1963; Kelley 1962a, 1962b; 1976; Marcus 1976; Matthews 1983; Proskouriakoff 1960, 1963-1964; Schele 1976, 1979, 1984, 1987; Schele and Miller 1983).

The Postclassic

The Postclassic period is marked by the apparently sudden depopulation of at least some major urban sites in the Maya lowlands, and cessation of the practice of erecting inscribed monuments to commemorate the endings of historic periods. This era is often designated the "collapse" of Maya civilization. It seems clear that the elite culture of the Classic period began to disappear from many Lowland sites within a period of about 100-150 years, between the end of the ninth and and the end of the tenth century A.D.

There is some evidence of major population movements at this time, especially in the central and northern portions of the Yucatan Peninsula, where a second period of florescence occurred among the Yucatan Maya between the Tenth and Fifteenth centuries, possibly under the influence of an immigrant population from highland Mexico. Mayanist opinion on this latter point, as well as on the nature of the Postclassic in general, is currently changing (Chase and Rice 1985).

Recent archaeological evidence from Belize and Quintana Roo seems to indicate a continuation of high culture at a number of urban Maya sites well into the Postclassic (Chase and Rice 1985; Folan _et al_ 1983; Pendergast 1985, 1986; Sabloff and Andrews 1986). Evidence of a "collapse" here has been reinterpreted during the past decade in demographic terms, with current interpretations tending to favor a 150-year trend of declining birth rates, accompanied by a comparable increase in death rates, as sufficient to account for the disappearance of the large, nucleated urban poopulations of the Classic Period. Such a trend could have been initiated and maintained by resource stress sufficient to produce chronic slight, though significant, nutritional deficiencies in Maya diets (Storey 1985, 1986; William Sanders, verbal communication 1986; Whittington 1986).

In general, the Postclassic appears to have been a time of major population shifts, political decentralization, and increased warfare, when the large population centers of the Classic broke up into a number of scattered and widely dispersed states or chiefdoms, and the network of political alliances that may have existed among the Classic centers ceased to function, or was at least reorganized along different lines. Some of the Post-classic chiefdoms of Yucatan acquired considerable power, and created their own urban centers and a distinctive art style. A period of protracted warfare ended in the destruction of the last Yucatan Maya capital of Mayapan about A.D. 1450, a little less than a century before the arrival of the Spanish invaders brought an abrupt end to of indigenous Maya civilization.

II. PREVIOUS RESEARCH ON MAYA DIET AND ANIMAL UTILIZATION

A. Zooarchaeological Studies

A variety of approaches to the study of Maya faunal utilization are represented in the literature of archaeology and its related disciplines (Carr 1986; Hamblin; Hunn 1977; Macri 1986; Saul 1972, 1973, 1975). Most recent research relevant to Mayan animal use can be related to the areas of zooarchaeology (Carr, 1986; Hamblin 1980; Shaw and Gibson 1986; Wing and Hammond 1975; Wing 1981), ethnology (Hunn 1977), and physical anthropology (Bennett 1986; Bennett et al 1985; Saul 1972, 1973, 1975; Whittington 1986).

Hamblin, in her 1980 doctoral dissertation analyzing the prehistoric fauna of Cozumel Island, remarked that "perhaps the most significant statement that can be made concerning faunal analysis in Mesoamerica is that it has been conspicuous by its absence" (Hamblin 1980:11). This statement was applicable to the Maya region until quite recently, where few faunal studies were carried out before the late seventies.

Although some descriptive studies of faunal remains have appeared during the past thirty years, major studies such as Hamblin's are still rare; systematic collection of faunal remains by trained archaeological specialists has been undertaken only during the past decade. This fact, plus climatic and taphonomic factors contributing to poor conditions for preservation of organic materials in this area, have inhibited the development of zooarchaeological studies. To date, only two doctoral dissertations based on faunal collections from Maya sites have been completed (Pohl 1976, Hamblin 1980), although several others are now in progress.

Aside from these few dissertations, published descriptions of animal remains from prehistoric Maya sites have tended to represent small collections (e.g., Olsen 1972; Wing 1974). Notable exceptions do exist, however. A sample of over 6,000 individual specimens, systematically recovered from the site of Mayapan during Carnegie Institution excavations in the 1950's, with contextual information recorded, was reported by Pollock and Ray (1957). Since about 90 percent of this faunal material was recovered from public architectural or ceremonial contexts, however, this may not be a representative subsistence sample. Pollock and Ray found deer to be the most abundant species, followed by dog; turkey was third, and was the most abundant avian species. Iguana was fourth in relative abundance at this site.

An example of a Maya faunal assemblage recovered from an exclusively ceremonial context was that recovered from Eduardo Quiroz Cave in Belize, excavated by David Pendergast and analyzed by Howard Savage (Pendergast 1971:78-111). Savage found a statistically significant disproportion of left and right elements of avian bones, a finding that has also been observed and interpreted in Mayan faunal assemblages by Pohl (Pohl 1985).

The extraordinarily large and varied collection from Cozumel, on which Hamblin's dissertation is based, consisted of over 20,000 faunal elements representing at least 77 species from ten sites (Hamblin 1980:12). The five assemblages forming the basis of Pohl's 1976 dissertation were, however, sufficiently small that some lumping was re-quired for her analysis (Pohl 1976:90).

The Hamblin sample, although unusually large, is limited in representing an island fauna, which differs significantly from typical faunal assemblages reported from mainland Maya sites, particularly in the virtual absence of deer (Hamblin 1980:248-249), and by the fact that the overwhelming majority of specimens are from Postclassic and Historic contexts (Hamblin 1980:311, Table 15). Hamblin has reported some intriguing evidence for the possible domestication of the collared peccary by the Cozumel Maya, who may have raised these animals in circular stone pens. Soil samples taken from within these enclosures revealed high concentrations of soluble salts and nitrates, typical of areas where large amounts of animal waste and urine have been deposited, while samples taken just ouside the "pens" showed no such concentrations (Hamblin 1980:223-248).

Wing has analyzed a number of faunal collections from Maya sites (Wing 1974; Hammond 1975; Hammond *et al* 1979; Wing and Steadman 1980). In these analyses she has documented the predominance of several terrestrial mammalian species in Maya faunal assemblages, including deer and peccary (35 percent of the total fauna from Lubaantun, with deer constituting 55 percent of the faunal material from Dzibilchaltun), as well as the importance of marine species. In addition, Wing has produced a comparative study showing the relative importance of various species in prehistoric Mesoamerican diets, based on faunal data collected by other workers, as well as those derived from her own fieldwork (Wing 1981). In addition to highlighting the dietary importance of dogs, which were the most abundant terrestrial vertebrate species at all of the seventeen sites included in her comparative study, she detected some temporal trends in Maya animal utilization, which may reflect either environmental or cultural influences, or both. Preclassic patterns of Maya animal use showed similarities to those of the earlier Olmec of the Gulf of Mexico coast, especially in the use of dogs for food. Only with the beginning of the Classic does a distinctive Maya faunal tradition, based on deer, peccary and turkey consumption, begin to appear (Wing 1981).

On the basis of faunal data so far obtained from lowland Maya sites, deer appear to have been the most numerically important prey species during the Classic period (Mack and Wing, in Willey *et al* 1965; Pollock and

Ray 1957:636-637; Wing, in Hammond 1975:379-382; Wing 1981). Domestic dogs are relatively more important in some Preclassic occupations (Wing 1978, 1981), but become less abundant with the increase of deer in Classic levels (Wing 1981).

A further temporal trend may also be present, suggesting greater utilization of small game species in the Late Classic, compared to the greater proportions of large game animals in Early Classic asssemblages (Wing and Steadman 1980:326-334). A similar pattern has been identified in another tropical rainforest area by Ross (1978), who observed that the increased comsumption of smaller animals in Amazonia may have been a response to increasing population density, a situation in which concentration on smaller species would have increased hunting efficiency by focusing on species having shorter reproductive cycles. Such a strategy may have included preservation of breeding stock of larger species by imposing taboos on their consumption.

The presence of marine fish remains in many inland faunal assemblages has been taken as evidence corroborating prehistoric Maya trade in salted fish. Salting as a preservation technique was reported by the Spanish at the time of contact (Landa, Tozzer 1941). Manatee remains, as well as fish remains, have been found at some inland sites, indicating this sea mammal may also have had some commercial importance (McKillop 1985). Freshwater fishes and molluscs, as well as land snails, appear to have been consumed in large quantities by the Maya (Andrews 1969; Moholy-Nagy 1978; Nations 1979a; Hammond 1975). Catfish and small perch have been reported living in the cenotes of contemporary Yucatan (Roys 1972), as well as at the time of the Spanish Conquest (Cuidad Real 1875), suggesting these natural waterholes may have provided an animal protein resource, as well as drinking water, to prehistoric inhabitants of the area.

B. Ethnological Investigations

One of the earliest modern descriptions of animal resources and utilization in the Maya area appeared in John Lloyd Stephens' popular accounts of his travels in the Yucatan Peninsula, Chiapas and Guatemala. In 1841, Stephens reported encountering herds of deer while in Guatemala (Stephens 1969, Vol. I:381), although game appeared to be very scarce in some areas. He also described women catching fish with small hand nets in a Guatemalan lake (Stephens 1969, Vol. II:16-17).

Ethnographic reports of Maya lowland populations began to appear early in the present century. Many of these describe hunting practices of the modern Maya, as well as hunting rituals that probably have prehistoric antecedents.

Alfred Tozzer, who carried on fieldwork among the Yucatec and Lacandon Maya between 1902 and 1905, photographed Lacandones shooting both fish and game with bows and arrows, and described the hunting of game of all sizes (1907:53), noting that hunting ranked second only to maize cultivation among subsistence activities. A small deer, probably the brocket, and wild turkeys are mentioned as the most important prey, with partridge, quail and monkeys also constituting important food species. Fishing was a significant activity in coastal Yucatan, as well as in the lakes and rivers of the Lacandon area. Turtles, freshwater crabs and snails were eaten; fish and turtles were sometimes killed with spears (Tozzer 1907).

In a report of work among the Maya of Yucatan and Belize published in 1918, Thomas Gann listed deer, peccary, wild turkey, and curassow among the chief species hunted by early twentieth century Maya. He described the smoking and salting of meat and drying of fish as preservation techniques then in use. Although firearms were used for hunting at the time of his field investigations, older Mayas could still remember seeing the bow and arrow used when they were very young. Armadillo, parrot, pigeon, quail and partridge, toucan, iguana, chachalaca, turtles, monkeys, tapir, jaguar, puma and squirrel are all mentioned by Gann as additional species hunted. Gann also describes deer hunting in burned-over milpas, and the use of traps of both the snare and cage types used in prehistoric times. Young boys hunted small game with slings, and a variety of fishes were caught by various methods, including hook and line, seine nets, traps, and with harpoon and spear (Gann 1918).

During the early 1930's Robert Redfield and Alfonso Villa Rojas, in their study of the Maya village of Chan Kom, described both individual and communal hunting of deer, peccary, agouti, gopher, and a variety of birds. They also mentioned the supernatural beings called zip, who are believed to protect the deer, watching "over them as men do over cattle" (1934:118). These beings are thought to resemble deer, although they are invisible to all but the oldest and most experienced hunters. Their magical powers must be circumvented by the Maya hunter in order to succeed in killing a deer (Redfield 1941; Redfield and Villa Rojas 1934).

Eric Thompson, in his monograph on the Maya of British Honduras (Belize) based on fieldwork conducted between 1928 and 1930, described a "deer dance" performed at San Antonio. The dancers wore realistic masks, and the action appeared to be designed to insure successful hunting. Thompson also refers to a hunting festival held in the Maya month of Zip at the time of the Conquest, which is described in several ethnohistoric sources. He implies the San Antonio deer dance may be a modern survival of that annual event (Thompson 1930:103-104). Similar dances seem to have occurred among the Quiche Maya in Conquest times (Edmonson 1985).

Mary Pohl has suggested that the bullfights held for modern Maya cargo ceremonies may be survivals of this prehistoric hunting festival, in which the bull has been substituted for the sacrificial deer (Pohl 1981; Pohl and Feldman 1982).

James Nations, whose 1979 doctoral dissertation was based upon studies of the relatively unacculturated Lacandon Maya of Chiapas, has described the modern and prehistoric ecology of this group (Nations 1979a, 1979b; Nations and Nigh 1980). Nations observed that Lacandon farming practices tend to perpetuate the natural vegetation patterns of their environment. A great diversity of species are cultivated in a single _milpa_ plot, creating a field system that is self-renewing. Crops are dispersed in patterns precluding large clusters of any single species, producing a field system that provides a sustained yield of varied foods throughout the year. It is interesting to note that such a system was suggested for the prehistoric Maya by Cyrus Lundell in the 1930's, as a result of his studies of vegetation patterns in the Peten (Lundell 1937). Similar cropping systems form the basis of some recent models of Maya agriculture (Wiseman 1983).

Although some portion of the crops Nations observed were lost to animals, at least some of these losses were planned by the Lacandon farmers, a part of the maize harvest being allotted to such game animals as deer, peccary and paca in order to attract them to the _milpa_ plot. The second-growth _milpa_ apparently functions not only as a garden, but also as an intentional grazing area for certain species, which are hunted while feeding there, a practice recalling Gann's descriptions of milpa deer hunting early in the present century. The result is a system of multiple land use, combining crop cultivation with a form of wildlife management. Olga Linares has observed a very similar practice in the Panamanian tropical forest (Linares 1976). She suggests that "garden hunting" may have functioned as a substitute for animal domestication among some tropical peoples of Central America, serving the same purpose by reducing the need for scheduling seasonal organized hunting trips, a proposal with which Nations agrees. Such a system would be advantageous to sedentary populations such as the Maya, and may be regarded as an ecologic optimization strategy.

A large amount of ethnohistoric evidence for prehistoric Maya intercropping systems of this kind has been reviewed by Nicholas Hellmuth (1977), who notes that such systems allowed the production of two or three crops each year and required little, if any, artificial fertilization. Although Hellmuth found ethnohistoric accounts of abundant game at the time of the Conquest, he makes no specific mention of "garden hunting" as a method of animal procurement at this time.

C. Paleonutritional Studies of Skeletal Remains

1. Methods of Determining Diet from Skeletal Material

Physical anthropology and the physical sciences have provided archaeologists with several methods for inferring diet and nutritional status from the examination of human skeletal remains. Until quite recently, such examination was largely confined to paleopathological studies, employing medical techniques of examination varying from gross osteological examination with the naked eye, to microscopic study of thin sections of tissue. While such studies have been useful in contributing to our knowledge of disease in prehistoric populations, the amount of data obtainable from paleopathological investigations alone regarding diet and nutrition in the past is necessarily very limited (Wing and Brown 1979:91). Paleopathological information is largely restricted to inferential statements concerning the probable existence of nutritional deficiences or vitamin insufficiencies (and/or inhibited nutrient absorption) within a skeletal population. Such inferences are based on observed incidences of gross skeletal lesions, temporal changes in average stature, or the incidence of such gross skeletal markers of disease and dietary stress as dental hypoplasias and Harris lines; the latter are observable only through radiographic analysis (Haviland 1967; Saul 1972; Nickens 1976; Wing and Brown 1979; Buikstra and Cooke 1980).

Examination of the teeth has also been used as a basis for making generalized inferences concerning prehistoric health and diet (Rose et al, 1985; Powell 1985). A high incidence of severe tooth wear, increasing with age, has frequently been interpreted as evidence for a diet consisting primarily of meat. In such circumstances, the incidence of dental caries is ordinarily extremely low, and pre-mortem tooth loss largely the result of mechanical wear and tear, leading to eventual destruction of the teeth. A shift in subsistence strategy may be documented in change from a pattern of heavy tooth wear, to one of an increasing incidence of dental caries, resulting from a significant increase in the proportion of high-carbohydrate vegetable foods (usually grains) in the diet. The latter pattern has been taken as evidence for change to an agricultural economy, in which meat is typically replaced by grains as the dietary staple (Turner 1985; Perzigian 1977; Larsen 1981).

The transition to agriculture may also be reflected in the appearance of signs of nutritional stress in infants during the weaning period, with a concomitant increase in infant mortality during this time (Santley and Rose 1979:190). Such evidence, while always suggestive, can never be more than imprecise and less reliable by the probable operation of other variables, including possible genetic selection within a population for resistance to dental caries (Turner 1985), and perhaps selective resistance to nutritional deficiency disease. The influence of such factors on a particular skeletal population can neither be readily determined nor easily ruled out.

Another factor limiting the usefulness of paleopathological evidence as an indicator of diet or nutritional status is its nonspecific nature. The skeletal markers of malnutrition may reflect any of a broad range of health or environmental stressors, in addition to dietary insufficiencies (Wing and Brown 1979), and at present no reliable method for distinguishing among the various possibilities is available.

During the past two decades, chemical and spectroscopic techniques have been developed that may allow some more precise determinations of prehistoric diet from human physical remains (Gilbert 1977; Lambert _et al_ 1979; Schoeninger 1979). Of these, the most promising results have been achieved by determining the trace element content of human bone recovered from archaeological sites, particularly studies involving strontium levels (Toots and Voorhies 1965; Price and Kavanagh 1982; Bennett _et al_ 1985), and from studies aimed at measuring ratios of stable carbon and nitrogen isotopes in preserved bone tissues (Bender _et al_ 1981; Chisholm _et al_ 1983).

The data derivable from determinations of carbon isotope ratios in human bone are compromised to some extent by several factors. First, the accuracy of dietary information derived from archaeological bone samples is dependent upon the extent and accuracy of the observer's knowledge of the environmental background, since isotopic ratios in archaeological bone can be altered by diagenetic factors (DeNiro and Epstein 1978, cited in Wing and Brown 1979:77). While environmental factors do not usually alter the original carbon isotope values in bone, this must be verified in the particular case by examination of the matrix material, and determination of the chemical factors that may significantly affect it (Wing and Brown 1979).

An additional complication that may arise in interpreting carbon isotope ratios in human bone for purposes of dietary reconstruction is the possibility that a human population may have utilized marine organisms for food. Consumption of marine resources, known to have been an important factor in Maya diets, produces concentrations of carbon isotopes very similar to those resulting from consumption of C4 plants, such as maize. In effect, carbon isotope ratios in human bone resulting from consumption of fish, shellfish or marine mammals cannot be distinguished from those produced by maize consumption, making the carbon isotope technique of limited applicability to Maya skeletal material. Another difficulty is caused by the fact that C4 plants are consumed by some terrestrial species in the Maya area, which, when eaten by humans, may alter the ratios in human bone. For this reason, studies of remains of food species from the site of recovery of human remains is also necessary, in order to detect the influences of this factor (Bennett et al 1985).

In spite of the foregoing problems, 13C/12C ratios have been utilized in combination with 15N/14N ratios from human bone collagen recovered from a group of Maya sites in some recent studies, with results yielding data that may be useful for testing hypotheses regarding Maya subsistence practices (Bennett 1986).

Trace element analysis appears to have a somewhat greater potential for yielding useful information on Maya diet from skeletal material (Bennett et al 1985; Bennett 1986). The choice of trace elements for study depends upon the degree to which a particular element is incorporated into bone from dietary sources, as well as its post-mortem retention in bone mineral (Wing and Brown 1979).

Strontium is the trace element most commonly used to study diet from skeletal remains, since it is incorporated in bone tissue in the same manner as calcium, although in much smaller quantities. The usefulness of Sr as an indicator of diet lies in the ability of terrestrial vertebrates, including man, to incorporate it in direct proportion to the amount in the dietary food source. Carnivores consume less strontium than herbivores, and this will be reflected in the Sr levels retained in their post-mortem bone tissues. Herbivores characteristically have higher Sr levels, while omnivores show intermediate levels (Wing and Brown 1979; Toots and Voorhies 1965).

A major problem in using strontium analysis for dietary studies is that results are frequently affected by diagenetic factors. Strontium levels in soil, which are affected by proximity to water, leaching, salinity, and soil minerals, must be controlled for when analyzing bone samples (Wing and Brown 1979:80; Toots and Voorhies 1965).

Some of the more important applications of strontium analysis are in studying temporal variations in diet, reflected in changing Sr levels over time in a skeletal population; and for determining the relative importance of meat with respect to vegetable foods at a particular point in time, by comparing Sr levels in human bone with those in the bones of known carnivores, herbivores and omnivores from the same site. Differential patterns of meat consumption within a human population may also be identified, if these are the result of controlled access to meat according to sex, age, occupation, or other social factors discernible from the archaeological record.

2. Paleopathological Studies of the Maya

Prior to the 1960's, paleopathological investigations of human remains from the Maya area were, aside from Hooton's early study of the skeletal material from the sacred cenote at Chicen Itza (Hooton 1940), virtually nonexistent. The past two and a half decades have produced a limited number of such studies, whose collective results may provide a basis for comparison with the results of trace element and isotopic research now being undertaken on material from Maya sites (Haviland 1967; Martin, Goodman and Armelagos 1985; Saul 1972, 1973, 1975).

One of the earliest such investigations was William Haviland's study of stature attained by individuals buried at Tikal, Guatemala, whose skeletal remains were analyzed and their stature during life estimated from measurements of long bones. Haviland observed a trend towards marked reduction in stature between Early Classic and Late Classic times, which he attributed to increasing nutritional stress in the Late Classic (Haviland 1967: 319). He further observed that skeletal remains of the hereditary ruling class emerging during the last century B.C. displayed fewer signs of nutritional stress than those of lower class individuals. An additional trend was increasing sexual dimorphism with respect to stature, which he interpreted as possible evidence of a decrease in the status of women, whose size diminished even more rapidly over time than that of males, presumably as a result of reduced access to foods having the greatest nutritional value (Haviland 1967).

The theme of stature reduction as a response to nutritional stress during the Classic period was further elaborated in the work of Nickens, who examined skeletal data from Mexico compiled by Genovese, and used these to estimate prehistoric stature throughout Mesoamerica. Nickens noted an overall trend towards decreasing stature, spreading from north to south throughout Mesoamerica. Like Haviland, he further observed a temporal decline in stature at Lowland Maya sites in the Late Classic. Nickens concluded this was a result of declining nutrition accompanying the adaptation to intensive agriculture, a pattern he compared to that observed in animals in the early stage of domestication, which is reversible with improved nutrition (Nickens 1976).

The most thorough and systematic paleopathological study of a prehistoric Maya group was Saul's osteobiographic analysis of a burial population from the site of Altar de Sacrificios. His examination of remains of 90 individuals of both sexes, ranging from infancy to old age, revealed a pattern of declining stature quite similar to that noted at Tikal by Haviland. In addition, Saul found evidence highly suggestive of nutritional deficiencies, including peridontal degeneration with ossified subperiosteal hemorrhages, possibly attributable to scurvy or inhibited Vitamin C absorption; and such possible indicators of anemia as porotic hyperostosis cranii, which was present in 32 individuals. Dental enamel hypoplasias, caries, premortem tooth loss, and osteitis were also present, and arthritic lesions occurred in 18 individuals. Although he could discern no significant chronologic trend in pathologic lesions, Saul commented upon the high incidence of lesions associated with malnutrition and/or parasitic infestation, and perhaps with childhood infections (Saul 1973:322-323; 1975:75). From the Altar de Sacrificios data, and similar but more limited data obtained from two other Maya sites, Saul concluded that malnutrition, parasitic disorders and childhood infections were prevalent among the Classic Maya, indicating a somewhat precarious state of health. The implications of Saul's data for diet in the Classic period are, of course, nonspecific (Saul 1972, 1973, 1975).

Skeletal populations from two additional Maya sites are now in the process of paleopathological analysis (Bennett _et al_ 1985:4). These burial populations, recovered from the Southeastern Maya site of Copan in northern Honduras, and from the Postclassic-to-Colonial Period site of Nigroman-Tipu in Belize, are far better preserved than the majority of human remains yet found in the Maya lowlands. The Copan population, now being analyzed by Rebecca Storey of the University of Houston, has not yet been described in a published report.

The Tipu population, recovered during excavations conducted as part of the Macal-Tipu project funded by the National Science Foundation (Graham, Jones and Kautz 1985), constitutes an unusually large sample, consisting of more than 500 individuals interred during a period of

50-80 years. Forthcoming excavation plans are expected to augment this sample with burials dating to the prehistoric period (Bennett et al 1985:4).

Investigations to date have produced a preliminary profile of Maya health at Tipu in early Colonial times which is in striking contrast to expectations. This population does not display a pattern of declining stature, and is in fact tall, by Maya standards. Studies of cortical bone indicate an absence of significant malnutrition, and lesions attributable to infections were observed in only a very small percentage of individuals. Harris lines and dental hypoplasias were also of limited occurrence. Porotic hyperostosis and cribra orbitalia, on the other hand, were found in about one third of adult males, but in only 10 percent of adult females, and appear to have been a common occurrence in juveniles in the 9-15 year age range (Bennett et al 1985).

Although the implications of these data are not yet fully understood, the incidence of porotic hyperostosis at Tipu appears, on the basis of trace element data obtained from the same population, to be inversely correlated with meat consumption, reinforcing the apparent association of porotic hyperostosis and anemia. The subperiosteal hemorrhages identified by Saul at Altar de Sacrificios occur at Tipu also, but in lower frequencies.

Mortality rates in late childhood and adolescence were high at Tipu, possibly indicating some stress;

however, these data may possibly be the result of sampling error. Mass burials resulting from multiple deaths due to epidemic disease do not occur at Tipu. The overall good health reflected in this population may indicate a migrant elite group, perhaps from northern Yucatan, although confirmation of this must await recovery of appropriate comparative data (Bennett, verbal communication 1986).

3. <u>Trace Element and Isotopic Studies of Maya Remains</u>

The only reported trace element analysis yet done of bone recovered from a Maya site is that by Bennett, on bones obtained from burials and faunal deposits at Tipu (Bennett <u>et al</u> 1985; Bennett 1986), although Saul is reportedly conducting similar studies on remains from Altar de Sacrificios (Norman Hammond, personal communication 1985).

Like trace element studies, isotopic investigations of Maya remains are still in a very early stage of development. Recent investigations of material from Maya sites have been performed by Bruno Marino at Harvard, and by Anna Roosevelt at the University of the American Indian (Bruno Marino, personal communication 1985; S. Bennett, personal communication 1986), but to date no findings have been published. At present, such studies are valuable for establishing baseline data for future comparative work, which is not possible until multiple samples have been analyzed and reported.

D. ETHNOHISTORIC RESEARCH

Ethnohistoric documents are a category of information resource for reconstructing Maya subsistence whose potential has until recently been underutilized. Ethnohistoric materials concerning the Maya include a number of native documents, some dating to pre-contact times, as well as numerous European accounts of the Conquest and Colonial periods. One of the most useful of the latter is the description of Yucatan at the time of the Conquest by Diego de Landa, Bishop of Yucatan, in the late sixteenth century (Landa, Tozzer 1941; Gates 1978).

Of native documents dating to pre-Columbian times, only four survived the general book-burning conducted by the Spanish at Mani in 1562. These codices contain information on ritual, calendrics and mathematics, as well as prophecies and astronomical tables for predicting eclipses, conjunctions and other celestial events far into the future. It is apparent that some of this manuscript material relates to subsistence, at least indirectly, since the glyphic texts are heavily illustrated with paintings of animals and depictions of techniques for their capture. A volume titled Animal Figures in the Figures in the Maya Codices by Alfred Tozzer and Glover Allen published by the Harvard Peabody Museum in 1910, reproduced a great many of these drawings, as well as giving interpretations of their functional uses in Maya writing.

In addition to the prehistoric books, a number of Maya documents exist from the Conquest and Colonial periods, some based on traditional oral literature, others describing events of historic times. Some of these were originally written in native Maya languages, rendered in the European alphabetic script. Knowledge of the hieroglyphic writing had virtually disappeared by the end of the sixteenth century, and native Maya historians had by then learned to read and write Spanish, and to write their own languages in the European alphabet. The literature of this period includes native histories, sacred texts such as the Popol Vuh (Goetz and Morley 1950; Edmonson 1971; Tedlock 1985), prophetic works such as the books of Chilam Balam, genealogical records of ruling families, and land titles. Although a portion of this literature has been published, much of it remains in manuscript form in archival collections.

Another body of ethnohistoric literature comprises the results of information-gathering activities of the Spanish monarchs during the years immediately following the Conquest. An important example of this is the corpus of material collectively known as the Relaciones Geograficas (1898), consisting of responses to a questionnaire sent to Spanish officials in Central and South America on the order of Felipe II of Spain. The fifty questions were designed to elicit a broad range of information about the New World, including data on natural vegetation, crops, animals native to various regions, and methods of farming, fishing and hunting. (For an English translation of the complete questionnaire, see Appendix).

More than two dozen relaciones describe bishoprics in the Yucatan Peninsula. The southern Maya lands are less well represented in these responses, although several relaciones describing Guatemalan communities have come to light and have been published, chiefly by the Sociedad de Geografia e Historia de Guatemala.

Some of the frequently utilized Colonial sources contain references to wild and domesticated species of the Maya region and their uses, although this information is attenuated and often difficult to locate. The most frequently cited descriptions of animal species native to the Maya area are those given in Landa's account. Ralph Roys, whose translations of native documents included species identifications for many animal species of economic importance, also provided glosses of many Maya animal names (Roys 1931, 1965).

The fact that a large proportion of extant documentary material of potential usefulness in reconstructing Maya subsistence remains unpublished, and unavailable to most North American students, is one of the chief reasons ethnohistoric documents as a data source for May animal procurement and utilization have only begun to be tapped. The search for such information in the ethnohistoric literature, and comparison of results with data from archaeological and ethnological investigations, will be the primary research methodology of this investigation.

The methods of ethnohistory combine those of historiography and culture history. Almost half a century ago, Jakeman outlined a three-phase method for the historical interpretation of documentary sources for the Maya (Jakeman 1945:134-165), in which he included criteria for evaluating sources to determine their relative reliability, measured on a numerical scale on which 1.00 represented absolute reliability, and .00 undisputable inauthenticity. Although his scale incorporated some objective elements,--e.g., whether or not the author of a source was present as a witness to particular events or facts,--the kinds of evidence he accepted as reliable are very often not available for Maya sources; and the probability estimates of reliability he assigned to various categories of sources, based upon his criteria, appear to have been subjectively derived. His index of authenticity does, however, represent a careful and painstaking effort to devise a method for evaluating Maya ethnohistoric literature, which remains useful generally, if not in all of its particulars.

The key factors used by Jakeman in evaluating the authenticity of information in ethnohistoric documents were (a) whether the document in question was an original source (e.g., a native hieroglyphic monument), or one of questionable authenticity; and (b) presence of the writer at the events described, i.e., firsthand observation. It is immediately obvious that the overwhelming majority of available ethnohistoric materials documenting Maya history cannot satisfy either of these basic criteria, and few can meet only one. This applies to native documents, as well as to the Spanish accounts, since a number of allegedly native manuscripts have been demonstrated to be forgeries or falsifications (Glass 1973).

Borah (1984) has discussed the uses of textual comparison to detect plagiarism, as well as more subtle kinds of evidence of borrowing from the works of earlier authors, in utilizing the ethnohistoric literature of Mesoamerica for purposes of historical reconstruction. The practice of taking information verbatim from the works of other writers, with or (more often) without attribution, was a common and accepted one in the sixteenth century, and is most evident in the general and descriptive works of the early post-Columbian period.

Both Borah (1984) and Carmack (1973, 1981) have emphasized the value of using ethnographic data and native informants to check the accuracy of information given in Spanish writings. Where surviving native traditions agree with the ethnohistoric data, this may provide some testimony to the reliability or unreliability of particular authors or works. However, the converse is not true; absence of surviving practices similar to those suspected in the prehistoric past cannot be taken as evidence of their falsity, and by the same token, ethnographic material collected more than half a millenium after the Conquest should be weighed with a healthy degree of skepticism as evidence supporting prehistoric practice.

With respect to faunal utilization, the limited information given in ethnohistoric documents tends to be corroborated by recent native practice, as is evident in the work of Lewis (1970), Redfield (1941), and others. Because the uses of animals by present-day Maya groups are usually a part of household economy, they represent the household level of socio-cultural integration, where aboriginal behavior patterns have persisted in forms largely unchanged since prehistoric times (Carmack 1973: 216). The study of such behaviors may provide a check on the data from documentary sources which is perhaps more useful than textual comparisons for determining the accuracy of accounts of Maya animal procurement and use in prehispanic times. However, opportunities to observe hunting patterns among contemporary Maya have become almost nonexistent, due to the decline in game populations resulting from overhunting since the Spanish Conquest (Carmack 1973, 1981; Hunn 1977; Press 1975; Vogt 1969).

III. THE IMPORTANCE OF ANIMAL PROTEIN IN HUMAN DIETS

Of all the varied nutrients essential for the maintenance of human health, growth and reproduction, protein is one of the most critical. Three-fourths of the dry weight of soft tissue in the human body is made up of protein (Wing and Brown 1979:47). An adequate protein intake is required not only to maintain and repair normal body tissues, but also to insure resistance to viral, fungal and bacterial infections (Gershwin _et al_ 1985), to promote healing of wounds, and to maintain normal neurologic function and behavior patterns (Winick 1976; Fernstrom and Lytle 1979). The importance of dietary protein was well summarized by McCay early in this century (McCay 1912:1), and its nutritional role has been emphasized by more recent investigators of human nutritional requirements:

> Protein serves as a source of amino acids for building and repairing tissues. Protein can also provide energy when other energy sources ...are inadequate (Wing and Brown 1979:27).

The amount of dietary protein required for optimal human health and function has been a matter of disagreement, as has the definition of what level of protein intake constitutes inadequacy (Gershwin _et al_ 1985:157). It is quite possible that protein requirements vary between individuals, as well as between age groups and populations. The results of protein deficiency are, however, always dramatic and unmistakeable. These include not only the deficiency diseases kwashiorkor and marasmus, resulting from protein-calorie malnutrition, but a diversity of lesser dysfunctional conditions, including increased susceptibility to infectious diseases, mental apathy, and learning disabilities (Behar 1968b). In tests of social dominance among monkeys, those fed a low protein diet were found "submissive and always dominated by control animals" who were fed a normal diet Winick 1976:132). This same group of studies concluded that the primary behavioral abnormality induced by early deficiency is a reduced attention span, which has also been observed in studies of human nutrition and development (Winick 1976:133, 145; Behar 1968b) as a factor inhibiting normal development and learning.

Dietary experiments with pregnant rats have shown that mothers deprived of an adequate dietary protein intake during gestation produced offspring which, although having normal birthweights, displayed "marked behavioral aberrations" (Simonson 1979:136). By contrast, progeny of mothers who received a diet adequate in protein but inadequate in calories had low birthweights, a higher than average rate of neonatal mortality, and showed some retardation in development, but their behavior was essentially normal. Studies such as these highlight the extremely important role of protein in promoting and maintaining normal neurologic function, as well as in assuring normal and successful reproduction.

Despite the adaptive advantages conferred by omnivorousness, there is some evidence that humans may be better adapted for metabolizing animal protein than for processing proteins derived from vegetable products. Since the human digestive system is able to process animal proteins more efficiently, a diet high in such foods is likely to result in fewer digestive disturbances than a diet in which the bulk of the protein intake is derived from plant foods, which contain more unabsorbable components (Oberleas 1982:285).

An additional benefit of diets rich in animal proteins is the enhanced absorption of trace elements, due to the action of animo acids released during their digestion (Oberleas 1982:286). Adequate intake of dietary animal protein may therefore be a method of guarding against trace element insufficiencies.

The major advantage of animal protein in human diets is the fact that it is a "complete" form of protein, containing all of the essential amino acids in exactly the required ratios. Protein quality is determined by the proportions of essential amino acids provided in the dietary protein source. "High quality" proteins, derived from animal foods such as meats, fish, milk and eggs, contain all the essential amino acids in precisely the proportions required by the human body. Vegetable foods vary in their protein quality. Some, such as soybeans, are almost as high in protein quality as animal foods, while others are low or lacking in some of the essential amino acids, e.g., lysine, tryptophan, threonine, and methionine. Such incomplete proteins require supplementation with complementary foods, which must be consumed either simultaneously or within a very short time, in order to bring about the synthesis of the requisite amino acids needed to convert incomplete dietary proteins into the complete proteins needed to maintain vital body processes (Wing and Brown 1979:27-52).

The transition from a meat-based diet, characteristic of many human groups whose subsistence is derived primarily from hunting, fishing and gathering, to an agricultural economy, in which grain or other vegetable foods replace meat as the dietary staple, puts human populations at considerable risk for chronic protein insufficiencies. While eating meat assures adequate high-quality protein, as well as a sufficiency of trace elements, diets based on grains and tubers must be more carefully planned and balanced to insure against deficiencies. Vegetarian diets are especially likely to be low in calcium, Vitamin B12 and zinc, with the additional risk of providing inadequate iron.

Applying the nutritional principle of complementarity, which enables diets consisting primarily of vegetable foods to supply all the necessary nutrients, including complete proteins, requires some intuitive or pragmatic knowledge of human nutritional requirements. It appears that prehistoric agriculturists were able to infer some of these principles, and to obtain sufficient amounts of complementary foods--e.g., corn in combination with legumes--to promote the synthesis of the missing amino acids, and thereby to maintain health.

Vegetarian or near-vegetarian diets do, however, place certain groups of individuals at greater risk, especially infants during the period of weaning. Weaning diets in which vegetable foods predominate are often inadequate, particularly in the complete proteins essential for normal human growth and development. Societies experiencing the transition from a food-collecting to a food-producing economy may possibly pay a price in infant mortality for the relatively greater stability and higher birth rates accompanying a settled agricultural lifeway (Santley and Rose 1979:190).

In the course of this economic transition, the risk of malnutrition is an ever-present threat to the entire population, though less so to adults consuming a more varied diet than to the very young. Other health risks accompanying the switch to consuming high-carbohydrate vegetable foods in large quantities include the decline of dental health, since such foods promote tooth decay, which is rarely a problem for those consuming meat-based diets (Perzigian 1977; Larsen 1981).

Human populations whose food production activities are centered around root crops, widely cultivated by tropical populations, face some additional hazards

(Bronson 1966; Dufour 1983). Such crops produce a far lower protein yield than grains such as maize; in addition, extensive processing of root foods is required in order to release their limited available protein, as well as to render them digestible and palatable. A further hazard in diets based upon the consumption of large amounts of bitter manioc, such as those of some Amazonian populations, is the natural toxicity of this tuber, which contains high concentrations of hydrocyanic acid. Its poisonous properties require even further processing, in order to render it safe for human consumption, involving grinding the tubers into mash, washing the mash, boiling, and overnight storage (Dufour 1983).

The amount of processing time required for root crops increases the unit cost of consumption in terms of human energy expended, especially if considered in terms of the protein return per calorie of human energy required for cultivation, harvest and food preparation, since these tubers are quite low in protein compared to grains (see Keegan 1986). Although root crops yield a greater return per acre than maize, they are distinctly inferior as a source of protein, yielding only 1-2 grams of protein per 100 grams of total weight. Maize, however, yields about 8 grams of protein for each 100 grams of weight (Bronson 1966:268), in addition to the advantage of being more easily processed and digested by humans.

Tropical environments have traditionally been regarded as being deficient in sources of animal protein, although some such environments offer a greater variety of protein resources than was formerly thought (Beckerman 1979). In tropical rainforest areas in particular, large mammals may be relatively scarce. If the territory inhabited by a tropical population is far removed from marine resources, this imposes a further restriction upon the available animal biomass. Small game, including rodents, squirrels, lizards and birds are typically utilized in these circumstances, a type of animal protein resource procured at greater cost, in terms of energy invested per unit of energy returned, than big-game hunting.

The problem of procuring sufficient dietary protein has elicited a variety of responses from tropical peoples. Among these are the initiation of food production, centered around a grass or root crop utilized in combination with one or more sources of complementary protein. Crops utilized as staple foods in the tropics are quite varied, including rice (Indonesia, Sri Lanka, etc.), millet (West Africa), yams (South America, New Guinea), sweet potatoes (Central and South America, New Guinea), manioc (Amazonia, Africa), and taro (Polynesia, New Guinea), as well as the maize cultivated by New World tropical populations, including the Maya (Bronson 1966; Buchbinder 1977; Chagnon 1968; Lindenbaum 1979; Ottenberg 1960; Reichel-Dolmatoff 1976; Yen 1971).

Other possible responses to a tropical environment poor in animal protein resources include the consumption of freshwater fish and mollusks, land mollusks, and insects as supplemental sources of dietary animal protein. Such resources were utilized by the prehistoric Maya, as indicated by the presence of freshwater fish remains and considerable amounts of shells from freshwater and land mollusks in archaeological deposits (Hammond 1975; Wing 1974; Andrews 1969; Nations 1979a; Moholy-Nagy 1978). The consumption of insect species is virtually impossible to document archaeologically in this area, where human coprolites are not preserved because of climatic conditions, but there is some ethnohistoric evidence that such species were utilized for food under some conditions and in some areas (see Chapter V below).

Still other solutions to a scarcity of animal protein are the adoption of various strategies of animal management, which may or may not lead to full domestication with controlled breeding. Such domestication as is known to have occurred among the Maya appears to have favored birds and some smaller animal species, although there is archaeological evidence that larger species, including the peccary and perhaps the deer, may have been domesticated, or at least managed in some degree. There is further evidence of a strategy combining milpa agriculture and minimal animal management, in an adaptive solution termed "garden hunting" by Olga Linares, Nations and others (see above, pp. 24-25). Such a strategy typically exploits both natural vegetation patterns and the habits of native faunal species, and has the advantage of requiring considerably less risk and a much smaller investment of energy and capital than animal domestication.

The environment inhabited by the Maya was in many respects more varied, both in terms of microenvironmental diversity and in available sources of animal protein, than many other tropical environments (see Chapter I). Unlike the Amazonian rainforest inhabited by the Desana, or the remote New Guinea highland forest occupied by the Tsembaga (see Chapter IV), the Maya homeland included vast expanses of seacoast, tidelands, and marine estuaries teeming with many species of marine life (Lange 1971). Even dwellers in the interior were able to benefit from these resources via trade relationships, which had been established by the Preclassic, and later developed into a complex commercial network mutually benefiting residents of both highland and lowland areas (Voorhies 1982; Freidel and Scarborough 1982).

An additional source of animal protein cultivated by the Maya was the domestic dog, a species conferring a variety of benefits, including that of acting as a hedge against protein resource uncertainty and periods of scarcity triggered by drought, animal pestilence or other unforeseen events (Wing 1978).

In all, animal protein resources potentially available to the prehistoric Maya appear to have been far from inadequate, although the biological studies necessary to establish reliable estimates of the total biomass available to Maya populations have not been carried out. Such studies remain an avenue for further research focused upon the reconstruction of prehistoric Maya subsistence practices.

IV. MAYA ANIMAL PROTEIN ACQUISITION AND USE: SOME THEORETICAL ASPECTS

A. Problems of Protein Acquisition in Neotropical Environments

Animal protein has long been perceived as being relatively scarce in the tropical rainforest (Gross 1975; Beckerman 1979). This scarcity is perceived as a function of the nature of the tropical environment, in which faunal biomass tends to be "disproportionately low compared to that of the plants" (Sponsel 1986:71). While species diversity, both faunal and floral, is high, animal population densities are usually low and their distribution patchy.

Species diversity in neotropical rainforest may be lower for larger mammals, such as the ungulates, than it is in tropical environments in other parts of the world; most of the terrestrial fauna in Amazonia, for example, are invertebrates. This is due, at least in part, to the fact that all but about two percent of the plant biomass consists of woody tissue, unavailable to herbivores (Sponsel 1986). Human modification of this environment by slash-and-burn agriculture allows development of a secondary growth pattern of vegetation, providing a more hospitable habitat for terrestrial fauna than the natural rainforest, a fact that has been exploited by a number of neotropical human populations (Linares 1976; Beckerman 1980; Nations and Nigh 1980).

A broad range of strategies have typically been employed by tropical peoples to insure adequate supplies of animal protein. These include utilization of a diversity of faunal species, including many less-desirable ones such as insects, as well as smaller mammals and fish. Trade in preserved animal foods, allowing the benefits of access to different microenvironments to be shared, is another useful strategy. Domestication of mammals and birds, as well as varying degrees of management falling short of full domestication, has been resorted to in order to insure a reliable supply of meat and eggs. The important regulatory role of food taboos and ritual restrictions on hunting as conservation measures has been well described (Reichel-Dolmatoff 1971, 1976).

Among the Maya, large, densely-settled nucleated populations very likely required restrictions on access to available protein resources, especially as wild game populations and habitats declined with increasing urbanization. Examples of such restrictive rules are plentiful throughout the world, occurring in both complex stratified and simpler societies occupying a variety of environments. There is evidence that in the Aztec Empire of Central Mexico, access to animal protein available in Late Horizon times was restricted to dwellers in the capital, and possibly to the ruling stratum (Santley and Rose 1979:202). Among the Tsembaga villagers of highland New Guinea, scarce animal protein was consumed only on ceremonial occasions, in times of misfortune or emergency, or by persons subject to physiological stress resulting from illness or wounds (Rappaport 1984:81-84). Such rules usually reflect a situation of scarcity, resulting from environmental impoverishment, demographic factors, or both.

It should be noted that several factors assumed to be limiting with respect to tropical rainforest resources have been controverted by some recent field investigations. The assumption that the rainforest is a uniform habitat has been demonstrated to be an oversimplification, since at least two microenvironments have been found to exist within in it depending upon proximity to rivers (Lathrap 1968). Another significant source of environmental variation within the rainforest is elevation (Beckerman 1980), with lowland and highland zones representing distinct resource zones. The latter has long been recognized as a valid distinction within the Maya area.

It is also noteworthy that studies of hunting and fishing by traditional native methods in the Amazonian rainforest during the 1970's have produced statistics that, far from demonstrating scarcity of animal protein in this kind of environment, show a much higher proportion of animal protein in the average diet than is characteristic of contemporary North American diets, and well in excess of the intake level recommended by nutritionists (Vickers 1980:18; Beckerman 1980:101). An early nutritional study of the diet of modern Mayas with a largely traditional diet showed a similar pattern, with an average daily protein intake of 74 grams (Benedict and Steggerda 1936). This study also revealed a high basal metabolic rate for Maya laborers, exceeding the average for North American white males by an average of 8 percent (Benedict and Steggerda 1936: 188), possibly the result of a genetic factor selecting for a trait adaptive to the tropical environment.

Such data as these, while needing further corroborative study, suggest that some currently accepted assumptions concerning limited protein resource availability in tropical environments should perhaps be re-evaluated.

B. Some Hypotheses Concerning Maya Animal Protein Acquisition and Use

Based upon present knowledge of protein resource availability in the Neotropics, some hypotheses regarding Maya animal protein utilization may be suggested for testing against the Maya ethnohistoric record. The following specific postulates will be evaluated in the light of ethnohistoric data:

1. Since tropical societies usually need to utilize a broad range of resources to meet their animal protein requirements (Beckerman 1980), we can expect such diversity to occur in the Maya ethnohistoric record, which should reflect the exploitation of as wide a range

of animal species as possible, including a variety of invertebrates.

2. Tropical environments in general, and the Maya area in particular, lack dense populations of large terrestrial mammals affording a high protein return for effort expended in hunting. More energy will therefore be spent in hunting for each unit of protein obtained than in non-tropical environments. Since large mammals yield the highest rate of return for the time and energy invested in their procurement, these will remain the favored protein source.

3. In a stratified society such as that of the Classic Maya, consumption of those animal species deemed most desirable may possibly have been regulated by an administrative hierarchy under the control of the ruling class.

4. As population increases, access to protein may become restricted to certain groups--the sick or wounded (Rappaport 1968, 1984), pregnant and nursing women, or persons of high status (Santley and Rose 1979). The ethnohistoric record may indicate whether protein resources may have been restricted by the Maya along similar lines, as well as which social groups may have been favored in the allocation of available protein.

5. Differential patterns of consumption by different social groups will tend to produce distinctions between "high status" and "low status" animal protein foods.

Since the consumption of "low status" protein can be expected to increase as growing populations create a heightened demand for the more desirable species, while simultaneously reducing their numbers through hunting pressure and progressive destruction of habitats, "low status" foods, such as insects, will probably be consumed in greater quantities. Such a practice is therefore postulated for the Maya by the latter part of the Classic Period.

6. A limited animal protein supply will require conservation measures, such as the regulation of hunting by means of cultural sanctions. These may include ritual prohibitions; taboos against the hunting of certain species, or against all hunting at particular times or in specified circumstances; and restrictions imposed upon the hunter, or upon the entire social group. For example, Reichel-Dolmatoff found that among the Amazonian Desana, no females in the group can be menstruating when hunting is undertaken (Reichel-Dolmatoff 1971). The ethnohistoric record may reveal that the Maya possibly devised similar rules, in order to preserve scarce and valuable game resources.

7. The growth of human population may lead to specialized procurement occupations, both as a means of controlling access to a limited protein supply, and to render procurement of the available supply more efficient. Specialized hunting, commercial fishing, pisciculture,

the creation of artificial game habitats, and increasing degrees of animal management can therefore be expected to occur by the Late Classic, as measures to insure a continuing protein supply and to optimize resource use.

8. A strategy frequently observed for dealing with game resource depletion following a period of extended residence in a single locality is fission of local residential groups, and subsequent moves to new locations (Vickers 1980). Although this practice is more usual among culturally less complex peoples than the Maya, and is more characteristic of hunter/gatherers or incipient agriculturists (e.g., the Siona-Secoya of Amazonia described by William Vickers), there is ample evidence of a tradition of periodic abandonment of long-occupied settlements, and even of urban centers, by Maya groups from Preclassic times on (Friedel 1978; Matheny 1987). While depletion of agricultural soils has often been advanced as a hypothesis to explain this phenomenon, depletion of fish and/or game resources may also have been implicated in such relocations, which were possibly motivated by a desire to seek untapped resources in pristine, previously unoccupied environments. Ethnohistoric evidence to support this possibility will be sought in the present study.

9. In order to take maximum advantage of the protein resources offered by all Mayan microenvironments, trade in preserved animal foods, such as salted fish and meat,

dried insects, and perhaps eggs would have been developed. The ethnohistoric record may offer information on this point supplementing the extremely sparse archaeological data available to document Maya trade in foodstuffs.

The above hypotheses assume behaviors that would have been largely adaptive in their effects. However, since Maya civilization, while successful for at least a milennium, underwent periods of decline, some nonadaptive behaviors may also be hypothesized. The ethnohistoric record may provide some clues to such behaviors, which which may have included the following:

10. Regulated consumption of increasingly scarce preferred sources of protein, such as deer and peccary, may have favored the elite class at the expense of the working population, leading to better health and higher birthrates among the elite, with a corresponding deline in health and birthrates among the lower classes (see Frisch and Arthur 1974; Frisch 1975). Such a model has been proposed for the Aztecs at the time of European contact (Santley and Rose 1979), and may be applicable to the Maya of the Middle-to-Late Classic cultural periods.

11. Agricultural intensification techniques destructive of game habitats may have been developed to the point where wildlife habitats could no longer be readily restored or artifically created. Large raised-field and terracing systems, unlike the milpa plots they replaced, do not afford suitable artifical habitats for

game. However, with a growing emphasis upon agricultural products as staple foods, the degradation of game habitats may have been tolerated by the Maya as a matter of expediency, fostering widespread environmental deterioration and a severe decline in game populations.

12. Increasing warfare during the Classic may have affected both the supply and the distribution of animal protein. Scarce protein resources may be consumed in disproportionate amounts by warriors, both before entering battle and when recovering from wounds (Rappaport 1968, 1984). If this practice existed among the Maya, a growing warrior class may have monopolized the available supply of high-quality protein, with long-range effects similar to those described in Hypothesis #10 above.

C. Theoretical Considerations

It has been noted that contemporary tropical peoples often have an "extensive and scientifically accurate knowledge of their environments" (Berlin and Berlin 1983:301), which can be utilized in ecologically-oriented research focused on explaining systems of human adaptation. Ecological studies have frequently emphasized native environmental awareness as reflected in systems of ethnobotanical and ethnozoological classification, and ways in which these relate to adaptation (Hunn 1977; Alcorn 1985). In addition, such studies may reveal ways in which these classificatory schemes provide a key to native world-views rationalizing the physical environment, and the place of humans within it.

Cultural ecology has been utilized in many archaeological studies seeking to explain prehistoric cultures in terms of ecological adaptation. The current emphasis on studies of subsistence and settlement as a basis for explaining other cultural phenomena may be directly traced to the theory of cultural ecology, usually credited to Julian Steward (Steward 1955,1959). Steward sought a method of analysis in which culture was considered as a dynamic adaptive process, rather than a static collection of traits. In seeking to devise a scheme to account for occurrences of different kinds of cultures in similar environments, as well as for the existence of similar forms of social organization in very different environments, he outlined three basic procedures of cultural ecological research methodology. These involved the analysis of relationships between technology and environment, the study of behavior patterns implicated in exploiting a particular environment, and determining the degree to which non-subsistence aspects of a culture are affected by subsistence practices (Steward 1959:90-91).

While Steward regarded non-subsistence aspects of culture as lying outside the cultural "core" (much as present-day cultural materialists tend to relegate such phenomena as ideological systems to the non-causal realm of "superstructure"), a few investigators have taken the view that human exploitation of the physical environment is directly affected by ideological systems. Such a view introduces an additional variable into human ecosystems, one that may play an important role in determining which of the possible adaptive responses to a given environnmental situation will be selected by a particular group.

The suggestion that ideology may affect subsistence decisions, such as selection among available prey species, strongly contrasts with the position of those researchers operating within the limits of the "ecological paradigm" (Nash 1983:13) now enjoying great popularity in American archaeology, who usually assign a causal role exclusively to economic and subsistence activities. However, the apparently universal human need to explain the physical world in symbolic terms has led some investigators, including Rappaport in his work with the New Guinea Tsembaga (Rappaport 1968, 1984), and Reichel-Dolmatoff in his study of the Amazonian Desana (Reichel-Dolmatoff 1971, 1976,, to include ideological factors, such as religious concepts and rituals, in their analyses of human adaptations to tropical environments.

Purely materialist studies of human ecosystems, including those of most cultural ecologists, have tended to view the ideological dimension of human ecology as epiphenomenal, representing a superstructural domain external to the modes of production and reproduction expressed in economic and subsistence processes, and having no causal effect upon them (Harris 1968, 1979). However, as Sponsel has recently noted, the mere fact of human presence in all its aspects inevitably affects environments and ecosystems; and human ecological behavior in all traditional societies is intimately and intricately interlinked with world-view, religious belief, magic and ritual (Sponsel 1986:73).

An effort to include the ideological dimension, and to describe its crucial importance in analyzing human subsistence practices in a neotropical ecosystem, was Reichel-Dolmatoff's analysis of Desana adaptation to the Amazonian rainforest (1971, 1976). The potential of this approach has been briefly reviewed by Alland (1975). Sponsel cited the work of Reichel-Dolmatoff as a specific exception to the "general neglect" of superstructural phenomena in the analysis of human ecosystems:

> The most outstanding exception to this neglect is found in Reichel-Dolmatoff's studies of the Desana...There is emic as well as etic recognition that animal protein is at the foundation of Desana cultural ecology...religious symbols, beliefs, and values are daily translated into practical action...Reichel-Dolmatoff adeptly manages to transcend the perennial rifts between cultural mentalism aad materialism, culture and behavior, and ethnoecology and cultural ecology. Although often criticized on methodological grounds and rather weak in analyzing the ecosystem, the Desana case is as fascinating as it is complex and really deserves much more attention. (Sponsel 1986:79-80).

Gordon Willey has also called attention to the importance of Reichel-Dolmatoff's work, and to its specific relevance for a holistic explanation of Maya adaptation:

> Gerardo Reichel-Dolmatoff (1976) showed convincingly that ideology--religion, world view, or however one may wish to describe it--has a formative role in cultural development and is linked to all phases of it. Although he was dealing with a simpler society, his arguments are germane to the Maya scene. (Willey 1980:261)

Willey goes on to point out the archaeological tradition of reasoning from the material to the non-material, a tradition which may contribute to the current ecological bias in analyzing human adaptation, and possibly impede our understanding of the role of ideology as an adaptive factor. Although Willey has elsewhere proclaimed himself to be a confirmed materialist (Hammond and Willey 1979:xv), he concludes his commentary by declaring that

> Subsistence, settlement patterns, socio-political organisation and ideology...are <u>interlinked systemically</u>...Maya research [has shown that] ideologies and images of the mind are not random creations...spinning along in independence from other aspects of life. They are designs which articulate...with a real and material world... there is a challenge to understand the dialectic that exists between the tangible creations of the material world and the more abstract creations of the mind. (Willey 1980:263; emphasis added).

While Steward viewed the relationships between environment and culture as essentially unidirectional, with environment the determinant and culture the dependent variable, some investigators tend to concur with Willey's view of culture and environment as interacting variables, linked in an interactive feedback relationship in which each affects, and is affected by, the other.

Although ideology is an essential part of all cultures, its causal relationship to subsistence activities and decisions has not yet been satisfactorily demonstrated.

A theoretical position utilizing the principles of cultural ecology, in which ideological factors will be considered as possibly relevant variables playing a dynamic role in ecological adaptation, will be adopted in the present study. As Willey and others have pointed out, any truly holistic theory of culture as human adaptation must account for the adaptive role of superstructural phenomena in human ecosystems. So far, this has not been achieved.

The realm of ideology has too often been treated as a kind of frosting on the cake, of which subsistence and environmental factors constitute the primary layers containing the pith and substance of what is important to the development and functioning of human adaptive systems. If we accept the premise that culture and human ecology are interactive, or even that the former constitutes an aspect of the latter, it is essential to consider the ideological dimension of culture as a significant element in human exploitation of environmental resources. While food taboos and hunting magic can be explained on an etic level in strictly biological or ecological terms, no understanding of their emic meanings is possible without recourse to the characteristics of the superstructure. This is one reason purely ecological models are so often lacking in explanatory power--by nature they are, of course, reductionistic (Johnson 1982); but this is a less serious fault than the fact that they cannot account for all the observed phenomena pertaining to subsistence.

Evidence accumulated by Maya archaeological studies suggests there may be human psychological imperatives, as well as economic and environmental ones, contributing to the uses of biological species in the adaptive process (Pendergast 1971; Pohl 1985). An efficient explanatory model must take all such factors into account. Even if all the mechanisms involved cannot be fully operationalized, assuming that psychological imperatives expressed in ideology may contribute to human adaptation, and may possibly even play a causal role in subsistence decision-making, should lead to a more nearly holistic analysis than one ignoring the possibly causal role of such factors.

In the present study, both environmental factors and ideological factors will be viewed as having mutual causal potential. Either kind of factor will be regarded as being capable of assuming a causal role in initiating the "kick" producing the deviation-amplifying, positive feedback relationships that lead to systemic change.

D. Optimal Foraging Models and Maya Subsistence

While optimal foraging theory offers a useful way of modeling subsistence, the necessary data to develop such an approach for the Maya are lacking.

Optimal foraging models assume that humans, as well as other animal species, direct their foraging activities in ways that make optimum use of resources available in particular environmental situations (Keene 1981; Orians 1979; Smith 1981; Winterhalder 1981a, 1981b; Yesner 1981). Such models have general utility for predicting foraging decisions and their outcomes in different kinds of environments. Models may be operationalized in terms of subsistence and economic goals; a currency (i.e., a measure of return, such as Kcal/hour of energy captured for effort invested); the given environmental constraints; and a set of available options (Keegan 1986:93).

Earle has made an effort to extend the principles of optimization, derived from studies of animal foraging behavior, to human groups whose subsistence base is in a stage of transition from hunting and gathering to agriculture, and whose culture is becoming increasingly complex (Earle 1980). As Earle points out, many concepts employed in optimal foraging analyses of hunting/gathering behavior can be utilized to study groups undergoing the transition to agriculture. Among these are measurements of the costs of procurement activities, and ways of comparing these to returns for effort invested.

A second effort to adapt optimal foraging theory to a food-producing society was recently published by William Keegan (Keegan 1986). Keegan uses the Machiguenga, an Amazonian population, to illustrate how optimal foraging principles may be applied to horticultural decision-making, in a model in which gardens are conceptualized as "managed patches" (Keegan 1986:95). Since the Machiguenga practice shifting, slash-and-burn cultivation similar to the Maya milpa system, Keegan's analysis may perhaps provide analytic methods applicable to Maya subsistence, if the necessary figures on animal biomass, productivity, hunting and fishing harvests, and more realistic estimators for prehistoric human populations in the Maya area are ever generated. Unless such critical data become available, optimal foraging analysis of the Pre-Columbian Maya will not be possible.

There is little likelihood of collecting the necessary data on fish and game harvests and cost/return ratios resulting from traditional procurement methods and practices in the Maya area, such as Vickers (1980) and Beckerman (1980) were able to obtain in Amazonia. In addition to the modern distortions of game populations, the acculturated Maya of the late twentieth century no longer hunt with traditional weapons, but with firearms, which would seriously skew any data obtained from the study of modern hunting. Valid data for fishing might be more possible to obtain, however, since traditional fishing methods are still in use, in addition to those adopted from Europe and North America. Adapting Vickers' or Beckerman's Amazonian data to the Maya case would be inadvisable for a number of reasons, including the fact that some primary prey species hunted by the Amazonians are not native to the Maya habitat.

The principles of optimal foraging theory may be of value for estimating an optimal mix of strategies the Maya may have pursued in developing an economy to sustain large urban population aggregates, as well as more dispersed suburban and rural concentrations of settlement. However, ways of estimating the unknown variables in such an ecosystem would be required, in order to achieve an optimal analysis of Maya subsistence economy. Since the necessary data for making such estimations are lacking, no attempt to use such an analytic approach will be made in the present study.

V. THE ETHNOHISTORIC EVIDENCE FOR MAYA ANIMAL UTILIZATION

A. The Sources

The historian Howard Cline, in his introduction to the volumes of the Handbook of Middle American Indians devoted to ethnohistoric sources, succinctly defined the task of ethnohistory as "to close that gap in continuity between findings of archaeology and ethnology" (Cline 1972, v.12:6). Although this is an abbreviated definition of a complex mission, it makes explicit the complementary nature of the relationship between the two related disciplines of archaeology and ethnohistory, which share as a common goal the reconstruction of the past.

These two fields of endeavor are particularly vital to each other in Mesoamerican studies, since the relatively large body of available ethnohistoric literature, both native and European, constitutes a major resource for supplementing archaeological data documenting the transformation of native cultures into the hispanicized culture of the Colonial period. While extrapolation to the prehistoric past on the basis of conditions observed at the time of contact must necessarily be done with extreme caution, the written records of the Conquest that have come down to us provide at least a small window to that past, one whose view, limited as it may be, can perhaps shed more light on Mesoamerican prehistory than we have yet allowed it to do.

> The written records of the colonial period do contain bits of data which occasionally illume the pre-Hispanic period, some with fair reliability to as early as the 7th century A.D. ...and generally back to the 15th century A.D...(Cline 1972, v.12:6).

Although bioarchaeological studies aimed at reconstructing the paleoenvironment and paleoecology of the Maya regions are a phenomenon of very recent date, both general and detailed descriptions of the land, its wild and cultivated plants and native animal life, appear in some of the European accounts of the sixteenth century. Many of these give information that is incomplete, and of doubtful reliability; however, there are notable exceptions, providing documentary material of potential utility for reconstructing prehistoric Maya subsistence and economy, including native patterns of utilizing animal species.

Since the majority of works examined in the course of this investigation date to the time of the Conquest or to the early Colonial period, a few words characterizing each of these periods are in order.

The time of the Spanish Conquest in the Maya area, as in Mesoamerica generally, varied greatly by region, according to the local sequence of events. Spanish penetration and influence varied temporally between north and south. While the conquest of the northern Maya of the Yucatan Peninsula was essentially complete by 1545 (Means 1917:53; Chamberlain 1948), that of the southern

Maya of the Peten lakes region, Chiapas and Belize was not accomplished until the very end of the seventeenth century (Jones 1984a, 1984b). For this reason, the literature of the Conquest in these two regions falls into different time frames, as well as into two geographically distinct areas.

The materials from which the data presented below have been drawn necessarily constitute a selected sample of the extant ethnohistoric literature of the Maya. Because of limited funds and time constraints, it was necessary to restrict sources examined to those available in the United States and Canada, with few exceptions. For this reason, the resources utilized consisted primarily of published materials.

In addition, a large proportion of the accounts examined for information on animal species of economic importance, procurement practices, and hunting/fishing rituals, have not been cited in the following discussion, since only those items that actually yielded such material have been included.

The greater part of the ethnohistoric literature makes little or no mention of native animal procurement and use. This is especially true of surviving records of the Spanish <u>conquistadores</u>, whose interest in the subsistence activities of the native inhabitants appears to have been largely confined to collecting their products for the support and maintenance of the conquerors themselves, and later of the Spanish colonial government and priesthood.

The body of literature upon which this study is based extends from the late prehistoric period, in the case of a small number of native documents, to the end of the seventeenth century. The year 1697 is an appropriate end point, since it was in this year that the Spanish achieved their final conquest of the southern Maya people, with the defeat of the Peten Itza and the destruction of their capital at Tayasal (Jones 1984b:6). The northern lowland Maya of Yucatan had been subdued a century and a half before; however, an unknown but apparently substantial portion of the northern Yucatan population had migrated southward following the arrival of the conquerors, settling in the Maya communities of Belize and the Guatemala Peten, in order to escape Spanish domination. This southern population appears to have successfully resisted Spanish influences, both political and cultural, for several generations before finally succumbing to Spanish hegemony. There is some textual evidence that the ultimate acquiescence of these Mayas to their invaders may have been intentionally timed, to fulfill the katun prophecies in the native books of Chilam Balam, a late fifteenth century priest of Yucatan, who foretold the imminent introduction of a new religion in these works which appear to date to late late prehistoric times (Jones 1984b:16-17).

In the following syntheses of ethnohistoric data, the documents cited have been divided into three main classes, two of which have each been subdivided into two subclasses. These subdivisions are primarily cultural and geographical, although they also incorporate a temporal dimension. As mentioned above, the bulk of these materials were written during the sixteenth and seventeenth centuries, with a few having been composed somewhat earlier or later. Many of the native accounts are of unknown date, and some indigenous documents of the Conquest period are believed to be later copies of manuscripts dating to earlier times. Others--in particular the literary works of the Quiche Maya, which include such well-known documents as the Popol Vuh--represent a traditional oral literature, which was rendered in written form only after the Conquest, when literacy on an extensive scale began to be promoted through the educational efforts of the Spanish *padres*.

Geographically, the materials included in this study are confined to the area occupied in pre-Hispanic times by those groups classified, on the basis of language and culture, as Maya: the Yucatan Peninsula, comprising the present Mexican states of Yucatan, Campeche, Quintana Roo, and part of Tabasco; the independent state of Belize; all of the present Mexican state of Chiapas; and most of present-day Guatemala (see figure 1). The large body of ethnohistoric literature pertaining to the Central Mexican region has not been included, with the exception of portions of some works primarily devoted to Mexico that also contain material relevant to the Maya--e.g., Bernal Diaz del Castillo's history of the Conquest (Diaz del Castillo 1904, 1908-16).

Politically the Maya area was, in colonial times, under the governance of several different entities. The Yucatan Peninsula was independently governed from the capital at Merida under the regime originally headed by members of the Montejo family, beginning in the 1530's (Means 1917). During most of the Colonial Period the present State of Chiapas was politically attached to Central America, first falling under the jurisdiction of the Audiencia de Los Confines (Honduras, 1544-1549), and later under that of the Audiencia de Guatemala, originally centered at Santiago de Guatemala (now Antigua), and subsequently at Guatemala City. However, judicial jurisdictions of New Spain (now Mexico) and Yucatan also overlapped, since both were included under the Audiencia of Mexico created in 1527, following an earlier period when Yucatan was under the authority of the Audiencia de los Confines (Chamberlain 1948). Since many of the colonial archives, both in Spain and Mesoamerica, are organized by audiencia, most of the documents pertaining to the Maya of Chiapas are now located in the archives of Guatemala City, rather than in Mexico City, although some records of colonial Yucatan may be found in the Archivo

General de la Nacion (AGN) in the Mexican capital (Greenleaf and Meyer 1973; Sherman 1973).

Besides these political distinctions, the Yucatan Maya have traditionally been distinguished from the Maya of Chiapas and Guatemala on the basis of cultural and developmental differences in prehistoric times. For this reason, as well as to reflect their different political situations, both at the time of the Conquest and during the century and a half separating their respective subjugations to the European invaders, the ethnohistoric literatures of the Yucatan Maya and the southern Maya of Guatemala/Chiapas have been subdivided in the following discussion, in the manner outlined below.

In accordance with the above historical and geographical distinctions, ethnohistoric accounts referred to in this and subsequent chapters will be described, and their relevant content summarized, according to the following classification.

Class I: Native Documents. This class includes all surviving native manuscripts, both those written before the Conquest and those of later date; traditional literature written by natives from oral accounts; and documents of Conquest and colonial times composed by the Maya, such as land titles and records of litigation, in so far as these may include any information relevant to animal procurement and use. This class has been subdivided into two categories:

A. <u>Northern Maya Native Sources</u>. This category includes native documents produced by the Yucatan Maya, including those attributed to Maya groups who, at the time of the Conquest, occupied any of the northern provinces in what are now the Mexican states of Yucatan, Campeche, Tabasco, and Quintana Roo; and any aboriginal works that may be traceable to the Itza of Belize or the Guatemala Peten, or to Maya populations migrating into their territories, during this period of time. Examples include the <u>Books of Chilam Balam</u> (Roys 1967), the <u>Ritual of the Bacabs</u> (Roys 1965), and the Paxbolon-Maldonado papers (Scholes and Roys 1968).

B. <u>Southern Maya Native Sources</u>. This category comprises the relatively large body of native literature of the Quiche Maya of highland Guatemala, as well as indigenous documents produced by other Maya groups of the southern lowlands and highlands.

Class II: <u>General histories and early descriptive reports by Europeans of "The Indies"</u> that include material regarding the fauna and/or hunting and fishing practices of the native inhabitants at the time of contact. Among such works are the journal of Cristopher Columbus's first voyage (Jane 1930), and the early accounts of Peter Martyr d'Anghiera (1516), Oviedo y Valdes (1535), and Lopez de Gomara (1542?), as well as the somewhat later synthetic work of Acosta (1590), Herrera y Tordesillas (1601-1615), and Lopez Medel (n.d.).

Class III: Contemporaneous accounts by Europeans of the Conquest and Colonial periods. This class is subdivided into two subclasses:

A. Accounts of Yucatan (northern Maya lowlands). These include the valuable Relacion of Bishop Landa (1566); the Relaciones de Yucatan, composed in response to the questionnaire sent out by Philip II of Spain to bishoprics in the New World (1578-1584; see Appendix for an English translation of this document); the Cuidad Real relacion on Ponce (1588); the comprehensive, though somewhat later, history of Cogolludo (1688); and a variety of other materials.

B. Accounts of Guatemala, Chiapas and Belize (southern Maya lowlands and highlands). This category comprises a number of important resources, including the letter of Garcia de Palacio to the Spanish king (1576); several late sixteenth century relaciones; such later works as Fuentes y Guzman's Recordacion Florida (1689-98); and Ximenez's natural history of Guatemala (1967).

In the synthetic summaries below, each class of documents will be considered as a separate group, in relation to each of the species and procurement techniques discussed.

B. A NOTE ON METHOD

The documents examined in the course of this investigation were identified from a variety of bibliographic sources. These included the volumes of the Handbook of

Middle American Indians devoted to ethnohistoric sources; the library catalogs of a number of universities and specialized collections, including those of the Bancroft Library, the Ayer Collection of the Newberry Library, and the Peabody Museum of Harvard University. The Library of Congress *Union List of Manuscripts* and *The National Union Catalog of Pre-1956 Imprints* were also consulted to identify and locate materials of potential usefulness, in addition to a number of more specialized works devoted to bibliographic resources available for Maya history.

A list of potential sources of ethnohistoric information relevant to the present study was compiled from this survey, and bibliographic information for each was recorded on data collection forms, one for each item. Any further information available from bibliographic sources was also recorded, including various editions and translations available, as well as library locations and classification numbers whenever these could be obtained.

Materials were examined in the library collections of the University of Washington (Suzzalo Research Library and University Archives); the University of California at Berkeley (including the Bancroft Library); Tulane University (Latin American Library and Rare Books and Microforms collections); the University of Texas at Austin (Benson Library of Latin American Studies); the University of British Columbia; the University of Oregon-Eugene; the British Columbia Provincial Archives; and other institutions. Items for which a specific location had been identified in advance were retrieved first; materials for which no locations had been found were searched for in all the libraries visited.

Materials were systematically examined for any data concerning fauna utilized by natives of the Maya area, for species descriptions, and for information regarding fishing and hunting practices and techniques for preserving animal foods in use at the time of the Conquest. Native literature was examined for any similar references to pre-Columbian practices, or to animal species used in aboriginal times.

Brief pertinent information was recorded verbatim on the data collection form; lengthier passages were photocopied, whenever possible, and some of the shorter documents were photocopied in their entirety. Microform material was duplicated, or hard-copy prints were made. Material from rare and fragile documents that could not be photocopied was copied by hand. All copied materials were attached to their appropriate data collection forms.

When all identified documents that could be located had been examined, the data collection forms, together with their attached photocopies and research notes, were sorted into categories according to the document classification scheme described above. All the descriptive material was then translated into English. This body of data was then utilized in generating the following annotated species list, and the descriptions of hunting, fishing, associated rituals, and preservation techniques that follow it.

C. DESCRIPTIONS OF ANIMAL SPECIES IN ETHNOHISTORIC DOCUMENTS

Upon reading early Spanish accounts of the Maya, it is immediately apparent that native subsistence was not a matter of great interest to the conquistadores. In their single-minded quest for gold and political dominance, such matters were undoubtedly of minor importance. Just as their descriptions of native agriculture are typically limited to a few phrases about maize cultivation and that of some other crops, so the procurement of animal protein is scarcely mentioned, being confined to the most general terms when it is referred to at all. Typically such references, when they do occur, note only that the natives raised birds of the native or Castilian varieties; or that they caught a great many fish in the rivers; or that in a particular town there was a great deal of deer and rabbit hunting, etc.. Sometimes a comment would be made about a particular bird or fish that made a special impression because of its quality of flavor, which the Spaniards found to their liking.

Species of animals eliciting more than a passing comment were likely to have been those for which no Old World counterpart was known, and whose exotic qualities were therefore likely to incite a degree of curiosity that sometimes produced detailed descriptions. The animals most often described by the Spanish writers are, therefore, not necessarily those of particular economic importance, but rather those least familiar to Europeans.

~~The~~ accounts of the Colonial historians, and of the early synthesizers of data obtained from firsthand reports by explorers, tend to be somewhat fuller and less fragmentary than those by Conquest writers, as will be seen. While such accounts are valuable, it must nevertheless be borne in mind that these are, for the most part, secondary descriptions, based largely upon data derived from earlier accounts, and in some cases upon hearsay. Many of these narratives share the hyperbole of the earliest histories of western European tradition, e.g., those of Herodotus, and are of comparable reliability. Some of the historians, notably Oviedo in the early sixteenth century, and Father Ximenez almost two hundred years later, obviously attempted to be factual, and to report the available information as fully and objectively as was possible from the limited, and often inaccurate, information at hand.

Native Maya literature is couched in metaphor and mythic references, making information regarding species use and subsistence practices difficult to interpret. The existence of annotated scholarly editions of many of these works (e.g., Edmonson 1971, 1982; Roys 1965, 1967) has been an aid in circumventing this difficulty.

1. Species Described or Depicted, and Their Uses

The earliest descriptions of Maya animal use by European writers appear in surviving accounts of the initial encounter between Hernandez de Cordoba's men and the native residents of Yucatan, during the Cordoba expedition of discovery in 1517 (*Regimiento* 1519; Peter Martyr, MacNutt 1912; Oviedo 1851-55, Tomo I; Santa Cruz 1920-1923, Tomo I:186-7; Gomara 1552:185-6; Las Casas 1875-6, Tomo IV:348-363; Cervantes de Salazar 1914; Diaz del Castillo 1904; all reprinted in Wagner 1942). Of these, only that of the *Regimiento* of Vera Cruz and Diaz del Castillo are based upon eyewitness observation, the *Regimiento* having had access to the testimony of some sixteen survivors of the expedition, and Diaz del Castillo having himself been a member of the Cordoba party. Cordoba himself left no report of this expedition, since he died soon after it was completed, of numerous wounds received at the hands of the Maya during the ferocious battles in which they engaged Cordoba's men.

Several of the accounts quoted in Wagner mention gifts of wild game and birds, given by the natives to the invaders at the Maya capital of Campeche, in accordance with the native custom of presenting animals to their lords as a mark of respect and esteem. The species mentioned vary from one account to another, and the two accounts based upon direct observation make no mention of these offerings, so the information given is at best uncertain. Peter Martyr's description appears to be an exaggerated one:

> They sat down to a sumptuous repast, where they were served with turkey, fat chickens, and wild birds, from the mountains, woods and swamps; partridges, quail, doves, ducks, geese, and wild game such as boar, deer, and hare; not to mention wolves, lions, tigers, and foxes. (De Orbe Novo, Dec. VII, Lib. II, MacNutt translation; quoted in Wagner 1942:35).

According to Oviedo,

> Some Christians went ashore and they [the Maya of Campeche] made much of them,...bringing them many very good birds to eat, not smaller than peacocks and of no less good taste, and other birds such as quail, doves, ducks and geese, and deer, rabbits and other animals. (Oviedo, Lib. XVII, Cap. III; quoted in Wagner 1942:38).

This is a somewhat more credible account, since it is restricted to species the Maya are known to have utilized as food, and says nothing about a "feast". The same may be said of the Gomara account, which mentions offerings of partridges, doves, ducks, turkeys, hares, deer, and other animals (Historia, 1852:185, quoted in Wagner 1941:42).

Traditionally it has been thought that the Maya subsisted primarily on vegetable foods, particularly maize, a view that in recent years has been seriously challenged by steadily accumulating evidence of a more diverse diet, supported by a broad range of subsistence activities. That animal resources and their procurement were an important element in Maya economy at the time of

European contact is attested by some of the more specific of the Spanish accounts. The _Relacion de Tahzib_ tells us that "for meat...[the Yucatan Maya] eat chickens, turkeys, venison, wild pig and the meat of other wild animals" (Relacion de Tahzib, RY I:188).

The following list of species descriptions is arranged by zoological classes, in order to facilitate comparison with species data reported in ethnographic and archaeological literature. Unless otherwise noted, the first Maya term given for a particular species is in the Yucatecan language; terms in other Maya languages are so identified. In some cases (e.g., the Tozzer edition of Landa's _Relacion de las Cosas de Yucatan_), an editor/translator's identifications of animal species have been relied upon, unless errors are evident in such identifications.

a. INVERTEBRATA

The following species lists represent an effort to fit taxa recognized by the Maya into a standard zoological classificatory scheme. Some overlap--e.g., between Mollusca, worms, and the larvae of insect species--is unavoidable, since Maya ethnozoological classification incorporates both similarities and differences not recognized by standard Western systematics, and is based upon somewhat different principles (Hunn 1977:xxi-xxliv). The arrangement below is therefore a compromise between these two very different systems of classification, and the broad, nontechnical categories employed by the early

Spanish writers, which themselves may be regarded as constituting yet another ethnozoological classificatory system.

It should also be noted that the lists below underrepresent the species referred to in native Maya literature, due to the impossibility of equating many Maya and Spanish ethnozoological terms and categories with standard zoological classes. In so far as possible, the adaptation of Tzeltal ethnozoologic categories to standard Western taxonomy provided by Hunn for species native to highland Chiapas has been followed (Hunn 1977:313-322); missing species discussed in the ethnohistoric literature have been interpolated, or have been appended at the end of the appropriate category.

Platyhelminthes (tapeworms=Cestoda)

Aschelminthes (parasitic roundworms=Nematoda)

No descriptions found.

<u>Mollusca</u>

<u>Gastropoda</u>

<u>Thiaridae</u>

<u>Pachychilus</u> sp.- terrestrial snail (Spanish <u>jute</u>, Tzeltal <u>puy</u>, "a genus of snails reported as being eaten by the Indians of Vera Paz, Guatemala" (Von Martens 1890:152, quoted in Hunn 1977:255. Hunn further reports the medicinal use of this, as well as other snail species, in a cure for impotence by contemporary Tzeltal Maya (Hunn 1977:119)). Moholy-Nagy

suggests *Pachychilus* may have been a supplementary source of animal protein for the prehistoric Maya (Moholy-Nagy 1978); large amounts of their shells have been found in Maya archaeological deposits, e.g., at Lubaantun (Hammond 1975). Nations describes the modern Lacandon use of *Pachychilus* shells for lime processing of maize, and suggests powdered lime from such shells may have been traded throughout the Maya area in prehistoric times from centers where the genus is indigenous--e.g., eastern Chiapas sites, including Palenque, Piedras Negras, Bonampak, and Yaxchilan (Nations 1979a). No references to *Pachychilus* species were found in the ethnohistoric literature.

Limacidae - slugs; Spanish *barbosa*, Tzeltal *nap'ak* (Hunn 1977:257-258)

Oleacinidae

"Conical-shelled terrestrial snails"(Tzeltal *k'ocin te*)

Helminthoglyptidae, Planorbidae

"Cylindrical snail", either aquatic or terrestrial (Tzeltal *k'o*; Hunn 1977:257)

Unclassified *Gastropoda*:

Snails, aquatic and terrestrial (various types)

Spanish *caracol*; Maya *ul* ="certain small mottled snails, which live among bushes and in rocky places" Motul Dict., quoted in Roys 1965:141); *xot*="*Melania levissima*, an edible fresh-water snail" (Roys 1931: 341); Tzeltal *puy*="Aquatic and terrestrial snails with conical shells" (Hunn 1977:255).

Class III.B.:

> There are an infinite number of kinds of snails that the Divine Omnipotence has created in these oceans, but the most useful is...[one] bred on the south coast, from near Panama to the village of Sonsonate. They cling to the large rocks along the sea coast, and the Indians go there in their canoes to collect them...(Ximenez 1967:215-216).

A dye was made from these snails, which the women used to dye petticoats, and to make designs (Ximenez 1967).

Strombus, Cassis genera - Marine conch

Littorina, Trochidae genera

Periwinkle - mussel, marine snail

Pelecypoda

Unionidae (pearl-button mussel=Tzeltal bak cikin)

Marine, Terrestrial (Land snails, slugs);

Bivalves

Lamellibranchia - clam, oyster, mussel

Oyster - Maya boc (San Francisco Dict., per Roys ~~1931~~:328)

Brachiopoda

Class II: Oviedo comments that many oysters are among the species taken in the sea (Stoudemire 1959:111).

Class III.B.: Ximenez reports oysters were abundant in the "south sea" [Pacific Ocean], where they were collected and traded in Guatemala (1967:212).

Other Unclassified Mollusca:

Pomacea:flagellata - freshwater swamp species. These are found in many archaeological deposits at Maya sites, e.g., Tikal (Moholy-Nagy 1978), Cuello (Hammond *et al* 1979).

Vermiformes, worms - Spanish *gusano*, *lombriz*; Maya *ah-zatz* (Roys 1931:343), Tzeltal *lukum* (Hunn 1977). The Motul Dictionary defines *ah-zatz* as "certain large worms which the Indians eat. They live on the ceiba and pixoy trees" (Motul Dictionary, quoted in Roys 1931:343). These may possibly be the large, striped grubs so commonly seen inhabiting the trees of the northeastern Yucatán peninsula, in the area of Coba.

Annelida

Oligochaeta

Earthworm - Spanish *gusano*; *lombriz de tierra*; Maya *lucum*, *lucum-can* (lit. "worm-snake") (Roys 1931:336; Pacheco Cruz 1919:64).

Class I.A.: In the *Ritual of the Bacabs*, the *lucum* or angleworm symbolizes a bow-string in an incantation to accompany chipping a flint point (Roys 1965:137). Roys further notes that such worms were "roasted, ground to powder, and mixed with *atole* chocolate for a drink to cure an itching rash on the mouth or the head" (Roys 1965:137).

Hirudinea

Leech - Tzeltal *ohcel*, *ohcel lukum* (Hunn 1977:258). According to Hunn, these are greatly feared by contemporary Tzeltal Maya, and are considered related to the earthworms, and to parasitic roundworms.

Unclassified vermiformes:

Various grubs, caterpillars, insect larvae and maggots are classed with "worms" by the Maya.

"Maize worm" - Maya ah-nab-nok (Roys 1931:337)

"Shipworm" = Spanish broma

Arthropoda

Arachnida

Scorpionida

Scorpion - Spanish escorpion, Maya zinaan (Roys 1931:343), sinaan (Tozzer and Allen 1910:305).

Class I.A.: The scorpion is well represented in the Codex Tro-Cortesianus (Tozzer and Allen:305-307; Pl.3). In addition, the Ritual of the Bacabs includes an incantation for curing the scorpion's sting (Roys 1965:54-55).

Class II:

> There are poisonous scorpions in many parts of Tierra Firme...They are almost black on a lighter color. Many times I have seen them in Panama on the coast of the South Sea (Oviedo, Stoudemire 1959:78).

Acarina

Thrombidiformes (in part) - Chigger, Tzeltal sohk (Hunn 1977:308)

Parasitiformes - Tick, Spanish garrapata, Maya pech; kulim (Roys 1931:336, 338); Tzeltal sip (Hunn 1977:308).

Araneida

Spider - Maya leon, leum, ah-leum="a general term for spider" (Motul Dict., per Roys 1931:336); am

Pacheco Cruz 1919:58); Tzeltal _am_ (Hunn 1977:310). The Motul Dictionary defines _am_ as a deadly spider with a red tail (per Roys 1965:129).

Class I.A.: In the _Ritual of the Bacabs_, the Maya shaman invokes the green spider in an incantation for neutralizing its poison (Roys 1965:53-54).

David Freidel has pointed out that Maya shamans used bundles of spiders (_am_) in divination, to forecast future events, and thinks this spider-divination element may be expressed in the _am_ portion of the name of the Maya Earth Monster, Itzamna--i.e., used here semantically as well as phonetically (Freidel 1986). Roys noted that _am_ was also the term for "a divining stone used by medicine men" (Roys 1965:129), which may represent an extension of the term originally associated with the spider-bundles used for the same purpose.

Class II:

> There are some spiders larger than a man's spread-out hand. I saw the body of a spider...that was as large as a sparrow. It was covered with down. The color was dark brown, and the eyes larger than those of a sparrow. These large spiders are poisonous...(Oviedo, Stoudemire 1959:78).

Class III.A.: The _Relacion de los Pueblos de Tetzal y Temax_ describes three kinds of poisonous spiders:

> There are very poisonous spiders of three kinds; the one they call _chivoh_ is black, and another they call _tzitun_ is yellow, and the other is called _am_, [which] is very black and stings with the tail, which is red...(RY I:301).

Class III.B.: Ximenez described a species of spider that "sheds its skin like a snake, and after leaving its former skin, it becomes timid and weak because the new skin is thin and tender, and remains so, until the new skin hardens" (Ximenez 1967:123).

<u>Crustacea</u> (shrimp, conch, crabs, crayfish)

<u>Conchostraca</u>

Clam shrimp, Tzeltal <u>bak</u> <u>cikin</u>="bone ear" (Hunn 1977:250); (included with freshwater bivalves, <u>Mollusca:Pelecypoda,</u> in Tzeltal Maya folk classification).

Isopoda

<u>Decapoda</u> (Crabs, shrimp, fresh water crayfish)

<u>Homaridae</u>

lobster (genus <u>Homarus</u>)

<u>Astura:Astacidae,</u> genera <u>Astacus,</u> <u>Cambarus</u>

Crayfish, "spiny lobster" - Spanish <u>cangrejo</u>, Chol <u>yux</u> (Moran:14, in Hellmuth 1977:432); Tzeltal <u>masan</u> <u>cay</u>="meadow grasshopper fish" (Hunn 1977:253).

<u>Anomura,</u> <u>Brachycura</u>

Crabs - Spanish <u>cangrejo,</u> Maya <u>ix-bau</u> (Pio Perez 1866-77, cited in Roys 1931:328); <u>ah-buk</u>="a certain sea crab" (Roys 1931:328).

Class I.B.: The use of crabs as food is referred to in the section of the <u>Popol</u> <u>Vuh</u> dealing with the second creation, indicating this species was so used by the highland Maya:

> Only fish, only crabs he would look for in the waters, just for his food every day, wandering by day in search of food...(Edmonson 1971:48-49).

Class II: Oviedo distinguished between land and water crabs, indicating the land crabs are a more desirable food species, since the "water crabs" had been known to cause illness.

> Crabs...come from holes they make in the earth...They walk sideways and are good to eat. The Indians are very fond of them, and in Tierra Firme there are many crabs. Crabs are...tasty...and very good when roasted over coals...on the seacoast and on the banks of the Guadalquivir where it enters the ocean,...and in many other places, there are many crabs, but they are water crabs (Oviedo, Stoudemire 1959:79).

<u>Natantia</u>; also <u>Mysidae</u>, <u>Euphausidae</u>, <u>Amphipoda</u>, <u>Branchiopoda</u>.

Shrimp - Spanish <u>camarones</u>, Maya <u>xex-cay</u> (Beltran 1859:230, cited in Roys 1931:341); Chol <u>xex</u> (Moran:17, in Hellmuth 1977:432)

Class III.B.: Ximenez refers to the abundance and variety of shrimp along the coasts of Guatemala and Veracruz, stating that in the latter location he saw "all the bottom of the sea covered with them", which lasted three or four days, and then they were gone (Ximenez 1967:212).

<u>Myriapoda</u>

Diplopoda

<u>Chilopoda</u>

Centipede - Spanish ?, Maya <u>chapat</u> (Pio Perez Dict., per Roys 1931:331); <u>tzimez</u> (Roys 1931:340); Tzeltal sulub can (="horned bug") (Hunn 1977:310).

Class I: Centipedes occur in the Dresden and Vaticanus codices, as well, as on painted pottery (Tozzer and Allen 1910:303-304).

Insecta

Insects appear to have been important to the Maya in the treatment of disease, since they were frequently invoked in the curative rituals of the Bacabs (Roys 1965) and are currently employed for medicinal uses by highland Maya (Hunn 1977). Some were apparently also eaten, sometimes as a "starvation food", as when the migrating Quiche tribes resorted to "nourishing themselves with the eggs of wasps and beetles" out of necessity (Recinos and Goetz 1953:180). The grubs of insects were also consumed under similar conditions, according to the Popol Vuh:

> ...through the mountains they wandered then. And what they ate was just the children of hornets, just the children of wasps and just the children of beehives, which they hunted. There was no very good food...(Edmonson 1971:188).

The Quiche apparently considered the consumption of such foods to be demeaning, a mark of low status, perhaps because of the traditional association with misfortune and "hard times":

> Prince Iztayul insults you; he says you are a wretch and that you feed only on scum, on chiquirines [cicadas], and other trifles not proper for a lord (Edmonson 1971:186-187).

There is some evidence, however, that certain insects may have been considered desirable as food, at least in some parts of Middle America, as they are among such South American groups as the Yukpa (Ruddle 1973). Oviedo, in describing the "Indian prisoners" (slaves?) engaged in the overland trade in fish who were met by the Avila party (see below), says they had

> ...received in payment [for the fish] things which they needed and liked, and things that those people had in abundance, and...in this case they were paid in cicadas and crickets, and locusts, with which their trading baskets were filled (Stoudemire 1959:106).

Peter Martyr, citing Oviedo as his source, elaborated on this information in his characteristic manner:

> ...in a region called Zenu, lying ninety miles east of Darien, a kind of business is carried on for which there are found in the native houses huge jars and baskets, cleverly made of reeds adapted to that purpose. These receptacles are filled with dried and salted grasshoppers, crabs, crayfish and locusts, which destroy the harvests. When asked the purpose of these provisions, the natives replied they were destined to be sold to the people inland, and in exchange for these precious insects and dried fish they procure the foreign products they require (De Orbe Novo, V.I, MacNutt 1912:341).

This appears to testify to the use of these insects in large quantities, either as food--which appears likely, if the information on drying and salting is correct--or for medicinal purposes, among the Panamanian natives. Insects, like the mammals, reptiles and birds, were also offered as ceremonial sacrifices by the Maya (Thompson 1970:182). Specific documentary evidence for Maya entomophagy is, however, sparse.

In the following insect species list, zoological identifications have been made according to the systematic list of taxa and catalog of specimens given by Hunn for species native to highland Chiapas (Hunn 1977:313-332).

Odonata (Dragonflies and Damselflies)

Dragonfly - Spanish libellula, Maya tulix (Roys 1931:339, 1965:140)

Ephemeridae

Zygoptera

Orthoptera:

Caelifera

Acrididae (short-horned grasshopper family)

Locust - Spanish langosta, Maya zak (Motul Dictionary, per Roys 1931:343); azul-ceh="a large flying insect like a locust. It has long antennae and strong teeth with which it cuts a tree like like a saw." (Motul Dictionary, per Roys 1931:327).

Class II: Lopez Medel described the locusts of Yucatan in his Treatise on the Three Elements as follows:

> Locusts also have been seen in the Indies, although they are not so common as they are here; in the province of Yucatan alone they are seen more than in other parts...(Cap. 9, Pt. 1).

Cyrtacanthacridinae

Acridinae

Ensifera

Tettigoniidae (long-horned grasshoppers)

Gryllidae (crickets)

Cricket - Maya maz; ix-kochol=a large wingless cricket, used medicinally for urinary retention

(Roys 1931:335).

Class II: Crickets are mentioned as among the insects traded in Panama by Oviedo and Peter Martyr (see above).

Mantodea

Blattodea

Blattidae - Cockroaches; Spanish cucaracha, Maya kuluch (Roys 1931:336), Tzeltal pewal (Hunn 1977:294).

Isoptera (Termites)

Termite: Spanish comejen, Maya thuyul="a certain white ant, or termite" (Pio Perez, per Roys 1931:340).

Class II:

> There are...others that are called comejen, one half ant, the other half a small worm in a small white case which drags behind. They are very harmful and penetrate timbers and houses. These termites do much damage...they cause the wood to rot, and they eat it away until the walls are as hollow as a honeycomb...To that animal a house is the same as cloth to a moth (Oviedo, Stoudemire 1959:72-73)

Dermaptera

Mallophaga

Louse (in part)

Anoplura

Louse (in part)

Pediculidae - Maya uk="the louse found on man and quadrupeds" (Motul, per Roys 1931:341); Tzeltal uc, referring to lice infesting humans; yuc refers to those parasitic on other mammals (Hunn 1977:308).

Unclassified louse:

Louse - Maya buch="a chicken louse" (Motul, per Roys 1931:329).

Hemiptera (water bugs, backswimmers)

Homoptera

Auchenorrhyncha

Cicadidae

Cicada - Spanish chiquirine, Tzeltal citikin (Hunn 1977:288)

Class I.B.: As quoted above, cicadas are referred to in the Quiche Title of the Lords of Totonicapan as food fit only for "a wretch", and unsuitable for a man of high status (Recinos and Goetz 1953). However, Hunn describes their pseudo-medicinal consumption among contemporary Tzeltal Maya of Chiapas. In order to insure that a child will speak well and fluently, the "magic" number of exactly 13 cicadas (Tzeltal citikin) are gathered, baked, and fed to the child (Hunn 1977:120). This is apparently an instance of sympathetic magic.

Membracidae

Cicadellidae (leafhoppers)

Flatidae (planthoppers)

Sternorrhyncha

Aphididae

Pseudococcidae, Eriococcidae

Neuroptera

Megaloptera: Corydalidae

Coleoptera: (Beetles)

Carabidae

Lampyridae

Firefly - Spanish luciernaga, lampiride; Maya cocay (Roys 1965:131)

Scarabaeidae Beetles - Spanish escarabajo, Maya mácech=wingless beetle with a shell (Motul Dict., per Roys 1931:336); thuyul Roys 1931:340); Tzeltal cimol, plus many other terms; ?umoh=varieties considered edible by the Tzeltal Maya (Hunn 1977:295-296).

Scarab beetle larva=Tzeltal k'olom (Hunn 1977:304). Beetles currently have medicinal uses among the highland Tzeltal Maya. According to Hunn, a meloid beetle (Meloe nebulosus, Tzeltal tuluk chan="turkey bug") produces an oily exudate, which is used to treat warts. Another variety, Zopherus jourdani (Tzeltal wayway chan="Sleep-sleep bug") is believed to be an aid to sleep (Hunn 1977:298). Although such folk medicinal practices often date to prehistoric times, no reference to either of these uses was found in the ethnohistoric literature.

Trichoptera

Lepidoptera: Butterflies and moths - Spanish mariposa, Maya pepem, pepen="a general name for the butterfly"=(Motul, per Roys 1931:338); Tzeltal pehpen.

Moth - Maya ix-tuzil=a clothes moth (Motul Dict., per Roys 1931:339).

Caterpillars=Lepidoptera larvae (in part); Maya Ix kantanen-kin (Roys 1965:135), a woolly caterpillar about two inches long; Tzeltal cuhkum= "woolybear" caterpillar, cup=a hairy, stinging caterpillar (Hunn 1977:304-305).

Class I.A.: Tozzer and Allen point out a representation of a grub in the Tro-Cortesianus (p. 28), which is believed to be the larva of Acentrocneme kollari, reportedly a popular food in central Mexico (Tozzer and Allen 1910:302; Pl. 3(3).

The Ritual of the Bacabs contains an incantation for kanpetkin [wasp] seizure in which the yellow Ix kantanen-kin woolly caterpillar is invoked (Roys 1965:135).

Macrolepidoptera (Frenatae)

Papilionidae

larva=Tzeltal buluk' sit (Hunn 1977:305)

Morphidae

Nymphalidae

larva=Tzeltal c'istul (Hunn 1977:304)

Satyridae

Hesperiidae

Noctuidae:

Thysania agrippina (Hunn 1977:281)=Tzeltal pehpen

Microlepidoptera=Tzeltal supul (Hunn 1977:280-281); larva=Tzeltal bac'il cup, "slug caterpillar" (Hunn:305).

Diptera - (Flies, Mosquitos and pupae)

Flies - Spanish moscas, Maya yax-cach=a general name for flies (Roys 1931:342).

Class II: "In the West Indies and in Tierra Firme... are very small flies" (Oviedo, Stoudemire 1959:72).

Culicidae

Mosquito - Spanish mosquito, Maya koxol (Pio Perez, per Roys 1931:335; Pacheco Cruz 1919:64).

Class II:

> There are many kinds of annoying mosquitoes, especially in some areas along the coast and rivers. Many places inland are free of them. (Oviedo, Stoudemire 1959:72).

Tomas Lopez Medel discussed at length the annoying mosquitos of "Las Indias":

> There are in the Indies many...more mosquitos than in other parts of the world...some large and others small, and others so very small that one can scarcely seen them (which are called jejones); these are found in the hot lands, because in the cooler places there is no recollection of them...and where they bite...it is necessary to smoke in order to defend oneself from them, there is no other defense from them, and those who go to work in places where these plaguing and annoying companions are smoke a great deal (Lopez Medel n.d., Cap. 9, pt. 1).

Class III.B.: "[Mosquitos] are another plague of this land, especially in the hot and humid parts" (Ximenez 1967:121). He describes a number of varieties, in great detail (pp. 121-123).

Tabanidae

Horsefly - Spanish tabano, Maya ?

Class II:

> In Tierra Firme there are many annoying horseflies that have a terrible bite. There are so many species and in such large numbers that the reader would be bored by a by a detailed description (Oviedo, Stoudemire 1959:73).

Class III.B.: Ximenez distinguishes two kinds of these, the large gad-fly and a smaller variety, both of which are described as "poisonous pests that bite...and draw blood" (Ximenez 1967:120).

Calliphoridae

Tachinidae (in part)

Fly - Spanish mosca, Tzeltal ha (Hunn 1977:275-278)

Sarcophagidae

Sarcophaga, maggot and blow-fly.

Class I: According to Tozzer and Allen, two figures in the Codex Tro-Cortesianus (pp. 24, 27) represent the maggot of the blow-fly Sarcophaga, shown on a dead human body (Tozzer and Allen 1910:301-302; Pl.3).

Siphonaptera

Hymenoptera (ants)

Scolioidea

Formicoidea, Formicidae?:Myrmicinae, Atta sp.

Ants - Spanish hormiga, Maya zinic="a general name for ants" (Motul Dictionary, per Roys 1931:343);

boo="a certain variety of ants" (Pio Perez 1866-77, quoted in Roys 1931:328; hoch (Roys 1931:332; Roys 1964:133); sinic (Roys 1965:140); xulab=a stinging ant (Roys 1931:141); ilib-ceh="certain fierce mottled ants"

(Motul Dictionary, per Roys 1931:334); <u>kamaz</u>=a species of white ant (Pacheco Cruz 1919:52); <u>ppoppox-can</u>=a species of stinging ant (Beltran, per Roys 1931:338); <u>xulab</u>= the leaf-cutting ant, which stings seriously (Motul Dictionary, per Roys 1931:341); <u>ah-zay</u>=large stinging red ant that breeds in damp places (Roys 1931:343); Tzeltal <u>sanic</u>; <u>c'isim</u>=leaf-cutting ant, <u>bah</u> <u>te</u>, <u>cikitoros</u>=army ant (Hunn 1977:259-263).

Class II: Oviedo described the ants of the New World as follows:

> There are very many different kinds of ants, and some are unbelievably destructive...Those eaten by the anteater are small and black. There are others that are red...The worst are black ants almost as large as bees...From them and other poisonous ingredients the Indians make the poison with which they tip their arrows. There is no antidote for this poison and of those wounded by it, not four in one hundred recover...(Oviedo, Stoudemire 1959:73).

Here Oviedo appears to be referring to the Caribs.

Lopez Medel also described ants, in some detail:

> There are many ants in the Indies, and many kinds and forms of them, some very black and large with wings, and others of a bright reddish color...the sting of some of these is so hurtful that it causes as much pain as that of a scorpion; and there is a kind of ant that goes onto the trees in the hot lands, which is very rare, whose sting will kill a man (Lopez Medel MS, n.d., Cap. 9, Pt. 1).

Formicinae

<u>Vespoidea</u> (wasps)

Eumenidae

Vespidae:

Polistinae (wasps)

Wasp - Spanish avispa, Maya xux="a general term for wasp" (Roys 1965:142); bobote (Roys 1965:130); chac-ec, chac- ek (Motul Dict., cited in Roys 1965:132, a stingless variety; Pacheco Cruz states that this type is edible, and give Yucatecs Maya terms for nine different varieties (Pacheco Cruz 1919:41-42); ich-uinic, iche-uinic(?) Roys 1965:135); kanal tup-chac, tup-chaac (Roys 1965:140); ah-muul=wasp with yellow-tipped wings, which nests underground (Roys 1931:337); ix-tacab=a wedge, i,e., a flat-bodied yellow-and-black wasp (Roys 1931:338); kanpetkin (Roys 1965:135, Pacheco Cruz 1919:156).

Class I.A.: In the Ritual of the Bacabs, a curative procedure for neutralizing the poison of the kanpetkin-wasp is given (Roys 1965:48-49). This is "a large yellow wasp with a painful sting...cited in incantations for kanpetkin-seizure and other seizures" (Roys 1965:135), as well as for kanpetkin poisoning. "Kanpetkin-seizure" may possibly refer to anaphylactic shock resulting from allergic reaction to the wasp's sting.

Class II:

> There are many dangerous, poisonous wasps, whose sting is beyond comparison...They build very large nests, and their racemes, filled with cells, are as big as the honeycomb made by bees in Spain...(Oviedo, Stoudemire 1959:72).

Hornets

Holom, Holon (Maya)=an insect similar to a wasp, but larger and of different color, with a severe sting. (Pacheco Cruz 1919:47).

Sphecoidea

Apoidea - Bees, Spanish abeja, Maya cab (Roys 1965:130), ah-bool ="wild bees which make honey and do not sting" (Motul Dictionary, per Roys 1931:328); ikelcab (Pacheco Cruz 1919:41); choch(?)="a species of bee or honey-fly (Pio Perez, per Roys 1931:332); ah-chuah-cab="certain wild bees" (Motul, per Roys, ibid.); Tzeltal honon= bumblebee (Hunn 1977:271-272).

"Doncellita"="honey mosquito" Maya uzcab (Ximenez 1967:113-120); this appears to be a kind of bee.

Beekeeping was an economically important activity among the Maya both before and after the Conquest, and the honey of the small stingless domestic bee became an important item in the tribute paid to the Spanish conquerors (Cerrato 1974:10-16; Codice de Calkini 1957:25, 43; AGI, Guatemala, leg. 128, ff.307-402; and AGI, Contaduria, leg. 911A, both cited in Scholes and Roys 1968:150, 152).

Class I.A.: A section of the Tro-Cortesianus Codex is devoted to bees and apiculture, which may be concerned with the ceremonies for apiculturists held each year in the month of Tzec (Tozzer and Allen 1910:298-301); honeycombs and beehives also appear here, sometimes represented in a very stylized manner.

Class II: Oviedo described the wild bees:

> There are many small bees about the size of flies, that breed in hollow trees...Across the middle of the wing there is a white bar. They do not sting...In fact, they have no stinger. They make large honeycombs...The honey is good and wholesome but it is almost as dark as boiled honey (Stoudemire 1959:72).

According to Lopez Medel, who had opportunities to observe beekeeping and honey collecting during his two <u>visitas</u> to Guatemala in the 1550's,

> ...there are also bees more or less like those of Spain, black for the most part, although others are found of the same color as ours: the former do not sting...the Indians go to search for the honey in all seasons, although it is hidden in secret places ...but nevertheless the Indians...are well able to hunt for and find it...
> Honey is made in the hot country, and also in the cooler lands, and in many places there are beehives exceeding those of Spain, especially in the hot lands, where it [honey] is made by domestic bees in separate hives, which also in some areas have particular owners, as in Guatemala...In all the province of Yucatan, it [honey] is made...in the woodlands and in the bush, and in the hollows of the earth... it is a marvellous thing to see; this land appears to have the reputation of...flowing with milk and honey...there is no part of the Indies...where there is traded so much honey and wax as in the province of Yucatan...and for the Indians and natives of these provinces it is their principal product...Bees are also raised in Yucatan and they make their honey underground in hollow places...(Lopez Medel MS, n.d., Cap. 9, Pt.1).

Class III.A.: Landa briefly described the annual ceremonies for beekeepers in quite general terms (Tozzer 1941:156-157).

> The festival day having arrived, they came together in the house where it was celebrated, and did all that they were accustomed to do in the other cases [i.e., in the hunting and fishing ceremonies] except that they did not draw blood. They had for mediators the Bacabs... They made many offerings and especially they gave to the four Chacs four plates with pellets of incense in the middle of each one and painted all round with certain figures of honey...They ended it as usual with wine and enough of it...(Landa, Tozzer 1941:156-157).

Unclassified Insecta:

Coccidae

Dactylopius coccus; *Coccus axin*, genera *Nopalia*, *Opuntia*. This is the cochineal insect, Maya *mukay* (Roys 1931:337), *niin* (Tozzer 1941:193,n.1026), related to the mealybug and resembling it. A red dyestuff was made by crushing the bodies of the females into a powder, which also had medicinal uses.

Class III.A.:

> There is a red worm [sic] from which a good yellow ointment is made for swellings and sores by only crushing them or kneading them together; and it serves as oil for painting the vessels and makes the color fast (Landa, Tozzer 1941:193).

b. VERTEBRATA

1. Pisces=Fish - Maya *cay*, "generic name for fish" (Pacheco Cruz 1919:40)

There is an extraordinary diversity of fishes in the Maya area, comprising about twenty families and hundreds of species (Stuart 1964). Both freshwater and marine varieties have been utilized for food by the Maya in prehistoric and historic times. Some of the Spanish writers commented on this abundance:

> In the sea along this coast [Yucatan] are taken many very good fish, such as pollack, *pargos*, flatfish (*lisas*), bream, sardines, pompano, oysters and wonderful spotted dogfish, which are brought in ships to San Juan de Ulua and Veracruz, where they are highly valued (Ciudad Real 1875:384).

Fish seem to have been a prestigious food associated with high status among the Quiche Maya. In the *Title of the Lords of Totonicapan*, the delicate-flavored trout of the highland lakes and streams were the fare of Prince Qotuha, considered a fit and appropriate food for a ruler: "...his table is composed of good fresh fish, *mojarras*, and other things worthy of a prince" (Recinos and Goetz 1953:187).

Fish were frequently utilized as sacrificial offerings, as well as considered an appropriate gift for presentation to a Maya lord by his constitutents, in aboriginal times; later they became an important component of the tribute paid to the Spaniards.

Although fish are abundant in many parts of Guatemala, some of the areas of highest elevation seem to have been devoid of them, which may have increased their value as a prized, scarce item among the highland Maya. Miranda described some colder areas of the Alta Verapaz where the deep, clear lakes and rushing streams were often lacking in fish. He indicates that the Spanish fathers were attempting to stock these waters, some of which, according to local tradition, had produced fish and turtles in the past, i.e., before the Conquest (Miranda 1954:350-351).

Fish appear frequently in the Maya codices. Species identifications, however, have not usually been possible to make from these depictions (Tozzer and Allen 1910:307; Pl.5, 6).

The following list of fishes is a necessarily abbreviated sample of those described in the ethnohistoric literature, since species identification has been possible in only a minority of instances.

Chondrichthyes

Squaliformes - Sharks; Spanish tiburon, Maya xoc, xooc (San Francisco Dictionary, cited in Roys 1965:141).

Class II: Oviedo describes shark fishing, and drying the meat for consumption, by the European sailors, but makes no mention of native shark fishing (Stoudemire 1959:111-113). The Maya are known to have hunted sharks for their teeth, which were used in bloodletting rituals, and perhaps also for their livers (see Lange 1971; Borhegyi 1961).

Orectolobidae - nurse sharks

Carcharhinidae - requiem sharks

Sphyrnidae - hammerhead sharks

"Dogfish" - Spanish cazon, Maya ah-pat (Roys 1931:338), pat (Pacheco Cruz 1919:40); yax-bay (Beltran, per Roys 1932:342), tzim-cay (Pio Perez, per Roys 1931:344).

Class I.A.: The eye of the dogfish was a remedy for coughs, according to the Book of Chilam Balam of Kaua (f.76 v., cited in Roys 1931:338).

Rajiformes - Rays and skates; skate=Maya ah-xuul (Roys 1931:341).

Dasyatidae=stingray; Spanish raya?, corbina; Maya iz-cay (Roys 1931:334); Chol ton (Moran:57, per Hellmuth 1977:432)

Class III.A.: Landa has left a description of the stingray, whose spines were used by the Maya for blood-letting, and which was also apparently used as a food fish:

> There is another fish on this coast...broad and round and good to eat, but very dangerous to kill...And if they are careless in going near it or treading on it in the water, it at once has recourse to its tail, which is long and thin and it stabs with a saw, which it has, so seriously that it cannot be taken out...without making the wound large, since its teeth are set in backwards...The Indians used these little saws in cutting their flesh in the sacrifices of the devil and it was the

duty of the priest to keep them...(Tozzer 1941:191).

Osteichthyes

Anguilliformes

Anguillidae - Eels, Spanish anguila, Maya ? ,

Tzeltal cancay="snake fish" (Hunn 1977:252).

Class I.A.: A possible eel appears in the Dresden Codex (p. 65B). (Tozzer and Allen 1910:Pl. 6(7)).

Muraenidae

Moray eel = Spanish morena, Maya ?

Class III.B.: Moray eels were a food species in Guatemala, according to Ximenez:

> [The moray] is a fish like an eel, although shorter and thicker. It is blackish, but a good food fish (Ximenez 1967:208).

Serranidae - Groupers and seabasses

Epinephelus - groupers

Mycteroperca "

Carangidae - Jacks

Caranx latus - Mackerel, Spanish Jurel; Maya x-kuk-zooch, or zoh (Roys 1931:336).

Class II: The jurel is among the fishes that Oviedo describes as being "caught in great abundance in the rivers" (Stoudemire 1959:110).

Trachinotus carolinus - Pompano, Maya kantaan, kataan (Roys 1931:334)

Hynis cubensis - "Round pompano" of the Caribbean

Class II: This is one of the fishes Oviedo mentions as being caught in the ocean (Stoudemire 1959:111).

Class III.B.:

> [The pompano] is a much esteemed fish, and prized in Veracruz, from whence it is brought to Mexico. It is a fish about a quarta long, and wide, and more than two fingers thick...the time they are said to be good is in the months of February and March (Ximenez 1967:207-208).

Lutjanidae - Snappers

Gerridae - Mojarras, i.e., perch

Perciformes

Cichlidae

Cichlasoma sp. - fresh water mojarra (i.e., perch), Spanish mojarra, guapote; Maya keek (Roys 1931:334), pokoz=freshwater fish or mojarra (Roys 1931:338), tzau="large freshwater mojarras" (Motul, per Roys 1931:340); xac, ah-xac (Motul, per Roys 1931:341); ajya'ax (Itza=blue perch; Cholti-Lacandon xche (Moran:46, per Hellmuth 1977:431); Tzeltal muharo, peskaro (Hunn 1977:252).

Class II: According to Oviedo, many mojarras were caught in the inland rivers (Stoudemire 1959:110).

Class III.B.: Ximenez also mentions these as a favored food species, occurring in the lakes and rivers of Guatemala (Ximenez 1967:209).

Sphyraenidae - Barracudas

Centropomidae

Centropomus undecimalis - Snook, sergeant fish; Spanish robalo, Maya chibcay (Pacheco Cruz 1919:40). A large fish resembling a pike, taken in great numbers off the Gulf coasts of Veracruz and Tabasco, whose remains occur frequently in Olmec archaeological deposits (Coe and ~~Diehl~~ 1980), as well as in coastal Maya sites (Wing 1974).

Siluriformes - Catfishes

Ariidae - Marine catfish, Spanish bagre/vagre, Maya box, box-cay (Roys 1931:329; Pacheco Cruz 1919:40).

Pimelodidae

Rhamdia - Catfish, Spanish bagre, barbo; Maya ah-luu=fresh water bagre (Roys 1931:336); hluu="the fresh-water vagre" (Pacheco Cruz 1919:40); Cholti-Lacandon lu,ahlu (Moran:10, cited in Hellmuth 1977:431); ?isim cay="whisker fish" (Hunn 1977:251).

Class III.A.: The bagre is the fish described as inhabiting the cenotes of Yucatan, where the Indians harvested them from the source of their drinking water:

> From these zonotes...the Indians drink, and also draw many vagres, which are a kind of small fish, savory and wholesome (Ciudad Real 1875, V.2:384).

Scaridae - Parrotfishes

Antheriniformes

Exocoetidae - Flying fish - Tzeltal pehpen cay= "butterfly fish"? (Hunn 1977:252).

Poeciliidae

Scombridae

Tuna, tunny fish - Spanish atun; also tonina, bufeo; Maya zib-~~cay~~ (Roys 1931:343); Tzeltal sakil c'uht cay(?) (Hunn 1977:252).

Class II:

> Among the many good fish caught in the sea are the tunnies. They are large and good and are caught by throwing gigs or harpoons into them as they swim near the ships (Oviedo, Stoudemire 1959:114).

Clupeidae

Sardine - Spanish sardina, Maya cheh-bac, chech-bac (Motul and Pio Perez dictionaries, cited in Tozzer 1941:190, n.998);

ix-toc (Roys 1931:339); cheechbac (Pacheco Cruz 1919:40).

Class II:

> ...there are broad sardines which have red tails; they are excellent food and among the best fish found there [Tierra Firme]. (Oviedo, Stoudemire 1959:110).

Shad (anadromous herring) - Spanish sabalo, zabalo; Chol Maya tzatzpat (Moran, per Hellmuth 1977:432).

Class II: "Very large shad...are also caught there [in the sea]" (Oviedo, Stoudemire 1959:111).

Gadidae

Gadus morrhua - Cod, Spanish abadejo, bacalao; Maya ah-pax-ulum (Roys 1931:338), paxulum (Pacheco Cruz 1919:40).

Sparidae

Sparus sargus - Sea bream, Spanish sargo, Maya ah-col-cay (Roys 1931:330).

Class II. Oviedo refers to a widespread inland trade from the coastal areas of Middle America, in which sea bream were transported in baskets from the seacoasts to the interior (Stoudemire 1959:106). Avila sent a party out who encountered a group of Indians engaged in this overland trade, ~~who said~~ they were prisoners, forced to carry these baskets inland where the natives were fond of fish, but had none.

Unclassified fishes:

"Mosquito fish" - Spanish ? , Maya utz cai

Class III.A.: This species is referred to by Landa (Tozzer 1941:190, note 997).

Pollachius virens - Pollock; also called bluefish. Spanish mero, Maya huun-cay (Roys 1931:333).

Class III.B.: Ximenez describes this as a kind of perch, black across the ribs and white below, abounding in the bay of Veracruz, and also in deep waters (Ximenez 1967:210).

Spiderfish - Spanish ?, Maya mex (Pio Perez 1866-77, per Roys 1931:336).

Class III.A.:

> I sometimes saw a fish on the coasts which...was all shell...It is of the size of a small turtle and covered on the upper side by a round delicate shell of beautiful shape and a very light green. It has a tail with the same thin shell resembling a punch and as long as the span from the forefinger to the thumb. Below it has many feet. It is full of minute eggs. Only the eggs are edible and the Indians eat them in quantity. In their language they call it mex (Landa 1900:381, quoted in Roys 1931:336).

From the description, this may be a crustacean or myriopod rather than a fish.

Salmo truta=Trout; Spanish trucha, tepemechin; Maya ?

Class II: Lopez Medel describes tepemechines as abundant in the rivers of Guatemala and New Spain in his sixteenth century treatise (Lopez Medel MS, n.d., Cap. 7).

Class III.B.: In his 1594 description of the town of Ycuntepeque, Guatemala, Juan de Pineda tells us that

> many fish are taken in this town from a river that passes near it, especially tepemechines, which is another name for those that are called trout (truchas); it is a very good and delicious fish to eat (Pineda 1939:559).

Ximenez distinguishes between the tepemechin and the trucha:

> [Tepemechin] is a much prized fish in the rivers. It is usually about a tercia in length, and inclines to be white or yellowish. It is not caught with the fishhook, but gathered in nets in the current, but must be taken in fast-moving water, or at night. Some call these trout, others say they are different. Those called truchas occur among the Zoques, and are another fish found in the rivers of this province of Guatemala. It is possible they are also in New Spain, although I have not heard of it (Ximenez 1967:211).

2. Amphibia

Frogs and toads make up the bulk of the amphibian fauna of the Maya area (Stuart, 1964:331), and both were utilized by the Maya, although the extent to which they were eaten is not known. The large toad, Bufo marinus, is very common, and there are indications that its toxic secretion, bufotenin, which possesses hallucinogenic properties, may have been used for ceremonial purposes (Hamblin 1980:109), and possibly for pharmacological ones as well, especially in childbirth (Kennedy 1982).

Gymnophiona

Caeciliidae

Dermophis mexicanus, Spanish jeringa, Tzeltal herinka lukum=syringe worm (Hunn 1977:247). This wormlike amphibian, found only on the Pacific slope of Chiapas, is locally referred to by the Ladino term tapaculo="anus plugger" (Hunn 1977:247), because of the native belief that it enters the anus during defecation and devours its host from within.

Class III.B.: This may possibly be the species described by Ximenez in his natural history of Guatemala as a "two-headed snake":

> [This is] a slow moving snake, two tercias in length, of a deep violet color that tends toward black, appearing to have two heads, although only one is the head, but...only when it moves is it possible to tell which is the [true] head. This [snake] breeds in places of filth, such as manure, or dung-heaps. It is said that this snake, which may enter into the body of man through the anus, may sometimes so enter in its search for excrement, on which it feeds; and only on death will it come out (Ximenez 1967:79).

Caudata

Plethodontidae

Bolitoglossa spp. - Salamanders

Anura

Bufonidae - Toads, Spanish sapo, escuerzo; Maya much="a general name for frogs and toads" (Roys 1931:337); Tzeltal pokok (Hunn 1977:247).

Bufo marinus - marine species; Tzeltal henhen (Hunn 1977:247).

Class I.A.: The Codex Tro-Cortesianus (p. 17) contains an apparent representation of a large toad, possibly the marine species Bufo marinus (Tozzer and Allen 1910:309, Pl.7(5)).

Class II:

> There is an offensively large number of nonpoisonous toads in Tierra Firme...Some of these toads are green, some are gray, and others are almost black (Oviedo, Stoudemire 1959:79).

Hylidae - Tree frogs, Tzeltal stok'ob (Hunn 1977:249).

Class I.A.: The Codex Tro-Cortesianus depicts what may be the species Hyla eximia (p. 26; see Tozzer and Allen 1910:310, Pl.8), a species abounding during the rainy season.

Ranidae - Frogs, Spanish rana, ranilla, Maya ah bab, bab ("paddler") (Motul Dict., cited in Roys 1965:129); much="a general name for frogs and toads" (Roys 1931:337); thoth=a coffee-colored frog (Roys 1931:339); uo, uoh, a fat edible frog (Motul Dict., per Roys 1931:341, who says the Maya term is believed to be derived from their cry--i.e., an onomatopoeic word).

Class I.A.: Frogs occur in the Maya codices, usually in association with water. Four occur on a single page of the Tro-Cortesianus (p. 31), and two on page 101 of the same manuscript, the latter being representations of dead animals (Tozzer and Allen 1910:309, Pl.7).

Microhylidae

3. Reptilia

The reptiles are a large and varied group in the Maya area. Land turtles, especially the mud and musk turtles, were important in Maya economy, and were used for sacrifice and ceremonial purposes as well (Tozzer and Allen 1910; Hamblin 1980), while the giant sea turtles were harvested by coastal Maya.

Lizards, especially the iguana, were an important source of both meat and eggs. Snakes, both dangerous and harmless, are extremely abundant in the Maya regions, and some of these were evidently used as food also.

The species described below are confined to those mentioned in the ethnohistoric literature.

Crocodilia

Alligatoridae

Caiman crocodilus - Crocodile, cayman; Spanish caiman, crocodilo; Maya ain, ayin (Roys 1967:71).

Class I.A.: The crocodile is cited in incantations for seizure, ulcers, and other conditions in the Ritual of the Bacabs (Roys, 1967:131). Crocodiles also appear in the Dresden Codex (52, 53).

Class III.A.: Ciudad Real, in describing the aguadas of Yucatan, says that in addition to providing a valuable water resource for the natives, these waterholes were inhabited by edible lizards:

> There are some like lakes, likewise having sweet water, not hidden in the earth like the zonotes, but on the surface, although they are deep, and which are called yoca, and by another name kaxck, which serve in the same way as the zonotes; and in them are found some turtles and lizards or caymanes, which are like the lizards of Spain, but much larger, that produce musk in glands beneath their arms and legs; and they have white flesh that is good to eat, although it is very sweet and oily; it is said that they are crocodiles [like those of] the river Nile (Ciudad Real. 1875, V.2:384).

Class III.B.: Palacio described crocodile-hunting by the natives of Guatemala:

> There are many creeks on the coast, in which they have large establishments for catching all kinds of fishes and turtles, notwithstanding that they are full of alligators, or rather crocodiles, very ferocious, and greatly feared by the people...The caymans have committed many ravages...yet it is wonderful ...that there are actually many Indians who dive beneath them...and attach cords to their legs, in such manner that they are dragged to the shore and slain. On my arrival at one of the villages, the inhabitants proposed to entertain me with a feat of this kind, but I would not consent...They nevertheless went off without my knowledge, and brought me one thus secured. Some of the caymans are from twenty to thirty feet and upwards in length, with large bodies and big feet, and covered with scales through which a musket ball cannot pierce (Palacio 1576, quoted in Feldman 1974:18).

Testudinata - Tortoises, turtles; Spanish tortuga, Maya ac (Roys 1967:66); aac (Pacheco Cruz 1919:32).

Testudinidae - Turtles

Class I.A.: Turtles are a subject of frequent illustration in the pre-Columbian codices, appearing in the Tro-Cortesianus in several places.

Class III.A.: "There are turtles and tortoises [in Yucatan]...in these [aguadas] are found turtles and lizards" (Ciudad Real 1875, V.2:386, 384).

Chrysemys scripta - pond turtle

Kinosternidae - mud and musk turtles

Spanish jicotea=mud turtle

Chelydridae - snapping turtles

Emydidae - box and freshwater turtles

Cheloniidae - sea turtles

Class III.A.:

> I can testify as an eyewitness about those [turtles] killed in Tierra Firme. In the village of Acla I saw one so large that six men were hard put to carry it, and ordinarily the smaller ones are quite a burden for two men. The large one that I saw there...had a shell seven spans long, measured down the middle of its back, and more than five spans wide. The turtles are captured in the following manner: Often turtles are caught in drag nets, but the way in which they are caught in quantity is when they leave the sea to come out on a beach to lay their eggs or to feed. When the Spaniards or Indians find their tracks in the sand, they follow them. The turtles...run toward the water, but since they are heavy and slow they are easily overtaken. Then a stick is placed under its front legs and as it runs along, the turtle is turned over on its back. Since...[it] cannot turn over from its back to an upright attitude, it must stay there. Leaving the turtle upside down, the hunters can follow tracks of any others that may be there, and ~~handle~~ hand that turtle in the

same fashion. In this way many are caught (Oviedo, Stoudemire 1959:111).

Squamata

Lacertilia

Gekkonidae

Iguanidae

Iguana iguana

Spanish iguana, Maya huh="a general term for this type of lizard" (Roys 1931:333; see also Roys 1967:73); ah-pach="a certain crested iguana" (Pio Perez 1866-77, quoted in Roys 1931:337); yax-icil=green iguana (Motul Dictionary, per Roys, 1931:342).

Class I.A.:

> The iguana was their familiar spirit...
> They went to Poc-huh, as the well was named, where they roasted the iguana (Book of Chilam Balam of Chumayel, Roys 1967:73).

The iguana was an important and exotic food species mentioned by the Spanish writers, who were uncertain as to its proper classification in the animal kingdom, and who took advantage of this uncertainty to count it as a fish for religious dietary purposes. Oviedo called it a serpent, while pointing out its ambiguous status.

Class II:

> The natives also eat a kind of serpent that is very fierce and fearful to look upon but is entirely harmless. It is not certain whether this is an animal or a fish, since it lives in water, in trees, and on the ground. The quadruped is larger than a rabbit and has a tail like a lizard's. The skin is spotted... Its neck and spine are studded with erect

> spines. It has sharp teeth and tusks and a long, wide double chin which hangs down from its chin to its breast...it will remain tied...for ten, fifteen, or twenty days, and...without eating or drinking anything. However, the Indians do feed it a little bread...which the animal will eat...The flesh is as good or better than rabbit...(Oviedo, Stoudemire 1959:18).

Class III.A.:

> There are in this land [Yucatan] many iguanas, very healthful, tasty and sustaining food very good for the days when fish is eaten, because, although it is an animal that ordinarily breeds on land, it is taken as a fish because it also is found in the water (Ciudad Real 1875, V.2:386).

Class III.B.: Fuentes y Guzman correctly termed the iguana "a kind of lizard" (Fuentes y Guzman 1932, V.2:161), and also provided an engraving illustrating the appearance of this animal for the benefit of European readers, to whom it was unfamiliar.

<u>Unclassified Reptile</u>:

<u>Humpedzkin</u> (Roys 1965:134; also <u>xhunpedzkin</u>, Pacheco Cruz 1919:32). No known English or Spanish equivalent.

Class I.A.: Roys states that several later sources describe this animal as a snake rather than a lizard [see below], and notes that it is cited in a number of the curative incantations in the <u>Ritual of the Bacabs</u> (Roys 1965:134). Pacheco Cruz reports that there is a plant called <u>xhumpedzkin</u>, similar to the henequen leaf but smaller and lacking its spines, which is used as a remedy for the terrible headache suffered by victims of the humpedzkin lizard (Pacheco Cruz 1919:32-33).

Class III.A.:

> Among the many poisonous insects, reptiles and serpents there is especially one, which the Indians call ix hunpedzkin. It is of the size and form of a small lizard, with white and black spots and a shining body. It breeds in the forests and in old houses among the stones and is so poisonous that, when it touches a person, even on the clothing, without biting or stinging, it kills completely and in so short a time that [the victim] does not last an hour. Nor is there time for any remedy. Its name in the language of the natives sounds like 'brief time', because it kills quickly (Relacion de...Merida, RY I:65-66; also quoted in Roys 1965:134).

4. Aves - Birds; Maya mut

Birds are extremely varied and numerous in the Maya area, with over 1,400 species, representing some 94 families, having been identified in this region (Stuart 1964). The number of species native to Guatemala alone has been estimated at about six hundred (Rodriguez Luna 1958-1959). Many of the early European writers remarked upon the great diversity of birds here, including Oviedo (Sumario, 1950:166-167). Father Ximenez also commented on this extraordinary diversity, not only in Guatemala, but in the New World as a whole:

> The supreme author has populated the land, winds and waters of all of this America with such a variety of birds, that in many books it would be impossible to begin to include them all; and therefore I shall speak only of some of the more common and best-known, which are the lesser number, since each day new and different ones are discovered...in each province...(Ximenez 1967:85).

The authors of the Relaciones Geograficas in their replies to the royal questionnaire provided some general information on the birds of the Maya and their economic uses.

> The birds that breed in the forest are turkey-quails (pabas-codornices), magpies, thrushes, parrots and other forms of birds of little importance, since to the great matters of the world they contribute little. The Indians breed in their houses domestic chickens or turkeys,...and produce them in very great quantity...Since the Spanish came, they introduced the chickens of Castille, which have done well here...Also, wild birds breed in this land that are used for their plumage, which is woven into clothing and they also are eaten (Relacion de...Merida, RY I:67).

> And the birds that they had were sparrow-hawks, wild chickens, doves, falcons, pheasants, and the doves of Castile (Relacion de Tilantongo, quoted in Cabrero Fernandez 1964:18).

In addition to constituting an important food source for the Maya, birds appear with great frequency in their rituals for curing, playing an important role in traditional Maya medicine (Roys 1965).

Species identifications have not always been possible to make on the basis of ethnohistoric reports. Native Maya sources often give several different names to slightly different varieties of a single avian species which are not distinguished in standard Western taxonomy. The Spaniards tended to identify species in terms of similar ones known from Europe, or to try to describe unknown varieties in terms of their attributes, sometimes supplying a native Mayan term for an unknown species which may facilitate its identification.

The following list cannot be considered as representative of bird species utilized by the Maya, since it consists only of those identifiable from the ethnohistoric literature, constituting a very small sample of the very great abundance of avian species native to this part of the world.

Tinamiformes

Tinamidae - Tinamou, partridge - Spanish *perdiz*.

Crypturellus spp.

Maya *nom* (Roys 1931:337), Chol *maxcul* *pupum*(?) (Moran:50, cited in Hellmuth 1977:432).

Class II:

> In Tierra Firme 'partridges' are as good as those in Spain, and just as tasty. They are as large as the chickens of Castille, and have very large breasts...The Indians catch these birds with bird calls, and by setting traps...There is also a small species similar to our gray partridges. They are more easily caught than the large ones and are better for sick people, since they are not so hard to digest (Oviedo, Stoudemire 1959:67).

Class III.B.: Ximenez states that the partridges of Guatemala are not like those of Spain, but larger and of different colors:

> Those of Guatemala are called *zaccoruvach* by the Indians, which means having a white face...They are too heavy to fly, like those [of Spain], because they have short wings, and a large body (Ximenez 1967:96).

He does not mention their uses.

Podicipediformes

Podicipedidae

Pelicaniformes

Pelicanus fuscus - Pelican, Spanish pelicano, alcatraz; Maya ponto, a "well known bird of the sea" (Pacheco Cruz 1919:24).

Class II: Oviedo describes the pelican, emphasizing its consumption of huge quantities of sardines, and mentions its utilization by the Spanish. He states that

> the Christians send dugouts and boats to islands and reefs near Panama to get young pelicans...They are fat and good to eat. The adults...are taken for their fat, which is made into very good oil for burning in lamps (Oviedo, Stoudemire 1959:65).

Class III.A.:

> There are great birds as large as brown ostriches and with a larger bill. They always go over the water in search of fish... they rise in the air and fall with a great rush upon the fish with a blow of that beak and neck of theirs and they never make a fruitless attack and on giving the blow they remain swimming and swallowing the fish alive without cooking or scaling it (Landa, Tozzer 1941:202-203).

Fregatidae

Fregata magnificens - Frigate bird, man-o'-war bird; Spanish fragata, fregata aquila, Maya ?

Class I.A.: This bird as been identified in the Dresden and Madrid codices (Tozzer and Allen 1910:325, Pl.15), where it is depicted as an apparent offering or sacrifice.

Class II:

> There are large birds, strong flyers, that most often fly very high. They are black and... have long slender wings..and the tail is open, like that of the kite, so they call them fork-tails. They are larger than kites and ...many times ships sailing to the New World sight them twenty or thirty leagues or more out at sea, flying very high (Oviedo, Stoudemire 1959:60).

Oviedo identifies these as man-of-war birds.

Lopez Medel also refers to the frigate bird, describing it as "a large...bird with broad wings" that habitually flies over the ocean, and is called Rabihorcado [literally, "forked rage"; see also quotation from Ximenez below)] (Lopez Medel MS, n.d.:Part 1, Cap. 8).

Class III.A.:

> There are some great lean birds which fly a great deal and very high, their tail divided into two points, the fat of which is wonderfully medicinal for scars from wounds and shaking of the limbs caused by wounds (Landa, Tozzer 1941:203).

Class III.B.: Ximenez also describes this species familiar to mariners, called "Rabiahorcado" (Ximenez 1967:104).

Ciconiiformes

Ardeidae

Herons - Spanish garza; Tzeltal hti?cay="fish eater" (Hunn 1977:139). Rodriguez Luna states there are nineteen species, belonging to ten genera, of Ardeids in Guatemala alone (1958-1959:157).

Class II: Oviedo describes purple herons, night herons and flamingos (Stoudemire 1959:59).

Class III.A.:

> There are many kinds of herons and egrets, some white and others gray, some large, others small, and in the Laguna de Terminos, there are many very light red ones, which are similar in color to powdered cochineal (Landa, Tozzer 1941:203).

Egretta alba - White heron, Maya zacboc (Pacheco Cruz 1919:30), zac-boc="a white heron" (Beltran 1859:229, per Roys 1931:342).

Threskiornithidae

Anseriformes

Anatidae - Ducks; Spanish anade, pato; Maya cutz-haa (Motul Dictionary, per Roys 1931:330; Pacheco Cruz 1919:19); maxix (Roys, ibid.:336); Tzeltal pec (Hunn 1977:136-137).

Class III.A.:

> They also raise the native ducks of this land. They make use of their plumage in weaving their garments and eat them as well (Relacion de Yucatan I:67, quoted in Roys 1931:330).

Class III.B.: With respect to ducks, Ximenez commented on the great variety of forms:

> Of these alone there are so many different kinds it is a marvel. Because they belong to the Ansares, which in Spain are called 'those who are raised in the houses', and their feathers are used in fine textiles, there are ducks that are called 'royal' and which are very large. Others are of medium size. There are others that are called gallaretas [i.e., widgeons; Anas ferina], and others that are very small, and others that are called pixixes; and with all these the lakes are filled, but at the time of their breeding season, all disappear, and it is not known where they hide themselves.

There are many others with which I am not familiar, and all of these are very good to eat...(Ximenez 1967:102-103).

Cairina moschata - Domestic Muscovy duck

They raise a certain kind of large white mallard ducks, which I think came to them from Peru for the plumage, and so often pluck their breasts, and they want that plumage for the embroidery of their garments (Landa, Tozzer 1941:201.

Tozzer adds, in note 1102, that "these are doubtless Muscovy Ducks (Cairina moschata".

Anas platyrhynchos - Domestic Mallard, Tzeltal pec.

Class III.A.:

There are mallard ducks which stay under water for a very long while fishing for food and are very bold and have a hook on their beak with which to fish (Landa, Tozzer 1941:203.

Tozzer notes (note 1125) that Landa is probably here referring to a cormorant.

Anas discors - Teal, blue-winged teal, Spanish cerceta, Maya maxix (Landa, Tozzer 1941:203, note 1126).

Class III.A.:

There are...very small ducks of great beauty which are called maxix. They are very tame and if they are raised in the house they do not run away (Landa, Tozzer 1941:203).

Falconiformes

Cathartidae Vultures, turkey vulture; Spanish aura, zopilote, Maya kuch (Landa, Tozzer 1941:202), uxcil (Roys 1931:341).

Class I.A.: This is another avian species widely depicted in the Maya codices and art, appearing frequently in the Dresden and Tro-Cortesianus manuscripts (Tozzer and Allen 1910:329-337).

Class II: Tomas Lopez Medel describes the _aura_ as resembling a large chicken of Spain, although even larger, black in color, which are very prolific and abundant in the Indies, being "so common that there is no part of the Indies where they are not" (Lopez Medel MS, n.d.:Cap.7).

Class III.A.:

> There are many birds as large as the chickens of this land, which the natives call _ahchom_ and the Spanish _auras_, which are black as ravens; they breed in remote and hidden areas inside caves...the chicks [are] very white... and in a short time they turn black. These birds clean and eat everything including dead and rotten flesh, and are useful in eliminating the causes of foul odors...(Relacion de la Cuidad de Merida, RY I:68).

Class III.B.: Ximenez describes the _zopilote_ as a bird noteworthy for its useful habit of consuming garbage, excrement and carrion, and keeping areas of human habitation clear (Ximenez 1967:87).

Sarcoramphus papa - King vulture

Coragyps atratus - Black vulture

Cathartes aura - Turkey vulture; Maya _ah-chom_, _chac-pol-chom_=red-headed vulture, i.e., turkey vulture, "larger than the kind called kuch" (Motul Dict., per Roys 1931:331).

Accipitridae - Raptorial birds (kite, eagle, hawk), Spanish _aves de rapina_, Maya ah-chuy-tun="hawk, osprey or kite of this land" (Motul Dictionary, per Roys 1931:332); ah-chuyum-thul=a raptorial bird that carries a rabbit in its claws (Motul Dictionary, Roys 1931:332).

Kites - Spanish milano, Maya ah ch'uy="he who carries something suspended" (Roys 1931:332; Roys 1965:133), chuy=bird of prey (Pacheco Cruz 1919:28).

Class II: The milano is mentioned by Lopez Medel as a bird native to the Indies, where it is highly valued (Lopez Medel MS, n.d., Pt.1, Cap. 7).

Eagles - Spanish aguila, Maya cot (Pacheco Cruz 1919:30; this term may refer to the red eagle, or coot); hun-kuk (Roys 1931:333).

Class I.B.: The eagle appears often in the traditional Quiche chronicles as an emblem and nagual associated with high status lineages and/or titled positions.

Class III.B.:

> This bird is found in these parts [of Guatemala] and I have seen two of them, which were brought to Guatemala [City]. They are not often seen, since they inhabit the mountain peaks and the highest and most inaccessible mountains... (Ximenez 1967:85).

Harpia harpyja - Harpy eagle

Class I.A.: The figure of the harpy eagle is of frequent occurrence in some of the Maya codices, often in association with warriors (Tozzer and Allen 1910:334-336).

"Royal eagle", Maya balam-hun-kuk (Roys 1931:333), "the size of the local turkey, with a crown and very long talons" (Motul Dictionary, per Roys 1931:333). Roys adds that its flesh "is eaten to cure buboes".

Hawks - Spanish _gavilan_, Maya _ib_ (Pacheco Cruz 1919:23); Tzeltal _likawal_ (Hunn 1977:143).

Maya _ah ii_="a certain hawk" (Motul Dictionary, quoted in Roys 1965:134). Roys says that it "resembles the _ah ch'uy_ [i.e., kite], but is smaller; it has a short, curved beak and is yellowish"; it is designated _Odontriorchis palliatus mexicanus_ (Pacheco Cruz 1958:146).

Class I: The hawk is cited in an incantation for "snake-pulsation of the abdomen" in the _Ritual of the Bacabs_ (Roys 1965:134).

Pandionidae - Ospreys

Falconidae - Falcons, Spanish _halcon_, Maya _kikliz, kiliz_=white-throated falcon, _Falco albigularis_ (Roys 1931:335); _ikliz_ (Pacheco Cruz 1919:23).

Galliformes

Cracidae - pheasant, curassow, guan

Ortalis vetula - Chachalaca, grouse; Spanish _alcon_, Maya _bech_=Yucatan long-toed grouse (Roys 1967:128), _bach_=Yucatan chachalaca (Roys 1931:328); Tzeltal _hohkot_ (Hunn 1977:149).

Class III.B.:

> They have one [wild fowl] that looks like a pheasant, which in the Mexican language is called chachalaca and in Spanish _alcon_ (Relacion de Acatlan, quoted in Cabrero Fernandez 1964:18).

Penelope purpurascens - Guan, i.e., "pheasant" Crested guan, Spanish *pava* (Rodriguez Luna 1958-1959:156), Tzeltal *pawa, pasa, paisano* (Hunn 1977:148), possibly also *te?tikil tuluk'*="forest turkey"; this species is often confused with the Great Curassow, *Crax rubra* (see below).

Penelopina nigra - Black Penelopina, Tzeltal *c'ekek* (Hunn 1977:148).

Crax rubra, Crax globicera - Curassow, Spanish *pauil, paujil* (Ximenez 1967:86, n.37), Maya *kanbul* (Roys 1931:334), *kambul* (Pacheco Cruz 1919:25); Tzeltal *?is mut* (Hunn 1977:148).

Class III.A.:

> There is a bird as large as the fowls there and which they call Cambul. It is extremely handsome, of great boldness and is good to eat (Landa 1900:397, quoted in Roys 1931:334; see also Landa, Tozzer 1941:202, note 1113).

The Motul Dictionary adds that the Indians domesticated these.

Class III.B.:

> ...a bird like a peacock, and similarly very handsome, especially for a crest of feathers...which only the males have. This bird is often domesticated, and is tamed in such a way that it will not go away from its tamer...This bird is eaten and is much prized (Ximenez 1967:86).

"Pheasant" - Spanish *faisan, faysane*, Maya *canbul* (Moran:31, per Hellmuth 1977:341). The term *faisan* (or *faysane*) appears to have been applied rather indiscriminately by many of the Spanish writers, as a kind of generic term for various Cracidae.

Class II:

> The pheasants of Tierra Firme do not have the same plumage as those in Spain...They ...taste much like the large partridges. They are not as large, but they stand higher, and have a long wide tail. Many are killed with crossbows. They have a certain call that...can be heard a great distance, and there is a long interval between calls. Because of this the bowmen kill them with ease (Oviedo, Stoudemire 1959:676).

Class III.A.:

> There are many grayish brown pheasants, as well as mottled ones of moderate size and not as good to eat as the Italian ones (Landa, Tozzer 1941:-202).

Phasianidae - quail; Spanish codornix; Maya bolon-chac (Roys 1931:328), bech (Pacheco Cruz 1919:25-26), bech-ha ="water quail", an aquatic bird that "moves on the sea as though on land and does not dive" (Pacheco Cruz 1919:25-26, quoted in Roys 1933:328); Chol tut (Moran:17, per Hellmuth 1977:432).

Class III.A.:

> There are wonderfully many quail and they are somewhat larger than ours and excellent to eat. They fly very little and the Indians catch them roosting in the trees, with dogs and nooses wich they throw around their necks, and it is very tasty game (Landa, Tozzer 1941:201 202).

Class III.B.:

> These also are different from those of Spain, in color as well as in size, and the Indians take them while walking since they can fly little. It is good as food when nesting, and if it is cooked well seasoned, because it is tasteless (Ximenez 1967:96).

Gallus gallus - domestic chicken (introduced?); Spanish gallina, gallo de castillo; Maya thel, xcax (hen) (Pacheco Cruz 1919:19); Chol yacib, ahtzo yazui, utehlon yaquib (Moran, quoted in Hellmuth 1977:431), Tzeltal mut (Hunn 1977:151).

The Maya are known to have raised domestic turkeys, and these were often classified as "chickens" in the terminology employed by various authors of ethnohistoric works.

> ...And all raise chickens, and those that are the most abundant are turkeys... (Hellmuth 1977:427).

> And also the Indian women are very industrious, and raise hens and turkeys which they call 'chickens of the land'...(Villagutierre 1933:244, quoted in Hellmuth 177:427).

> In the bush, there are very large wild chickens (gallinas y gallos), and more that are domesticated (Relacion de Acatlan, quoted in Cabrero Fernandez 1964:18).

The Spanish terms gallina/gallo and pava/pavo seem often to have been used interchangeably by early writers, and to have been applied somewhat indiscriminately, blurring distinctions between the various galliformes. The Maya appear to have raised a variety of fowls, some of which apparently had no European counterparts, compounding the difficulty of making species identifiications from ethnohistoric records. The Spanish, however, in declaring thoses birds required for the annual tribute exacted from the natives, distinguished between "native fowl" and the European variety, although either was usually acceptable for purposes of tribute:

> The town and people of Zamailco...the encomienda of Rodrigo Alvarez, a citizen of the city of Merida...will also pay annually 400 mantles...22 _arrobas_ [quarter 100-weights] of beeswax; 2 _arrobas_ of honey; 400 fowls, of either the native or Spanish variety, as they prefer; 4 _fanegas_ of salt and 3 _arrobas_ of fish (Cerrato, the 1549 Tax List for 175 towns in Yucatan; in Landa, Gates 1978:141).

Pavo cristatus

Colinus virginianus - Bob-white - Spanish _perdiz_, Maya _bech_ (Roys 1967:128).

Meleagridae - turkeys; Spanish _gallipavo, gallo de la tierra, pava;_ Maya _cutz_ (Roys 1931:330), _ah-kotzoo_=turkey cock (Motul Dictionary, per Roys 1931:335); "in Guatemala it is known as the _chompipe_" (Ximenez 1967:86, n.38); Chol _ahco, ah cox_ (Moran:49, per Hellmuth 1977:431).

Melleagris gallopavo

Agiocharis ocellata

Class I.A.: The turkey appears with great frequency in the Maya codices, usually depicted as a sacrificial victim or offering (Tozzer and Allen 1910:326-327). Decapitation of the turkey was a regular part of the rituals during the unpropitious five-day period of Uayeb at the end of the Maya solar year, a procedure illustrated in the Dresden Codex (25-28; Tozzer and Allen 1910:Pl.16).

Class II: Oviedo gives a long description of the New World turkeys, which he compares with "Spanish turkeys" [i.e., peacocks, per Stoudemire 1959:63, n.49], and says that "many are killed by hunters", and that their hunting requires "a good fast dog". He goes on to describe varieties raised as domesticates by "the Christians", but says nothing of the turkeys domesticated by the natives (Stoudemire 1959:63-64).

Class III.A.: Landa compares the wild and domestic varieties of native turkey:

> There are many wild turkeys, which...are as large as the cocks of the Indians and as good to eat (Tozzer 1941:202).

<u>Gruiformes</u>

<u>Rallidae</u>

<u>Fulica</u> <u>americana</u> - American coot; Quiche <u>kot</u> (?) (<u>Popul</u> <u>Vuh</u>, Edmonson 1971:179, line 1961); Tzeltal <u>pec'ul</u> <u>ha?</u> (Hunn 1977:137); possibly Maya <u>cot</u> (Pacheco Cruz 1919:30).

Class III.A.: Possibly this is the "small eagle" referred to by Landa (Tozzer 1941:202).

Charadriiformes

<u>Columbiformes</u>

<u>Columbidae</u> - doves/pigeons, Spanish <u>paloma</u>, Tzeltal

scumut; at least 17 species have been identified in Guatemala alone (Rodriguez Luná 1958-1959:156).

Class III.A.:

> ...They breed the doves of Spain, and also other varieties, but none are so small (Relacion de...Merida, RY I:67-68).

Landa also states these were domesticated: "Some people raise doves as tame as ours and they multiply rapidly" (Tozzer 1941:201).

Class III.B.: Ximenez reports observing the migration of wild doves "from the north sea to the south" and notes that "it is said they are very good to eat", but he makes no reference to their being hunted for this purpose (Ximenez 1967:95).

Columba livia - domestic pigeon or rock dove; Tzeltal palomas, sakil mut (Hunn 1977:155).

Columba flavirostris - Red-billed pigeon, a lowland variety (Hunn 1977:156).

Columba fasciata - Band-tailed pigeon, Tzeltal sc'a bikil, sabal mut="morning bird" (Hunn 1977:155, who notes these terms may also be applied to the red-billed pigeon; see above).

Zenaida asiatica, Melopera leucoptera(?) - White-winged dove, Maya zac-pacal (Roys 1931:342, Pacheco Cruz 1919:29); "certain white doves of this land", Motul Dictionary, per Roys 1931:342. Pacheco Cruz says this variety is domesticated (1919:29).

? - Maya ucum=a rare gray wild pigeon with a white neck (Roys 1931:340); Spanish torcaza="a variety of dove...they live in the high mountains and are rarely seen" (Pacheco Cruz 1919:29).

Class III.A.: "...there are three kinds of very handsome little pigeons." (Landa, Tozzer 1941:201).

Leptotila verreauxi - White-fronted dove, Spanish paloma torcaz=gray wild pigeon with a white neck; Maya tzutzuy (Roys 1931:340, Pacheco Cruz 1919:29); white-tipped dove--Tzeltal bac'il scumut="true dove"; Tzotzil k'us kumum (Laughlin 1975:429).

Columbigallina rufipennis - Ground dove, Maya mucuy (Roys 1967:128), Chol pupum, cacpupum (Moran:49, cited in Hellmuth 1977:431).

Some sources equate this species with the turtle dove, i.e., Spanish tortola, Maya mucuy (Motul Dict., cited in Roys 1965:138); Chol ut (Moran, per Hellmuth 1977:431).

Psittaciformes

Psittacidae - Parrots, Parakeets; Spanish papagayo, loro, perico; Maya xthuth (Pacheco Cruz 1919:29), moo="a large parrot" (Pacheco Cruz 1919:30); chaac piliz, chactun piliz, chac piliz mo (Tozzer 1941:202, 1117; also see Roys 1931:331); ix-kan-tzul-op=yellow foreign parrot, a type "abounding in the State of Tabasco' (Roys 1931:334); ah-kota=a parrot with a large beak (Motul Dictionary, per Roys 1931:335), also called ah-lo, ix-oop.

Fourteen distinct species of Psittacids inhabit Guatemala at present (Rodriguez Luna 1958-1959:156).

Class II: Oviedo commented upon the numerous varieties of parrots in 'The Indies':

> There are so many different species of parrots that it would be a long task to describe them. They are better subjects for the painter's brush than for words... These parrots...are strong flyers, and always go in pairs, male and female. They are very destructive to corn and other food crops cultivated by the Indians (Stoudemire 1959:60).

Class III.B.: Ximenez notes that the talking yellow parrot had already become well known in Europe, and describes another variety "called chocoyos, all green" that do not talk, "and others called periquitas [i.e., parakeets] that are of the same form and color, though smaller...and they learn to speak, although not as much as the parrots" (Ximenez 1967:90-92).

> There are found in this land [Guatemala] parrots of all kinds...often [hunted] for their feathers, from which are made finery and ornaments for the dances...(Miranda 1954:349).

Ara macao, Psiattacus macao - Macaw, Spanish guacamayo, macayo; Maya mo, op, ix op (Roys 1965: 137-138); x-op (Pacheco Cruz 1919:29); moo="a general name for large macaws" (Roys 1931:337).

Class I.A.: A macaw carrying a torch appears on 40B of the Dresden Codex (Thompson 1950:270). Roys notes that in the manuscript of the Book of Chilam Balam of

Kaua, a macaw is pictured astride a snake (Roys 1965:137). Tozzer and Allen illustrate macaws occurring in both the Dresden and Tro-Cortesianus codices (Tozzer and Allen 1910:343-345, Pl.25).

Class III.B.: Macaws may have been domesticated, or at least subject to some degree of control and management, as suggested in some accounts of the Cholti-Lacandon of Chiapas:

> And there were many tame macaws. At 5 o'clock in the afternoon, after having flown around, they came to roost on the ridge poles of all the houses, forming a delightfully beautiful landscape of various deep red colored clusters of flowers (Hellmuth 1977:426, paraphrasing Valenzuela 1695, etc.).

Ximenez specifically states that these birds were domesticated, and valued particularly for their feathers, which were used primarily in ceremonial contexts.

> This bird is very beautiful...It is the size of a chicken, although it has very short legs, and a curved beak, and a thick tongue like the parrot, and they sometimes learn to talk. This bird has been domesticated, and they are kept in the houses, especially by the Indians for their feathers, which they also use as ornaments for their altars and their dances. And they sometimes give a cry that splits the head (Ximenez 1967:90).

> There are...macaws, which are birds that have feathers of red, green, blue and yellow, which the natives use in their dances and *areitos*, and from them are made some elegant fans (Betancour and Arboledo 1965:274).

Cuculiformes

Cuculidae

Coccyzus americanus

Strigiformes - owls; Spanish lechuza, Maya ah-cuy="a species of owl" (Motul Dict., per Roys 1931:330); xoch=owl or red owl [Spanish mochuelo] (Pacheco Cruz 1919:27); xnuc, icim=forest owl (Pacheco Cruz 1919:27).

Rodriguez Luna states that at least sixteen species of owl are native to Guatemala (1958-1959:155).

Tytonidae

Tyto alba - Barn owl; Tzeltal shoch' (Hunn 1977:160).

Class III.B.: Ximenez says these nest in ~~the~~ churches, and in rocky places, and

> procreate infinitely, as may be seen in the church of Rabinal, where they continually lay eggs and hatch their young, and where more than thirty have been seen in the same nest of all ages, from those beginning to fly down to recently laid eggs...They eat rats, and other small animals, and bring them to their young (Ximenez 1967:97).

Strigidae

Otus spp.

Otus choliba thompsoni - Yucatan screech owl; moan bird. Spanish zumaya, zumacaya; Maya ah coo akab, ah culte="mad one of the night" (Roys 1931:329); Tzotzil ts'urukuk=screech owl (Laughlin 1975:476); "a nocturnal bird of the forest which has a cry like that of an owl and screams like a child" (Motul Dictionary, per Roys 1931:329).

Class I.A.: This bird appears in the Codices Dresden, Peresianus and Tro-Cortesianus, and is an important element in Maya iconography and hieroglyphic writing; the bird itself was symbolic of death (Tozzer and Allen 1910:337-340, Pl. 23).

Bubo virgianus - Yucatan horned owl, Spanish Buho cornudo, Maya icim, icin; tun culuchhu (Motul Dict., per Roys 1931:334).

Class I.A.: This species appears in the Tro-Cortesianus codex, and is well represented in Maya art (Tozzer and Allen 1910:336-337, Pl.21, 22).

Class III.B.: Ximenez describes the great horned owl of Guatemala, a nocturnal bird "greatly abused by the Indians, because it is said to be a messenger of hell, and a harbinger of misfortune..." (Ximenez 1967:97). This bird apparently served no other function than that of an omen (see Landa, Tozzer 1941: 202, note 1118; Tozzer and Allen 1910:336-337).

Caprimulgiformes

Apodiformes

Trogoniformes

Trogonidae - Trogons, i.e., quetzal bird

Class I.A.: This bird is one of the species most often depicted in Maya manuscripts and art. Its chief economic importance was for its plumage, which was a luxury item, used in headdresses for rulers and other members of the elite class. It may have been domesticated for its feathers (Tozzer and Allen 1910:340-343, Pl. 24).

Pharomachrus mocinno - copper-tailed trogon, Spanish quetzal, trogon; Maya yuxum (Roys 1965:142).

Trogon mexicanus - Mountain trogon, Tzeltal k'uk

(Hunn 1977:169).

Coraciiformes

Piciformes

Rhamphastidae - Toucans, Spanish picudo, Maya pam, ah-pam (Roys 1931:337).

Class II:

> There is in Tierra Firme a bird that the Christians call picudo because it has a small body and large beak (Oviedo, Stoudemire 1959:68).

Oviedo describes these birds in detail, but says nothing of their uses.

Picidae - Woodpeckers; Spanish picamadero, pico, picaposte, Maya colonte (Roys 1965:131), ah colomte (Tozzer 1941:201, n. 1108), ch'ahum (Roys, 1965:132).

Class I.A.: This bird appears in several incantations in the Ritual of the Bacabs (Roys 1965). Its bill is used to bleed the gums to relieve toothache (Roys 1931:185).

Class III.B.: Ximenez describes the red feather crest of the woodpecker, and gives a detailed account of how the woodpecker pecks holes in pine trees, "and in this manner they fill entirely a pine tree of great height [with holes], which is a marvel to see" (1967:99). He relates a folk ~~adage~~ regarding this bird, concerning whose veracity he is skeptical:

> It is said of this bird, that if the tip of its beak is tapped with a stone, it will

> bring forth a familiar plant in blossom, [which] I take as apocryphal, since up to this day, there has been no factual evidence at all to prove it (Ximenez 1967:99).

Passeriformes

Dendrocolaptidae

Formicariidae

Cotingidae

Tyrranidae

Hirundinidae

Corvidae

Paridae

Certhiidae

Cinclidae

Troglodytidae

Mimidae - Mockingbirds, Spanish cercion, Maya chico=Yucatan mockingbird, "sometimes domesticated for their song" (Roys 1931:332).

Melanotis hypoleucus - Tzeltal culin (Hunn 1977:179)

Mimus gilvus - Tropical mockingbird, native to Chiapas; Tzeltal hti? cuhkum="woolybear caterpillar eater" (Hunn 1977:179).

Class III.B.: Ximenez describes the Mexican mockingbird native to Chiapas, which was introduced into Guatemala and kept as a pet for its song (Ximenez 1967:93), but apparently was not eaten nor used for any economic purpose there.

Turdidae

Sulviidae

Ptilogonatidae

Cyclarhidae

Vireonidae

Coerebidae

Parulidae

Ploceidae

Icteridae - Orioles

Molothrus aeneus - Cowbird, bronzed cowbird, Spanish ?, Maya dziu (Roys 1967:166; see also Roys 1931:344); Tzeltal sanate, from Spanish sanate=grackle, "a different though related species" (Hunn 1977:197).

Cassidix mexicanus - Great-tailed grackle, Spanish sanate, Tzeltal hoh mut="raven bird" (Hunn 1977:197).

Class II: Oviedo briefly describes these birds, comparing them to those of Spain (Stoudemire 1959:59).

Class III.B.: Ximenez also discusses this species, without reference to any economic or ceremonial value (Ximenez 1967:89).

Dives dives - Blackbird, Spanish mirlo, merla; Maya pichum, pich (Roys 1967:96)

Icterus spp. - Orioles, Spanish chilchotote, chiltote; Tzeltal tu c'ic (Hunn 1977:194-195); possibly this is the bird (Maya chico) described by Pacheco Cruz as being "domesticated for its song", for which he gives as the Spanish equivalents _zenzontle_ or _zinzonte_ (Pacheco Cruz 1919:19-20).

Class III.B.:

> Among the song-birds that are bred in cages, the most excellent is the oriole...which is black and yellow in color...[it is] tamed in such a way that it goes about alone, without being shut up in a cage. And it will go from flying in the trees and come to its cage, and to the hand of its owner, and has been known to eat from plates on the table, and also to take food from the mouth of its owner...and to put its beak between his lips and clean whatever is stuck between the teeth. There is another kind that is not domesticated, called catbirds, because their cry is like that of the cats...(Ximenez 1967:92).

Icterus prosthemelas=Lesson's Oriole, Maya _hom-xan_, or _hom-xanil_ (Roys 1931:333). "Hom-xan means to smother a fire" (Roys 1931:333).

Thraupidae

Fringillidae

5. MAMMALIA

Among the mammals of economic importance to the Maya in prehistoric times were deer, both the white-tailed and red brocket varieties; cottontail rabbit; collared and white-lipped peccary; and many rodent species, of which squirrel, paca and agouti were probably the most important as food species. Raccoon, porcupine, and opossum were also present, and were sometimes hunted; primate species were limited to the howler and spider monkeys. The domestic dog has been present since earliest times, and was prized as a food source, as well as for hunting and ceremonial purposes, in prehistoric times (Stuart 1964; Wing 1978; Hamblin 1980).

Marsupialia

Didelphidae

Didelphis virginiana

D. marsupialis

Philander opossum

Marmosa spp.

Opossum - Spanish *zorro, zorra mochilera*; Maya *och* (Roys 1967:152,153); *churcha* (Oviedo); Tzeltal *uch* (Hunn 1977:202).

The opossums were a subject of curiosity to the Spanish because of their characteristic of carrying their young in a natural "pouch".

Class II:

> The opossums in Tierra Firme...come to the houses at night to eat the chickens, or at least to cut their throats and suck the blood...The unusual and strange thing about these animals is that if they have young at the time they make these nocturnal raids...they bring the young with them... in the middle of the belly there is a pouch...And when the opossum thinks she has been heard...[she] instantly puts her young into the pouch and runs away if it is possible...the pouch...contains the teats so the young can nurse while they ride along. I have seen some of these opossums and they have even killed my hens...(Oviedo, Stoudemire 1959:58).

Class III.A.:

> There is an animal that we Spanish call fox [*zorro*] and the Indians och, a little

larger than a cat, which produces six or eight young and suckles them, and has two pouches in its belly...where it carries its young and takes them where it wishes and lets them out to eat small insects... (Relacion de la Cuidad de Merida, RY I:64-65).

Insectivora

Soricidae

Cryptotis micrura - Shrew; Spanish musgano, Tzeltal ya?al be (Hunn 1977:209)

Sorex spp.

Chiroptera - Bats; Spanish murcielago, Maya zots, zotz="a general name for bat" (Roys 1931:343); Tzeltal soc' (Hunn 1977:201-202).

The number of species of bats in the Maya regions has been variously estimated. According to Rodriguez Luna, some fifteen species exist in Guatemala (Rodriguez Luna 1958-1959:153); however, Hall and Kelson (1959) state that sixty-two species, representing eight families, are known in Chiapas (cited in Hunn 1977:200).

Class I.: Bats were an important totemic species among the Quiche Maya (Carmack 1981:84), and "bat" seems to have been an element in the names of some of the Maya rulers whose exploits were recorded on inscribed stelae erected at lowland sites, e.g., Yaxchilan (Proskouriakoff 1963-1964).

Class I.A.: The leaf-nosed bat appears as a glyphic element in the Maya script, although it has not been found depicted in the codices (Tozzer and Allen 1910:365-366).

Class II: Oviedo discussed bats, including the danger of their bite and the native remedies for it, giving personal testimony to the efficacy of these. He goes on to say that edible bats exist in Puerto Rico

> ...that are eaten...they appear like reed birds, very white, and fat and of good flavor, according to the Indians (Stoudemire 1959:62).

Hunn reports that the modern Tzeltal Maya consider bats to be inedible, and all are considered to be vampires, i.e., bloodsuckers, although actually this is true of only the _Desmodontidae_ species (Hunn 1977:201).

Phyllostomidae

Anoura geoffroyi - Geoffroy's tailless bat

Carollia perspicillata - Seba's short-tailed bat

Sturnira ludovici - small black bat; Anthony's bat

Artibeus jamaicensis - Jamaican fruit-eating bat

Desmodontidae - Vampire bats

Desmodus rotundus

Vespertilionidae

Myotis nigricans - Black myotis, small red bat (Tzeltal _c'in cahal soc'_, Hunn 1977:202).

Primates

Cebidae - Monkeys, Spanish _mono, mico;_ Maya _maax_ (Pacheco Cruz 1919:14).

Alouatta palliata - Howler monkey, Spanish _mono, saraguato, barbudo;_ Maya _ah baatz, baatz_ (Roys

1931:320); Chol batz (Moran 43, 44, per Hellmuth 1977:430); Tzeltal bac' (Hunn 1977:204).

Ateles geoffroyi - Spider monkey, Spanish mico, Maya ix-tuch=Mexican spider monkey (Roys 1931:389), maax, max.

Class II:

> When the Christians shoot arrows at the monkeys, or hit a monkey, the animals pull the arrows out and sometimes hurl them down again...Other monkeys break the arrows into small pieces. Some of these animals are very small, about the size of a man's hand...others are as large a a middle-sized mastiff. Between these two extremes there are monkeys of many different species, shape, and colors... (Oviedo, Stoudemire 1959:57).

Oviedo gives no information regarding the monkey's economic importance to the natives.

Class III.A.: Landa mentions monkeys as one of the species hunted in the Province of Tabasco, but says there are no monkeys in Yucatan (Tozzer 1941:5).

Edentata

Myrmecophagidae

Tamandua tetradactyla,

Cyclopes didactylus - Anteaters, Spanish oso hormiguero ("ant bear", Oviedo, Sumario 1950:153-155); Maya lutz (given as name of three-toed anteater by Bartlett in Murie 1935:29; this appears to be erroneous. Kelley (1976:165) and others translate lutz as "fishhook"); ah chab="sweaty one" (Relacion de la Cuidad de Merida); ah chab is defined as "the Maya name of the three-toed ant-eater" by Roys (1967:65).

The anteater does not appear to have been a species of economic value to the Maya, and, as noted in the Relacion de...Merida, it was not eaten by the natives, as its flesh is reported by Oviedo as being "foul and bad-tasting" (see below), probably a result of the excessive amounts of formic acid ingested. This no doubt was a factor contributing to its avoidance as food, and may also have rendered it unqualified for ritual purposes, although no specific reference to it as a taboo animal has been found. Because of its unfamiliarity and distinctive habits, the anteater was frequently described by the Spanish writers.

Class II: Oviedo described the anteater as having fur like that of a bear, and lacking a tail, being smaller than the bears of Spain, but having the same features, except for its very long snout, and its shortsightedness. These animals were often captured with clubs or sticks (a palos), and are described as harmless and easily taken with dogs. They put their long, delicate tongues into the knifeblade-thin fissures in the anthills, using it to enlarge these cracks. The ants, attracted by the tongue's moisture, collect on it, and when the anteater's tongue is covered with ants, the animal draws it into the mouth and eats them, then puts it out for more. Oviedo says the flesh of this animal is foul and bad-tasting (Oviedo

1950:153-155; Stoudemire 1959:51-53).

The comparison of the anteater with a bear, as well as the use of the term _oso_ in its Spanish name, probably contributed to the erroneous appearance of "bears" in a number of early Spanish accounts as being native to the Maya regions. The tayra (_Eira barbara_), which occurs here, was also sometimes called a "honey bear", and the present Tzeltal Maya may apply the same term (_c'uhc'uneh cab_="honey licker") both to the anteater and to the tayra (Hunn 1977:221). True bears (_Ursus_ species) are not found in the Maya area, although the black bear (_Ursus americanus_) is found in mountaineous areas of northern and western Mexico (Leopold 1959:411-412).

Class III.A.: In the _Relacion de la Ciudad de Merida_ the anteater is described as having the shape of a rabbit, and an extremely small mouth that is scarcely able to contain its tongue, which is extremely long; it sustains itself by eating only ants (the manner in which this is done is described in terms similar to Oviedo's), on which it grows fat and resplendent; but the Indians do not eat its flesh because they do not think it is good. Whether this was simply due to dislike, or to a taboo, is not made clear (RY I:64).

Class III.B.:

> There are...small bears with no mouth but at the tip of their snout an opening through which they put out ther tongue and suck up the honey they find in hollow trees, and when that fails them they go to anthills anthills and when their tongue is covered

> with ants, they draw it in, and that is how they live (Vasquez de Espinosa 1942:277, #648).

This report displays some confusion about the diet of the anteater, implying that it seeks honey as well as ants.

Dasypodidae

Dasypus novemcinctus - Armadillo; Spanish armadillo, Maya ibach (Roys 1931:334), uech, ah uech (Roys 1931:340), ybache, etc.; see also Landa, Oviedo, Ximenez).

Class I.A.: The nine-banded armadillo is mentioned in the Book of Chilam Balam of Chumayel (Roys 1967:96), and is clearly depicted as a prey species caught in a pitfall trap in the Codex Tro-Cortesianus (48; Villacorta Calderon 1930:320).

Class II: Oviedo described the armadillo as

> a very strange animal to the Christians, and quite different from any animal in Spain or anywhere else...Its hide is like the skin of a lizard, between white and gray...In appearance it is exactly like an armored horse, with its caparison and armor completely covering its body. From under the armor the tail comes out, and in their proper place the legs, and the neck and the ears in their place... This animal is about the size of a small dog, ...and is not vicious, but rather timid. They make their homes in mounds of earth, and by digging with their paws they hollow out their caves and burrows, somewhat like those made by rabbits. They are excellent food and are captured in nets, and some are killed by crossbowmen. Most often these animals are taken when the fields are burned over in preparation for planting or to renew the grass for cows and cattle. I have eaten of them several times, and the flavor is better than that of kid. It is healthful

food...(Oviedo, Stoudemire 1959:53-54).

Class III.A.:

There is another kind of animal that we call the armored ones, and the Indians call ybaches, which has a body like a plate of armor. It is dark brown and walks like a pig, breeds underground in dens it makes, and is good to eat when fresh. It has the appearance of a pig. Sometimes they become poisonous to eat, since on occasion people have eaten these creatures and died of it, with severe vomiting and diarrhea. But in spite of this, no Indian can refuse to eat it (Relacion de la Ciudad de Merida, RY I:63-64).

There is another [animal] which they call ix-uech. We call them armados, because they have certain shells and are enclosed by them. There are two sorts...one does harm to anyone who eats it, and the other is very good. They recognize them by the shells...The only difference is that the bad one has six stripes across its body, and the good one has eight or nine. They are of one color, which is between white and red (Relacion de los Pueblos de Tetzal y Temax, RY I:302; also quoted in Roys 1931:340-341).

Class III.B.:

Armadillos breed in this valley in great numbers...they are amusing for the speed with which they hide themselves, and because at the end of their courage when the hunters attack them they retire into their armor, and they run with great speed from the highest crag to the deepest valley, continuing on their speedy course over broad and long distances, until they hide in their deep and twisting burrow, where the hunters capture them and pull them out with little pronged sticks, because of the danger of encountering poisonous snakes in the subterraneaan holes in which they hide. The flesh of the armadillo is the most delicate and tasty of all the wild animals, white as snow, like a breast of fowl, and covered with a quantity of fat. This animal sustains itself on ants and wood beetles and grubs of the fields and forests...(Fuentes y Guzman 1932, v.I:276-277).

Lagomorpha

Leporidae

Sylvilagus floridanus - Cottontail rabbit, Spanish *conejo*, Maya *t'ul, t'uul, thul*="a general name for rabbit" (Roys 1931:339), also *muy* (Roys 1931:337); Chol *tuul* (Moran:17, per Hellmuth 1977:430).

Class I.A.: The rabbit appears in some of the Maya codices, including the Dresden (p. 61; Tozzer and Allen 1910:Pl.30), and its head is an element in some glyphs.

Class I.B.: In the *Historia Quiche de Don Juan de Torres*, the tribe of Tamub "hunted the hares [sic] in their burrows, stealing the hares and the *zompopos*" (Recinos 1957:29).

Class II: Oviedo maintained that

> ...in Tierra Firma there are both rabbits and hares. They are called this because in color of the back they resemble hares, but in other places they are white, on the belly as well as on the sides. Their legs are grayish brown...from what I have been able to learn, they are more like hares than rabbits, and they are smaller than the hares of Spain. Usually they are captured when the woods are burned over, and at times the Indians also catch them in traps (Stoudemire 1959:53).

Class III.A.:

> There are many rabbits, that come onto the house plots where people live, and a group of children will join together and kill them with sticks; but they are not as tasty as those of Spain (Cogolludo 1955, v.I:320).

> There are rabbits without number, those of this land [Yucatan], very similar to those of Spain; the Indians catch them in the dry season by beating ~~them with~~ sticks among their houses, where they prefer to dwell

rather than in the bush, because (it is said) of the snakes (Ciudad Real 1875, v.I:386).

Rodentia

Sciuridae - Squirrels; Spanish ardilla, Maya cuc, ah cuuc, kuuk (Roys 1965:131), cuceb (Roys 1967:182); Chol chuch (Moran:6, per Hellmuth 1977:430); Tzeltal cuc (Hunn 1977:205).

Sciurus aureogaster - Gray squirrel

Sciurus Deppei - Deppe's squirrel, red squirrel

Glaucomys volans - Southern flying squirrel

Class II:

> There were found in this land, generally in all parts of it, when the Spanish first came...squirrels of many colors...(Velasco 1894:20-21).

Class III.A.: "There are very many pretty squirrels [in Yucatan]" (Landa, Tozzer 1941:205).

Class III.B.: Fuentes y Guzman refers to the bat-winged flying squirrels, found in the mountains and forests of Wutzaltenango, Totonicapan and Solola [Guatemala] (In Juarros 1823:486-487).

Geomyidae

Heterogeomys hispidus - Pocket gopher; Tzeltal ba; the only species found in the central Maya highlands (Hunn 1977:206).

Macrogeomys underwoodi

Pocket gopher - Spanish tuza; Maya as bah, ba (Motul Dictionary 1929:123; Roys 1931:327-318).

Class III.A.: The Relaciones de Yucatan mention this animal as a food species:

> There are other animals, which the Indians call bas, like a large rat. They are bred underground and live on roots. They catch them with snares at the outlets of their holes, and they are good food for the Indians (RY I:171, quoted in Roys 1931: 327-328).

Erethizontidae

Coendu mexicanus - Mexican porcupine, Spanish erizo, Maya ah-kiix-pach-och, kiix-och="spiny-back opossum" (Roys 1931:335); Tzeltal c'is ?uhcum="spiny opossum" (Hunn 1977:214).

Class III.B.:

> There occur also in [these forests]...as in the wood of other valleys, a great abundance of spiny porcupines, whose quills are frequently and effectively used for their curative properties among the Indians...for which reason they are held in esteem and [the Indians] attempt to hunt them... (Fuentes y Guzman 1932, v.I:276).

Guzman describes the difficulty of hunting these animals, and the damage they do to the dogs with their quills. He does not mention them as a food species, referring only to their procurement and use for medicinal purposes.

Dasyproctidae

Cuniculus paca

Paca - Spanish paca, tepisquintle; Maya haleu= "Mexican agouti" (Roys 1967:130; Tzeltal hlaw (Hunn 1977:215).

Class III.A.: An animal described in the Relacion de la Cuidad de Merida may be a paca, whose Indian name is given as haleb (RY I:64).

Dasyprocta spp.

Agouti - Spanish _aguti, aguti pinta_ (spotted agouti); Maya _ah tzu, tzub; haleb; haleu_="Mexican agouti" (see _paca_) (Roys 1967 Chumayel:96, 130; Roys 1931:333).

Class III.A.: The agouti may be the animal described in the _Relacion del Pueblo de Mama_:

> Also there are other animals which the Indians call haleo, which is a very important food. Of the size of a large cat, it has short legs and a spotted skin like a new-born fawn (Relacion del Pueblo de Mama, RY I:171; also quoted in Roys 1931:333).

Landa also described the agouti:

> There is a small animal of a very sad disposition. It always goes about in caverns and under cover at night. To catch it the Indians set a certain trap. It is like a hare and moves with leaps and timidly. It has very long thin front teeth and the canine-tooth is even smaller than that of the hare...It is marvellously mild and gentle and they call it zub (Landa 1900: 401, quoted in Roys 1931:340).

Carnivora

Canidae

Canis latrans - Coyote, Spanish _coyote_, Maya _chamac?_ (Roys 1967:196, n.1); Tzeltal _'ok'il_ (Hunn 1977:215.

Class III.B.: In his reply to the questionnaire of Felipe II, describing the provinces of Zapotitlan and Suchitepequez, Estrada mentioned the coyote as a native of Guatemala:

> [Among] the animals of the forests are... a kind of wolves, although they are not called that, but are called coyotes... (Estrada 1955:78).

C. *familiaris* - Domestic dog, Spanish *perro*; Maya *peq*="a general name for the dog" (Motul Dictionary, quoted in Roys 1931:338); *tzotzim-pek*="a dog of this land with very short hair" (Motul Dictionary, quoted in Roys 1931:340); *tzul*="the domestic dog" (Roys 1931:340); *ah-bil*, *kik-bil*=hairless dog (Motul, per Roys 1931:328); Chol *tzi* (Moran, etc., per Hellmuth 1977:431); the Tzeltal Maya distinguish between the indigenous short-haired dogs, i.e. *c'i* (the generic term), or *bac'il c'i* (="true dog"), and long-haired varieties (*kaslan c'i*="Ladino dog") (Hunn 1977:215).

Class I.A.: The dog appears with great frequency in the Maya codices, especially as a sacrificial animal. Both the furry and hairless varieties are portrayed, as well as some with spotted coats (Tozzer and Allen 1910:359-365, Pl. 36, 37).

Class I.B.: The *Titulos de la Casa Ixquin-Nehaib* suggest that the small hairless dogs ("*perros...pelones*") may have been used as guards or defenders by the Quiche Maya (Recinos 1957:90). These must, therefore, have been a different breed from the native barkless dog described by Columbus and others (see below), since the latter would surely have had little value as a watchdog.

Class II: In the journal of his first voyage, Christopher Columbus reported that in Cuba he found "a dog that never barked" in the house of a fisherman (entry for Sunday, October 28, 1492; in Jane 1930:163-164), which may have been the same breed of dog Ximenez later described as existing before the Conquest, but having become extinct by the time he wrote his natural history. In his entry for the following day, Columbus reported more barkless dogs (Jane 1930:165).

Oviedo also discussed these barkless dogs, which he states were also found on the mainland ("tierra firme"):

> On the mainland...there are some small dogs, mongrels, that they have in the houses, of all the colors of coat that exist in Spain; some bushy and some smooth, and they are mute, because they never bark nor whine, nor howl, nor do they give cries or groans even if they are beaten to death, and they look much like little wolves, but they are not [wolves], but native dogs...and they are much more reserved than our dogs, except with those of the house in which they dwell, to whom they show love...and for whom they wag their tails, demonstrating devotion to those who give them food...(Oviedo 1950:163).

Class III.A.:

> There are dogs native to this land that have no hair at all, and do not bark, who have thin sharp teeth and little bulging eyes. They were fattened by the Indians for eating, and they held them in great esteem. These have bred with the dogs of Spain, and they have engendered mixed breeds, some of whom bark and have hair, and the Indians eat them also...and also the Indians have another sort of dog that has hair, but barks very little and has the same size and shape as the others (Relacion de...Merida, RY I:63).

> The usual sustenance of the Indians [includes]...the meat of...little dogs bred purposely for eating, and it is said that their meat is very good to eat (Relacion de Chunchuchu y Taby, RY I:150).

> Moreover they raise in their homes dogs native to this land, which neither bark

nor bite, and the Indians eat them and prize them as a delicacy; also they raise the dogs of Castille, and eat them (Relacion de Mutul, RY I:86).

[There are] dogs raised by the Indians that we call 'dogs of the land', that have no hair, and the Indians eat them for their festivals as a principal food, and say they have a taste like that of a fattened pig.... (Relacion del Pueblo de Mama, RY I:169-170).

None of these animals was domesticated except the dogs which cannot bark nor do harm to man (Landa 1900:400, quoted in Roys 1931:338).

These [dogs] were used to hunt birds and deer and were also eaten (Relacion de... Merida, RY I:63; also quoted in Roys 1931:328).

Class III.B.:

There were formerly in all of this land, small animals like dogs, and this was the name by which the Spanish called them, which were raised by the Indians, domesticated in their houses, and they did not bark, which have been confused with another kind of our dogs. These were very good to eat... These have become totally extinct, so that today they are not found in all of this kingdom of Guatemala where they were formerly, nor have I seen any in New Spain (Ximenez 1967:66-67).

Urocyon cinereoargenteus - Grey fox, Spanish zorro, raposa; Maya uah miz il kaax (Murie 1935), chamac=grey fox (Roys 1967:196, n.1).

Class II:

There are foxes of the same appearance as those of Spain, but not the same color. Those in the Indies are darker than black velvet. They are very swift, but smaller than those in Spain (Oviedo, Stoudemire 1959:50).

Procyonidae

Procyon lotor - Raccoon, Spanaish mapache, Tzeltal me?el (Hunn 1977:219). According to Hunn, this species is still fairly common in Chiapas, and is eaten by the modern Tzeltal Maya.

Nasua narica - Coati, coatimundi, Spanish pisote, Maya chiic, ah-max-chic (Roys 1931:332), tsab, emuts; Tzeltal kohtom (Hunn 1977:219).

Class III.A.:

> There is another kind of animal which the Indians call chic, and the Spaniards pijote, a Mexican word. These are like badgers and the Indians eat them (Relacion de...Merida, RY I:64).

Potos flavus - Kinkajou, Spanish mico de noche, Maya akab-max="night monkey" (Roys 1931:327).

Mustelidae

Mustela frenata - Weasel, Spanish comadreja; Maya zabin, zabim, sabim (Roys 1931:342a, 1967:196); Tzeltal sabin (Hunn 1977:220).

Class III.A.:

> There are other animals which are of no use, such as the zabin, which is like a ferret (Relacion de...Tetzal y Temax, RY I:302, quoted in Roys 1931:342).

Eira barbara - Tayra, bush dog; Spanish oso colmenero; Maya zam-hol (roys 1931:343), Tzeltal şak hol (Hunn 1977:220).

Class III.A.:

> There is another animal which they call samhol, which is a bear the size of a dog. They eat nothing but honey, of which there

is a large quantity. As people keep hives outside of town, if they neglect them, these animals will destroy them (Relacion de los Pueblos de Tetzal y Temax, RY I:303; quoted in Roys 1931:343).

Mephitis macroura - Hooded skunk

Spilogale angustifrons - Spotted skunk

Conepatus mesoleucus - Hog-nosed skunk

Skunks - Spanish _zorrillo, zorrito;_ Maya _pay, pay-och_ (Roys 1931:338); _ek-pay_="black skunk" (Roys 1931:333); Tzeltal _pay_ (Hunn 1977:221).

Class III.A.:

There is an animal which they call pay and we call it _zorrillo_. It is colored white and black. When one tries to catch it, it gives forth such a perverse and bad odor that no one can endure it (Relacion del Pueblo de Mama, RY I:171; quoted in Roys 1931:338).

There is another variety of _zorrillo_ a little bigger than a squirrel, marked with many black and white spots, which has a very elegant appearance; but when urinating it produces such a stench that it can be sensed from very far away, so that one cannot stand it without holding one's nose; and the natives have a remedy for tolerating this stink, which is to burn the leaves of the guano palm, which are those leaves with which the Indians cover their houses (Relacion de...Merida, RY I:65).

Lutra annectens - Southern river otter; Spanish _nutra, nutria, perro de agua;_ Tzeltal _h'lal c'i_="rain dog" (Hunn 1977:218).

Felidae

Felis onca - Jaguar; Spanish _tigre_, Maya _balam, bobil-che_(?); _chac-bob, zac-bob_="white jaguar" (Roys 1967:196, n.6 & 8); also _chac-bolay, chac-mol,_ chac-~~ekel~~, zac-bolay, zac-bolay, zac-ekel (Roys 1931:331).

Class I.A.: The jaguar was the Maya "king of beasts", serving as a symbol of royalty, and having religious significance as well. The term balam appeared frequently as a patronymic, as well as a kind of honorific title appended to the names of religious specialists, e.g., the Chilam Balam, or "jaguar priest" of Yucatan, whose prophetic works foretold the coming of the Spanish, as well as the war and pestilence that would accompany this event (Roys 1967; Edmonson 1982; Craine and Reindorp 1979).

Class I.B.: Among the highland Quiche Maya, the jaguar also served as a sacred and royal symbol. Sharp-pointed perforated jaguar bones were given to chiefs, for use in piercing the ears, nose and other body parts to draw the royal blood for offering to the gods (Historia Quiche de Don Juan de Torres, Recinos 1957:40). The claws and skin of the jaguar were also used by the Maya rulers:

> The ancestors said the canopy and throne of Galel and Ahpop [had] claws of the lion and tiger [i.e., jaguar], both insignia of royal right (Recinos 1957:63).

Rulers were sometimes thought to be able to convert themselves into jaguars, since this species was one of the naguals, or familiar spirits, of rulers, endowing their possessors with supernatural powers associated with the animal in question (Popul Vuh, Edmonson 1971:81). The economic role of the jaguar appears, therefore, to have been primarily that of providing raw material for artifacts associated with the Maya ruling elite, rather than directly contributing to subsistence economy.

Class II:

> The whole body and legs are covered with black spots, close together, outlined in red, which makes for a beautiful marking... In Tierra Firme there are much larger ones, for I have seen some more than three palms tall [i.e., about two feet], and more than five long...I do not believe any of the biggest royal lions is as strong or as fierce. There are many of these animals in Tierra Firme, and they eat many Indians and do other damage... (Oviedo, Stoudemire 1959:45-46).

F. Concolor - Cougar, red lion, Spanish gato monte, Maya ah coh, a-uay-mi (Roys 1931:340).

Class II:

> In Tierra Firme there are royal lions [cougars] exactly like those in Africa [sic]. But they are somewhat smaller and not so bold ...they are not dangerous unless pursued or attacked (Oviedo, Stoudemire 1959:49).

F. pardalis - Ocelot, Spanish tigrillo, ocelote (from Aztec ocelotl); Maya zac-xicin="white ear" (Roys 1931:343); Tzeltal cahal coh=red cougar (Hunn 1977:223).

Class II:

> The ocelot is a very fierce animal, and has about the same shape and color as the small gray tame cats we have in Spain. But it is as large or larger than the tiger...It is the fiercest animal in that land and the one the Christians fear most, and it is swifter than all other animals that have been discovered there...The swine carried to Tierra Firme that have escaped to the forests have not lived long, for they have been eaten by

the ...ocelots...(Oviedo, Stoudemire 1959: 49-50).

F. wiedii - Margay, Spanish tigrillo, Maya chulul (Roys 1931:332), bobil-che (Roys 1967:196, n.8).

Pinnipedia (Biologia Centrali-Americana, V.2:vi)

Phocidae

Monachus tropicalis - Seal; Spanish lobo marino, Maya coh-ha="water puma" (Roys 1931:333), tzula="water dog", the West Indian seal (Roys 1931:340).

Class II:

> There are also seals, much larger than ours...(Velasco 1894:22).
>
> ...In the seas of the Indies is found a large kind of seal, and they are very fierce, although not as much so as those in the Mediterranean Sea, but those of the Indies are more exotic and wild, and they are found only in the ocean (Lopez Medel MS, n.d., Part 2, Cap. 7).

Class III.B.:

> There are many of these [seals] in the bay of Veracruz. At night they go onto the land to sleep, on unpopulated islands ...they are black, with feet for both walking and swimming (Ximenez 1967:206).

Sirenia (Biologia Centrali-Americana, V.2:vi)

Manatidae

Trichechus manatus - Manatee, "sea cow"; Spanish manati, manato; Maya baclam (Roys 1931:328).

The manatee was exploited by the Maya for a variety of purposes (McKillop 1985). This marine mammal posed classificatory problems for the European writers, most of whom called it a fish, but hastened to point out its differences from ordinary piscean species. Many compared it to a calf, and all noted that its method of reproduction was more similar to that of the mammals than the fishes.

Class II:

> The Spaniards at this time found a new sort of fish [sic], which was a considerable advantage to them...called Manati, in shape like a skin they use to carry wine in, having only two feet at the shoulders, with which it swims, and it is found both in the sea and in rivers. From the middle it sharpens off to the tail, the head of it is like that of an ox, but shorter, and more fleshy at the snout; the eyes small, the colour of it grey, the skin very hard, and some scattering hairs on it. Some of them are twenty foot long, and ten in thickness. The feet are round, and have four claws on each of them. The females bring forth like the cows, and have two dugs to give suck. The taste of it is beyond ~~fish~~; when fresh it is like veal, and salted like tunny-fish but better and will keep longer...Sometimes they are taken ashore, grazing near the sea, or rivers, and when young they are taken with nets. Thus the Cazique Carametex took one, and fed it twenty-six years in a pond, and it grew sensible and tame, and would come when called by the name of Mato... It would eat whatsoever was given it by hand, and went out of the water to feed in the house, would play with the boys, let them get upon him, was pleased with musick, carry'd men over the pool, and took up ten at a time...(Herrera y Tordesillas 1752, v.I:278-279).

The story of "Mato", the tame manatee, appears in several other early accounts (see below).

> ...Among other kinds of fish not before seen [are] manatees, in the rivers of the tierra caliente, not far from the sea, resembling a calf of three or four months, whose meat is very good, similar to veal, because it feeds on the river grasses, and it is said to conceive in the womb, and that

always a male and female are born together... (Velasco 1894:22).

The manatee is a sea fish...It is very ugly and resembles those large ox skins used to carry must...The head of this fish is as big as a cow's head, and it has eyes like a cow's. It has large stumps of arms, with which it swims. It is a very tame animal and comes up to the shore and if there is any grass there that it can reach, it eats it. Since these fish, and many others too, often swim on the surface...they are killed by bowmen in dugouts and boats...A pair of oxen, sometimes two, is required to pull the cart that carries the manatee to the city. Sometimes the fish is loaded into the dugout instead of being towed to shore, because as soon as it dies it floats on the surface. I think that it is one of the tastiest of all fish, and one that tastes most like meat. It looks so much like a cow that a person seeing only a part that has been cut off could not tell whether it was beef or veal. In fact, it tastes so much like beef that it would fool anyone in the world...None of our fish in Spain, not even the sturgeon , is so good (Oviedo, Stoudemire 1959:113).

Lopez Medel also mentions the manatee (Lopez Medel n.d., Cap. 8, Part 2).

Class III.A.: Landa describes the manatee, giving some additional facts about this species:

There are many sea-cows along the coast between Campeche and La Desconocida, from which, besides the large amount of fish or meat which they have, they make a great deal of lard, excellent for cooking food. Of these sea-cows marvellous stories are told...[here Landa refers to the above tale of the tame manatee, here called Matu, attributing it to Oviedo]...they are so large that one gets more meat from them than from a...yearling calf...and the female always bears two...and they have their face very like that of an ox, and they raise it out of the water to feed on the grass on the shores. And the bats are accustomed to prick them in a round flat snout, which they have which turns back on their face and they die from it as they are wonderfully full of blood...The flesh is good...with mustard, it is almost like good beef (Tozzer 1941: 190-191).

Class III.B .:

...And among the fish [sic] they procured the most...is one that we have been told is caught in the Gulf, and it is the manati, whose image we represent in a sketch... Of this kind of fish...a great quantity is gathered throughout the entire year. It has... two short arms, fleshy, and wrinkled like those of an elephant, and these serve not only for swift swimming in the water, but are usefully employed for going on land when it grazes there; it has in each arm, or hand, four claws, the head is similar to that of a calf, the eyes are small in relation to its size, and corpulence, and it has the property of opening and closing them with much speed and ease; the skin covering is dense and thick, ringed with ash-colored skin at intervals, from the navel to the tail, and tapered, and the size of the body depends on its age, but the biggest that have been captured are of 25, and of 30 feet (pies) in length. They do not breed like the other fishes...but give birth to their calves...they have two teats, or udders...their flesh is more like that of land animals, than that of aquatic animals, it is in all very similar to that of the pig...and lasts a long time, and also dried in the sun, or smoked, is preserved for many days, and its fat is very abundant, and keeps a long time wihout becoming rancid, and is put to use in many medications...(Fuentes y Guzman, Recordacion Florida 1933, v.2:329-330).

Guzman also made a sketch of this animal, which he included with his description.

Many of these fish [sic] are bred from the Laguna de Terminos...to the Golfo Dulce. It is like a yearling calf...it does not have scales, but a hide of a great thickness and it has some hair. The tail is very wide. It draws near to the banks to eat grass like an ox. This fish has genitalia like those of a woman, and gives birth to its young like any other animal, and nourishes them at its

> breasts...Its meat is like that of a cow, and marbled with fat like streaky bacon... (Ximenez 1967:204).

Perissodactyla

Tapiridae

Tapirus bairdii - Tapir, "mountain cow", Spanish danta; Maya tzimin; Chol tiil (Moran:24, per Hellmuth 1977:430).

Class II:

> ...The largest...is the size of a year-old calf. Their hair is dark brown and a little thicker than that of the buffalo...Their meat is very good though it is a little more tender than the meat of the cattle from Spain. The feet...are a very good and delicious article of food, except that they must be cooked for twenty hours or more...But when they are done, it is a dish fit to offer to anyone who delights in eating something very tasty and delicious. They hunt these...with dogs. After the dogs corner it the hunter must run quickly to capture the [tapir]...before it goes into the water if there is any nearby, because after it goes into the water...it has the advantage over the dogs and chews them to death...These animals lick their paws very frequently just like a bear...The hind paws are not sought after as an article of food. Both hind and fore feet are split twice so that each has three claws. Its tail is very short and its ears long...(Oviedo 1941, Vol.II, Chapter XI:1027-1028).

> ...[an animal that] Nature created in prodigious form. It is as large as a bull, and has a trunk like an elephant...Its hide is like a bull's...Its hoof resembles that of a horse...It has ears like an elephant's though smaller and drooping, yet they are larger than those of any other animal (Peter Martyr d'Anghiera, De Orbe Novo, Book 9 of the Second Decade, 1516; quoted in Hershkovitz 1954:492).

> The biggest beast is the Danta, like a calf, but thicker, the loins, legs and knees low,

> as [in] the elephant,...having five claws on the fore feet, three before, and the other two behind; and only four on the hind feet; the head long, the forehead narrow as it were dented; the eyes small, the upper chop hanging down an handful over the mouth which it lifts up when provoked, showing the teeth and tuskes, being like those of a boar; the ears standing upright; the neck close to the shoulders; the tail short, with few bristles; the skin six fingers thick, and being double about the loins, can scarce be grasped with the hand, being proof against any weapon when dry'd. It feeds on grass, the Indians eat its flesh, which is sweet, of whom they say men learnt to let blood, because when over-burden'd therewith, it rubs the inside of the legs against the sharp reeds, and bleeds as much as is requisite (Herrera, Stevens 1725, V.I:197).

Class III.A.: Ciudad Real mentioned the tapirs of Yucatan:

> There are found along the Rio de Lagartos some dantas, which are called tzimines, which is the same name they give to horses because they say that they resemble them (Ciudad Real 1875, V.2:386).

Class III.B.:

> The first and principal of the animals most peculiar to these lands is the danta, which is similar to the elephant...and has the form of a large burro, and it has a trunk like that on an elephant, for guiding itself. This animal breeds in the mountains...and the volcanic region of Guatemala...It is a very fierce animal, and indomitable, and not domesticable as the elephant is said to be. [For another opinion regarding the tapir's domesticability, see Lewis 1970]. When it is small it has a very spotted skin like the tiger, and when grown loses its spots, and takes on a brown color, and its hair is very short. It does not go from the mountain thickets into the light, and when suddenly met, it gives a great snort, and runs away, and will not attack if it is not molested (Ximenez 1967:51-52).

Artiodactyla

Tayassuidae - Peccary, "wild pig"; Spanish puerco montes; Maya citam, keken; ac=male peccary (Roys 1931:327); Tzeltal citam (applied to both species, and to European pig, per Hunn 1977:226).

Tayassu pecari - White-lipped peccary, Maya keken (Roys 1967:96); Chol cehcem (Moran:39, per Hellmuth 1977:430).

Dicotyles tajacu, Tayassu tajacu

Collared peccary, javelina; Spanish jabali, Maya citam.

Class II:

> There are...many wild swine native to Tierra Firme, and they are often seen in large herds ...These pigs, however, do not have tusks... but they kill our dogs by biting them savagely. The swine are somewhat smaller than ours, and are covered with thicker hair or wool. They have the navel in the middle of the spine [sic; this is the dorsal musk gland; see Lewis 1970], and the back hoof is not cloven...The Indians call a pig chuche and catch them in traps and kill them with spears...these animals are very dangerous when encountered in herds...Sometimes thay are found when the females have gone aside to bear their young. Then the suckling pigs are captured. There are many of these and they have a very fine flavor (Oviedo, Stoudemire 1959:50-51).

Class III.A.:

> There are swine, small animals and very different from our own, for they have the navel on the back and stink greatly (Landa 1900:400; quoted in Roys 1931:329).

Roys further notes that the term citam is also applied to a species of peccary found only on the island of Cozumel, possibly the domesticated subspecies of the collared peccary developed there, as described by Hamblin (1980).

> There are three sorts of wild hogs; some call them citam and others, u-kekenil-che. The former are smaller (RY I:300; quoted in Roys 1931:335).

Roys adds that "today the term Keken-che is applied to the peccary, and Keken to the domestic hog" (1931:335).

Ruminantia

Cervidae - Deer; Spanish venado, ciervo; Maya ceh; Chol/Lacandon chijc, quehei (Moran:11, per Hellmuth 1977:430).

Two species of deer, the white-tail and the small red brocket, are native to the Maya regions.

Odocoileus virginianus - White-tailed deer, Maya ceh.

Class I: The deer depicted on the ceremonial vessel from Actun Balam described and illustrated in Pendergast (1969:41-52 and frontispiece) appear to be of the large white-tailed variety; here they are shown being ritually killed.

Class II:

> There are many deer [ciervos] on the mainland like those of Spain, in color and size; but they are not as swift, to which I can well testify, because I have run down and killed them with dogs in these parts several times, and also have killed them with the cross-bow. (Oviedo, Sumario:151).

Class III.A.:

> [The Maya women]...raise other domestic animals, and let the deer suck their breasts, by which means they raise them

and make them so tame that they never will go into the woods, although they take them and carry them through the woods and raise them there. (Landa, Tozzer 1941:127).

There are deer that are brown, larger than great sheep; there are great numbers of them, and the Indians nearly live by hunting them habitually; and in some years there is deer pestilence from which they die in large numbers and one finds very few of them (Relacion de la Ciudad de Merida, RY I:63).

Class III.B.:

There are many of these [deer] in these lands...that sustain not only many people, but also many animals such as tigers, lions and snakes...it is a great festival, when these Indians go out to collect them with their dogs alongside them, and they confine them to one place or river, or lake, where they are shot, and they gather them to their heart's content. Tame ones are also raised as in Spain, and they are often domesticated (Ximenez, 1967:56-57).

Mazama americana - Brocket deer, Spanish cabra, cabra montes=goat, mountain goat; gamo corzo; corco cabra; Maya yuc (Rel. de...Merida, RY I:63), ah yuc (Murie 1935).

Class I.A.: The deer shown caught in a pitfall trap on page 92 of the Codex Tro-Cortesianus has been identified as a Yucatan brocket (Tozzer and Allen 1910:Pl.30).

Class II:

There are gamos as well, many of them...and they are in form and appearance like those of Spain; and in taste, they are like the deer [ciervos], as good or better than those of Spain (Oviedo, Sumario 1950:151).

Class III.A.:

> There are wild goats [_cabra montes_] that the Indians call _yuc_ that have no more than two horns like goats and are not as large as the deer, who have many branches to their horns (Relacion de la Cuidad de Merida, RY I:63).
> For subsistence they have...fallow or roe deer [_corcos cabras_]... (Relacion de Cinanche, RY I:139-140).

> There are...small [deer]...they call _yuc_ which in our language means goat, and so they appear, because the horns and size are like that of goats, except for the color, which is like ashes (Relacion del Pueblo de Mama, RY I:170).

> There is a certain kind of little wild goats, small and very active and of darkish color (Landa, Tozzer 1941:203-204).

In a footnote (note 1134), Tozzer states that

> These are undoubtedly brockets (_Mazama pandora_) which live in thickets...(Tozzer 1941:204).

The confusion of the brocket with a species of goat appears to have been both linguistic, as noted in the _Relacion de Mama_ (above), and physical, the latter based upon characteristics of the horns (_Relacion de Merida_), which in the brocket were regarded as more closely resembling those of a goat than the antlers of a deer.

2. Fabulous Beasts and Monsters

The early Spanish accounts contain a number of descriptions of animals and monsters whose existence has never been verified. Such creatures turn up with regularity in prehistoric Maya art, as well as in the glyphic inscriptions and codices (Robiscek and Hales 1981, Tozzer and Allen 1910), and appear to have figured importantly in Maya mythology and religion (Thompson 1970). In addition, the usual anthropomorphized animals appear as characters in Maya folktales (Edmonson 1985), as they do in the folk literature of all native American groups.

It is easy to dismiss these fanciful species as flights of imagination; however, descriptions of monsters and other undocumented species do possess value for the ethnohistorian, apart from their testimony to the occurrence of mythical animals and monsters in native Maya literature, as well as in prehistoric Maya art. Descriptions of fanciful species are of value to the ethnohistorian for clues they may provide, both to the contemporaneity of various accounts, and to the reliance of any particular writer upon the works of earlier writers.

Woodrow Borah, in a recent essay devoted to problems in evaluating ethnohistoric resources available for Mesoamerica (Borah 1984), noted the fact that in the sixteenth century, and indeed in most centuries up to the Enlightenment, scholars routinely borrowed or copied verbatim from existing writings, usually without attribution (Borah 1984:29). The degree to which a given work may represent what we would now regard as plagiarism of earlier works may, in some instances, be revealed through verbatim accounts, or highly similar descriptions, of fabulous animals discussed by other writers. Examination of ethnohistoric documents for passages duplicating other writers' descriptions of mythic beasts or monsters may perhaps provide us with a means of testing a particular work for its degree of reliance upon earlier sources, as well as for the author's propensity to repeat secondhand descriptions. At the very least, repetition of such information can provide ethnohistorians with some clues as to which written sources were known to a particular author, as well as to the degree to which he may have copied from these sources in his own account, as opposed to relying primarily upon firsthand experience or informants.

There is also another dimension to these monster stories, related to the fact that monster stories in general, from dragon tales to allegedly eyewitness accounts of the Loch Ness serpent, usually have some basis in objective fact. The chief difficulty in interpreting such accounts lies in developing criteria for separating fact from rumor or invention, and this is frequently impossible to accomplish in the absence of better contemporary records than those available to us for the Maya of the Conquest period.

It is often clear that fabulous beasts are simply the result of combining the attributes of two or more natural species, a very common phenomenon in folk literature. Such composite creatures abound in the pre-Columbian codices, as well as in Maya artistic representations on ceramic vessels, in the illustrative material accompanying glyphic inscriptions on public monuments, and in the glyphs themselves (Proskouriakoff 1968).

It should also be borne in mind that some of the faunal species encountered by the first Europeans to visit the New World were, in reality, sufficiently remarkable that descriptions of river monsters and two-headed snakes would not have strained the credulity of those who had observed some of the more impressive species inhabiting the Americas. This is apparent in the tone of wonderment found in even the more objective accounts of such fearsome species as the fer-de-lance, and other noxious denizens of the Mesoamerican rainforests:

> There is a kind of snake that the natives call taxinchan, of the length of three tercias, which moves by thrusting its head into the ground and giving a leap, and by the force of these leaps it proceeds; its back and head are gilded, and the point of its tail; it breeds in the woods, and when it stings someone it causes blood to burst forth from all the pores of the body, which appears to sweat blood, and if no remedy is known or undertaken, death will occur within a day...(Relacion de la Ciudad de Merida, RY I:66).

In view of the conquerors' experiences with creatures such as the taxinchan, it is not surprising that they would have believed in the actual presence of such animals as those described below.

Among the zoological oddities found in the Maya ethnohistoric literature is the Ecatepeque river monster, vividly described by Herrera y Tordesillas, who states that near the town of Ecatepeque are

> ...two little hills, so full of several sorts of snakes, that the Indians dare not go up to them, and not far from them...a great ridge of mountains,...and at the foot of them runs a river, that breeds much fish. Above thirty Indians of Acatepeque going to fish there one very moonlight night, as they were talking, heard loud hissing near them, and saw a creature looking at them with eyes like fire ...they could see it was a sort of snake, having feet about a span long, and a kind of wings above, the creature about as long as a horse, and mov'd very slowly, for fear of which they never return'ed thither any more (Herrera, Stevens 1752, V.I:192).

Herrera adds that three of them saw it again as they crossed the river, and one died of fright. The identical tale appears in Espinosa (Compendium:212-213, #599).

Other undocumented species clearly resulting from confusion of the traits of several species, and their amalgamation into a single form, include the striped primate that allegedly hid in the water and attacked humans, described by Espinosa (Compendium: 207, #584).

The esoteric literature of the northern Maya (e.g., the books of Chilam Balam, the Ritual of the Bacabs) abounds in fabulous creatures, some of which appear to personify the ubiquitous puns so characteristic of Maya languages, while others form the bases of riddles. As such, their significance can be very difficult to determine. Some examples include the Bob-och, a mythical beast that destroys crops (Roys 1967:155, 166), and is also invoked in rituals for curing (Roys 1965:130).

Possibly this was an animal combining attributes of the jaguar (bobilche) and the oppossum (och), although there is no direct evidence available to demonstrate this.

3. REFERENCES TO POSSIBLE TABOO SPECIES IN THE ETHNOHISTORIC LITERATURE

The presence of "taboo" species among the Maya is problematical; however, there are some indications in certain documentary sources suggesting restrictions on the uses of certain species, as attested by the following examples.

In the final part of the Popul Vuh, the storm god Tohil gives instructions to his worshippers and sacrificers, in a somewhat obscure passage referring to hunting, which has been interpreted as a command that certain animals were to be reserved for the gods, and were therefore not to be hunted for human use. The two kinds of animals specifically mentioned are deer and birds (Edmonson 1971:186, n. 6203).

During his march to Honduras in 1524-25, Cortes and his army encountered what may have been "sacred" deer preserved in game parks. These deer were apparently "taboo" animals, since their hunting was strictly prohibited by the Maya.

> On asking the guides...why the deer ran so little, and why they were not frightened at the horses...they replied that in those pueblos, which I have already said they call the Mazatecas (i.e., the land of the deer), they are considered to be gods, because gods

> have appeared in their shape, and their idol has commanded them not to kill or frighten them, and they have not done so, and this is the reason why they do not run away (Diaz del Castillo, Maudslay 1908-16,V.1:31).

The same episode is described in Means (1917:30), who cites the account given by Villagutierre Soto-Mayor (1933:40; 1983:36). The term Mazatecas used in this account is of Nahua derivation, meaning literally "deer people" (a known tribal name), so this may possibly be a totemic reference (David Kelley, personal communication 1986).

The gods referred to as appearing in the shape of deer were perhaps the zip, described in ethnographic accounts of the Maya (see Chapter II, above). However, it is equally possible that the injunction against their hunting, together with the practice of keeping them together in a protected area, reflect the instructions of Tohil given to the Quiche in the Popol Vuh, as described above.

It is most unlikely that the "taboo" on deer hunting was generally applied to the species as a whole, as has been suggested by Wood (Villagutierre Soto-Mayor, Wood 1983:36,n.152). There is ample archaeological evidence to the contrary, indicating that deer was one of the most important food species in Maya diets in pre-Conquest times, and possibly the one often consumed in greatest quantities during the Early to Middle Classic period by mainland Maya populations (Wing 1981). The injunction of

Tohil specifically mentions "the young of deer, the young of birds" as those that are to be reserved for offerings to the gods (Edmonson 1971:186), and this would be consistent with the practice of capturing and taming young deer, and rearing them in protected preserves in preparation for their eventual sacrifice, which is what appears to be described in the accounts of the "tame" deer encountered by Cortes' army. The domestication of turkeys, the avian species most often sacrificed, may also have been attributed to the instructions of Tohil, as recorded in the traditional sacred book of the Quiche.

D. ANIMAL PROCUREMENT TECHNIQUES AND IMPLEMENTS DESCRIBED IN THE ETHNOHISTORIC LITERATURE

1. <u>Hunting Techniques and Artifacts</u>

The techniques and artifacts of animal procurement utilized by the Maya are frequently described and illustrated in ethnohistoric materials, including the native documents, where hunting and its associated apparatus were of sufficient importance to merit frequent mention.

<u>Atlatl</u> (spear-thrower)

Class I Sources: In the Dresden Codex (Codex Dresden 1962:60A, 60C), an atlatl is portrayed. Similar implements occur in the Venus pages of the Dresden, and in the Madrid Codex as well.

The dwarf depicted on the Actun Balam ceremonial vase, recovered from a cave in Belize by Pendergast (see below, and Pendergast 1969), appears to be holding an atlatl (Pendergast 1969:45-46). Spear-throwers are also depicted on a stela at Tikal, and shown as war weapons in sculptures found at Chichen Itza.

Class III.A. Landa reports that the Yucatecans

> ... had a certain method of throwing darts by means of a piece of wood about three fingers thick, pierced to about the third of its length, and six palms long and with this and with cords they threw with force and accuracy (Tozzer 1941:31-32).

Tozzer points out that specimens of this tool have been recovered from the sacrificial _cenote_ at Chichen Itza, indicating its use until fairly recent times.

Bird line (Spanish _cuerda de liga_)

Class I: _The Annals of the Cakchiquels_ make reference to "the cord (to catch birds..." (Recinos and Goetz 1953:66).

Blowgun (Spanish _cerbatana_, Maya _Dzonche_)

Class I.B: The use of the blowgun by the Hero Twins is described in the _Popol Vuh_:

> 1 Hunter aimed the blowgun pellet [at 7 Parrot], so that it would hit his mouth, so that it would break his jaw (Edmonson 1971:37-38).

Although this scene is described in terms of a bird hunt, the quarry was an anthropomorphized being. In other parts of the _Popol Vuh_, blowgun hunting or practising blowgun shooting appear to be construed as recreational activities, sometimes practised by the Hero Twins at times when they were supposed to be engaged in the more serious business of farming:

> '...Because we have our blowguns, if there are birds we'll be shooting,' they said then, rejoicing at being able to practice their shooting (Edmonson 1971:55);

and when the twins asked the dove to

> Just watch for our grandmother..., call out immediately when she comes along, so that we can grab the hoe and the axe,

it was because

> ...it was just blowgun shooting they were doing; it wasn't really farming...(Edmonson 1971:95).

Robiscek and Hales (1981), in their description of a series of ceremonial ceramic vessels painted in codex style depicting scenes of hunting with the blowgun, suggest that at least one of these scenes represents one of the Hero Twins (Hunahpu) hunting birds with the blowgun, since one of the associated glyphs appears to represent his name. The scenes painted on these vessels may illustrate the action described in the Popol Vuh (see above.) The provenience of these ceremonial vases is, however, uncertain. They may be of either northern or southern origin (Robiscek and Hales 1981:95-96).

Class III.A:

> An Indian goes out with two dogs, and the barking of the dog will drive them [the prey] up a tree and the Indian brings down great numbers with a blowgun, in this way (Relacion

de Tequite, RYI:110).

> ...they use the blow gun a great deal and shoot well with it (Landa, Tozzer 1941:186).

<u>Bow</u> (Spanish <u>arco</u>; Maya <u>chulul</u>, <u>halal</u>) <u>&</u> <u>Arrow</u> (Spanish <u>flecha</u>, Maya <u>halal</u>)

Class I: Arrows appear to be among the weapons carried by a Maya hunter setting out to hunt deer in the Codex Tro-Cortesianus (18, 40, 41; pages 300,304, 306, Villacorta Calderon 1930), although these may be darts or spears.

Class II: Lopez Medel includes the bow and arrow in his discussion of birdhunting among the natives:

> Here we shall occupy ourselves in treating of the ingenuity and industry that the West Indians have for catching and hunting birds, and the most usual [way] is with the bow and arrow...(López Medel MS, n.d., Cap. 9, Pt. 1).

Class III.A: The use of the bow and arrow in hunting is described in Cogolludo's <u>Historia de Yucathan</u> (quoted in Means 1917, note p. 14):

> The Indians of this land were and are very dextrous with the bow and arrows, and so they are mighty huntsmen...They shoot with their arrows peacocks [sic], some birds they call <u>faysanes</u>...and many others.

Landa describes the bows and arrows of the Yucatan Maya in his discussion of native arms:

> Their...bows and arrows...they carried in their quivers, pointed with flints or very sharp teeth of fishes for heads, with which they shoot with great skill and force. The bows are made of a beautiful tawny wood which is remarkably strong, more straight than curved, and the cords are of their hemp. The length

> of the bow is always a little less than the height of the man who uses it. The arrows are of very slender reeds which grow in the lagoons and more than five palms in length; and they fasten to the reed a piece of thin wood, which is very strong and to this the flint is fitted (Landa, Tozzer 1941:121).

The popularity of hunting with the bow and arrow among the Yucatecans is attested in a Spanish document prohibiting the practice, and insuring its abolition by ordering that bows and arrows be burned:

> Since the Indians are always wandering the woods to hunt, I order that all bows and arrows are to be burned. But each cacique shall hold two or three dozen bows, with arrows, for special occasions, or necessity as against tigers (The Ordinances of Tomas Lopez, Of the Royal Audience of the Confines, promulgated in 1552. Reprinted in Landa, Gates 1978:159).

<u>Communal hunting</u>

Class III.A.: Landa tells us that the Yucatec Maya

> ...joined together for hunting in companies of fifty more or less...(Tozzer 1941:97).

The Relacion del Pueblo de Mama describes even larger hunting parties:

> [Deer] are hunted with bows and arrows, and on occasion a hundred Indians will go out from a town to hunt them and kill 20 or 30 (Relacion del Pueblo de Mama, RY XI:169-171).

<u>Cords</u>

Palacio described the practice of diving underwater and attaching cords to the legs of crocodiles, then hauling them to shore, as a method of crocodile hunting employed by the Maya of Guatemala in the late sixteenth century (see quotation above, under <u>Reptiles</u>).

Decoys (see also Gourd Trap, Stratagems)

Class II: Peter Martyr relates how decoys were used to hunt pigeons:

> In catching birds they use doves just as we do. They tie a tame dove in the trees, and the birds of each species which flock about it are then shot with arrows. Another way is by spreading a net in an open space, sprinkling food around about it, and placing the tame dove in the middle. The same system is used with parrots and other birds. The parrots are so stupid that, while one chatters on a tree in whose branches the bird-catcher is concealed, the others flock thither, and allow themselves to be easily caught (De Orbe Novo, v.I, MacNutt 1912:409).

Dogs

Class III.A, Northern Maya sources:

> ...and they grow dogs so that they may fetch deer, wild boar, badgers, Tigers, some little Lions, rabbits, armadillos, iguanas, and other animals (Cogolludo, Historia de Yucathan (quoted in Means 1917:14)

> ...the dogs,...in hunting...raise partridges and other birds, follow deer a great deal and some of them are great trackers. They are small and the Indians ate them... They say that they have a good taste (Landa, Tozzer 1941:203).

"Gourd Trap"

This is actually a strategem, involving a ruse which takes advantage of native knowledge of the habits of certain birds. The Annals of the Cakchiquels may refer to this practice:

Class I:

> With a gourd they made a trap to catch birds...(Recinos and Goetz 1953:67).

Class II: Although the native writer of the Annals did ~~not~~ describe the details of this "trap" or its use, Peter Martyr provided a description in elaborate detail of a technique used to capture water birds, which may be the same device used by the Cakchiquels:

> We have elsewhere related that the natives cultivate a tree in their gardens, whose fruit resembles a large gourd. The natives throw a large quantity of these gourds into the ponds, after having carefully stopped up the holes by which water is introduced... to prevent their sinking. These gourds, floating about on the water, inspire the birds with confidence; the hunter then covers his head with a sort of cask made of a gourd, one in which there are little holes for his eyes, like a mask. He wades into the water up to his chin...As the birds find the gourd which conceals the hunter similar to all the others floating about, the man is able to approach the flock. Imitating with his head the movements of the floating gourd, he follows the little waves...and gradually approaches the birds. Stretching out his right hand he seizes a bird by the foot, and without being seen, quickly jerks it under the water and thrusts it into a bag he carries. The other birds imagining their companion has dived in search of food...fearlessly continue their movements, and in their turns become victims of the hunter (Peter Martyr D'Anghiera, De Orbe Novo, the Third Decade, V.I, 1912:410).

<u>Nets</u>

Class II: Lopez Medel describes several kinds of nets used for hunting birds:

> At other times, for some kinds of birds, they use some nets that they put on the trees, in order to catch them; other times they have a large net that they stretch up in the air with some tall poles...(Lopez Medel MS, n.d., Cap. 9, Pt. 1).

Class III.B.: Diaz del Castillo describes the use of nets to catch deer in Chiapas, in connection with an adaptation of this technique to warfare:

> [The Indians used] ropes...to cast lassos over the horses and tie them so as to pull them over, and on all sides they had stretched many nets such as they use for catching deer... (Maudslay 1908-1916, V.1:297).

Spear, Lance: Spanish *lanza*, Maya ?

Class I sources: Large spears are among the weapons carried by the deer hunters depicted in the Codex Tro-Cortesianus (38, page 300 in Villacorta Calderon 1930), and actually employed to cut a deer in half in the same manuscript (39, ibid., p.302). Although Villacorte-Calderon refers to the weapon used here as an arrow (*flecha*), the object depicted is far too large and elaborate to be an arrow (which obviously could not have accomplished the task depicted), suggesting rather a good-sized sword with a decorated hilt (Codex, p.39, page 302 in Villacorte Calderon). A similar weapon is shown plunged through the torso of a dead jaguar in the Dresden Codex (Codex Dresden, Forstemann facsimile, 1962:26). Both of these appear to resemble swords, i.e., weapons used in battle, rather than implements of the chase.

Class III.A.: Landa states that the Maya

> ...used also small lances an *estado* [i.e., the height of a man, about 1.85 yards; see Tozzer 1941:121,n.553] in length, with the head made of a very hard flint... (Tozzer 1941:121).

Tozzer commented that this kind of flint-pointed lance may be depicted in the Codex Tro-Cortesianus (50, 51), possibly thrown with an atlatl (Tozzer 1941:n.554).

Stratagems (See also Decoys, Gourd Trap)

Class I: In the section of the Codex Tro-Cortesianus devoted to hunting, there is an apparent representation of a hunter hidden under a deerskin, taking advantage of this disguise to plunge a huge sword through the body of a deer, literally cutting it in two; this interpretation is offered by Villacorte Calderon (1930:303) for this scene, which may possibly have a symbolic rather than a literal meaning.

Class II: Oviedo describes how the Indians made use of bird calls in hunting.

> [Partridges] are caught as follows: the Indian catches a lock of hair above his forehead...and pulls it and then loosens it, ...and with his mouth he makes a whistling sound like that made by partridges. The birds are attracted by this call and fall into the traps...(Stoudemire 1959:67).

Unfortunately, the use of the pulled-out hair in this enterprise is not made clear; Oviedo specifically states that the traps used were made from henequen fiber (see below).

Traps

Class II: Oviedo mentions that the traps used by the Indians to catch birds were "made of henequen fibre", but does not further describe them (Stoudemire 1959:67).

1. Birdlime traps: Although this technique seems to be referred to in the Popol Vuh, it is uncertain whether it

was employed by the Maya in aboriginal times (Edmonson 1971:54,n.1554). It was described by Miranda in a late sixteenth-century relacion of the Province of Verapaz (Miranda 1954:350) as a native method then in use for capturing birds to pluck their feathers, which were sold and used to make fans. The particular species of bird he describes as being caught using this technique is unclear. Miranda gives it no name other than pajaro de las plumas, which suggests the quetzal; however, his description of it more closely fits the green parrot (Miranda 1954:349). He describes the procedure, rather unclearly, as follows:

> The manner of hunting them is with twigs or cords with birdlime, which they put in their drinking water or in the trees where the bird gets its food, which is a fruit known to the Indians...Other times they wait for them to return to their nests and gather them inside it and pluck the feathers of the whole body and tail, save those of the wings...(Miranda 1954:350).

2. Cage traps: Class I: This type of trap, used often to catch birds, appears in the Maya codices. The Tro-Cortesianus shows an ocellated turkey in such a trap (page 93; reproduced in Tozzer and Allen, Plate 16). An illustrated description of this type of trap, which was still in use among the Maya in the 1940's, may be found in Steggerda (1944:270, Plate 1(a), and 271). Steggerda reports it is used by the modern Maya to capture small song birds.

3. <u>Deadfall</u> <u>traps:</u> A trap of this type, used to kill small rodents such as rats and mice, is described by Steggerda (1944: Plate 1(d)), who observed its use by the modern Maya. It is a baited trap, utilizing a large flat stone that falls on the animal when the bait is taken, and is apparently a device long in use.

4. <u>Pitfall</u> <u>traps</u>:

Class I sources: This type of trap is clearly illustrated in the Codex Tro-Cortesianus, where a nine-banded armadillo is shown caught in such a trap in at least two instances (Codex 48, 91). On page 92 of the same codex, a brocket deer is shown apparently impaled on a spike of some sort, which appears to be located inside a pitfall trap (Codex 92; Tozzer and Allen 1910:pl. 30.1).

The modern Maya combine the pitfall principle with that of the snare or noose in a complex trap for capturing raccoons and other small animals (Steggerda 1944:Plate 1 (c)). A ditch, dug in the animal's usual path, is concealed with grass and branches, and bait is placed inside the noose.

5. <u>Snare</u> <u>traps</u> (i.e., nooses) (Maya <u>pehtz</u>, from Cholti vocabulary of Father Moran, quoted in Noyes's <u>relacion</u> on Ponce (Noyes 1932:309,n.27), was probably like the Spanish <u>armadijo</u>, a small trap or snare for catching game.

Class I.A: The Maya codices would seem to indicate that snare-traps were used to capture a variety of game animals, including the deer, the ocellated turkey, and the peccary (Codex Tro-Cortesianus, in Villacorta Calderon 1930:48, 49, 93).

Class I.B: Snares were employed for trapping by the Quiches, as is apparent from their native literature:

> They took their...snares to hunt birds... Then they stretched the traps on the trees and they caught the quail in them...they brought the quail in the snares...offering them (Annals of the Cakchiquels, Recinos and Goetz 1953:68).

Class III.A: The northern Maya, according to Landa, "used traps and snares, by means of which they took a great deal of game" (Landa, Tozzer 1941:31).

Steggerda (1944) illustrates and describes traps of the snare type, specifically designed to catch large birds, such as turkeys and chachalacas, and others for capturing the paca alive, and for killing small mammals.

6. Underground traps: Steggerda illustrates two of these recently in use by the Maya, both utilizing the snare, or noose. One is a "mole trap" for catching gophers, which is placed underground in the animal's path. This is undoubtedly the type of trap described in the *Relacion del Pueblo de Mama* (Class III.A):

> There are other animals the Indians call *baas*, which resemble a large mouse [i.e., gophers]; they breed and live underground and sustain themselves by eating roots. They catch them with snares at the outlets of their holes, and they are very good food for the Indians (RY I:171).

The other trap Steggerda describes is set in front of the iguana's rocky den, catching the animal in a noose as it leaves its lair, in the same manner as the gopher.

2. FISHING: METHODS AND ARTIFACTS

Boats, canoes

These are variously called canoes, dugouts, and barks.

Class I: The Cronica de Calkini mentions that a member of the elite, one Ah Kin Canul, kept "four barks in which his slaves went fishing" (Calkini 1957:111).

Class II: Oviedo describes native fishing in boats:

> Since these fish, [sic; he is here referring to the manatee] and many others too, often swim on the surface of the water, they are killed by bowmen in dugouts and boats (Oviedo, Stoudemire transl. 1959:113).

Bow and arrow:

Class II: Oviedo (above) has described killing fish and manatee with the bow and arrow from boats.

Class III.A:

Landa recorded that the bow and arrow were used for fishing as well as for hunting by the Yucatan Maya, apparently by those who were casual fishermen rather than specialists, and who therefore lacked conventional fishing gear.

> There are fish not only in the lagoon, but the abundance of fish on the coast is such that the Indians almost do not bother about those of the lagoon, unless it is those who have no apparatus of nets, who are accustomed to kill great numbers of fish with the arrow as there is little water...(Tozzer 1941: 189-190).

Landa also described how the Maya hunted the stingray with the bow and arrow:

There is another fish on this coast,... broad and round and good to eat, but very dangerous to kill...since it also does not know how to go into deep water, and likes to go into the mud where the Indians kill it with bow and arrows...(Landa, Tozzer 1941: 191; see also quotation in species list under Rajiformes).

Harpoon:

Class II: In addition to describing the use of harpoons for tuna fishing (see p. 114 above), Oviedo tells of capturing manatee from a dugout canoe, using the harpoon:

> When such a fish is sighted, the Indians shoot it with a heavy arrow to which is tied a thin strong cord which has been tarred. Then the fish swims away rapidly and the bowman plays out many yards of the cord, to the end of which is tied a cork or stick. As the fish grows weaker, ...[it] turns toward the shore. The bowman begins to pull in his cord, and when he has pulled in all but a few yards, he draws the cord toward the shore and the manatee finally touches bottom. Then the waves help the fisherman to land the manatee. And the bowman and those who help him drag the manatee up on the shore (Oviedo, Stoudemire 1959:113).

Class III.A.: Landa also described how the Yucatec Maya used the harpoon to catch manatee:

> The Indians kill them with harpoons in this way--they seek them in the tidal creeks and shallow waters (for it is not a fish which knows how to go into deep water) and they carry harpoons tied to ropes with buoys at the end. When they have found them, they harpoon them and throw loose their ~~ropes~~ and buoys, and the sea-cows, from the pain of their wounds, fly to all parts of the low and shallow water, but never go to the deeps of the sea, nor do they know how to do so. And as they are so large and full of blood, they go about disturbing the mud, and they bleed very freely. And so by the traces in the mud, the Indians follow them in their little boats

> and afterwards find them by means of their buoys and pull them out. This catch gives great sport and profit for these are all flesh and fat (Tozzer 1941:191).

Class III.B: On their way to Honduras, the Cortes party participated in fishing with a harpoon and net for "crocodile fish" (possibly the halfbeak?):

> In...[an aguada] there are some large fish about a yard long, called crocodile fish, which taste good, but they will not strike at a fishhook and can be caught only with harpoons and nets, as some of the Indians and our soldiers got them (Villegutierre Soto-Mayor 1983:189).

<u>Hook</u> <u>and</u> <u>line</u>:

Class III.A.: Hooks used for fishing are mentioned by Landa (Tozzer 1941:156).

<u>Nets:</u>

<u>Dip</u> <u>nets:</u> One of these has been identified on a stela at Izapa (Norman 1976:86, 87). David Kelley has also published a representation of a creel containing fish, engraved on a carved bone from Tikal (Kelley 1976:235, Fig. 80, MT 38D).

<u>Drag</u> <u>nets</u>: Class II: Oviedo mentions the use of these in turtling, as one method of capturing the very large sea turtles such as the one he saw at Acla (Stoudemire 1959:111; see quotation above), although this was apparently a less frequent method than that of simply rendering the turtles immobile by turning them on their backs.

<u>Trammel</u> <u>nets</u>: These are referred to by Landa (Tozzer 1941:156), used by fishermen during ritual fishing

following the annual ceremonies in the month of Zip.

Net sinkers: These appear to have been made from stone and from potsherds by the historic Maya (Gann 1918, Thompson 1930); however, no mention of them was found in the ethnohistoric literature.

Poison:

Class III.B. In the Recordacion Florida, Fuentes y Guzman describes the use of barbasco, a poison made from the root of the toxic Jacquinia armilaris, an evergreen bush, to kill fish:

> There are commonly collected large amounts [of fish] from the abundant and profitable assemblages in these healthful and useful waters, by fishing both for profit and entertainment for a variety of tasty fish, by dint of the poisonous and deadly barbascos, which are procured in abundance...these kinds of roots or [those of] the soap root (amole), bred and fortified by nature with toxic qualities, are mixed for greater potency and effectiveness with quicklime...And this kind of fishing with barbasco is not preferred to that with the cast net (atarraya) or the harpoon, for liveliness and entertainment and lively gyrating in the waters; and therefore, with this industry of the barbascos, are procured for this part of Goathemala bobos (?), tepemechines (a kind of trout), mojarras (perch), anguilas (eels) and espinosos (sticklebacks, spiny fishes), and other species desired by and pleasing to the strongest and most discriminating appetites... (Fuentes y Guzman 1932, v.I:311-312).

The author goes on to discuss the market value of some of these species. He appears to be saying that poison was used for commercial fishing only, while more conventional methods utilizing hook, net or harpoon were preferred for sport fishing.

E. HUNTING AND FISHING RITUALS AND ANIMAL SACRIFICE IN THE ETHNOHISTORIC LITERATURE

1. The Ritual Sacrifice of Animals

The ritual sacrifice of animals, like that of humans, was an integral observance of native Maya religion, and one that has persisted into the twentieth century.

Although many species were utilized for this purpose, dogs, deer and birds seem to have been especially favored as sacrificial offerings. Deer meat was a frequent offering, dressed and cooked for consumption by the gods (or rather, by their earthly representatives, the priests). Conventional offerings to the four directions normally included deer, turkey, fish and iguana. Although dogs were sacrificed, they do not seem to appear as food offerings in the Maya codices.

Class I.A.: The haunch of venison appears as a sacrificial offering in the codices, and is also incorporated as an element in the hieroglyphic script (Dresden Codex 35, Forstemann facsimile; Tozzer and Allen 1910:Pl.31).

The dog appears as a sacrificial animal in the Dresden Codex (p.30; also see Tozzer and Allen 1910:36, Pl.37(9)).

Class III.A.: The Relacion de Tahzib, dated 1580, describes information on sacrifice in earlier times obtained from Indian informants, who stated that at Tahzib, originally called Hunpiczib,

> ...in the time of their heathendom there was an idol made of clay in the form of a woman...This idol was worshipped and called Hunpichib, and they customarily offered it bread and chickens and cooked venison, and prayers were offered to it by the priest...(Relacion de Tahzib, RY I:186-187).

The Relaciones de Yucatan also described offerings of the "blood of men, birds and animals", and during major festivals the sacrifice of "men, women and children", offered for good luck in hunting and fishing, among other objectives (Relacion de Mutul, RY I:79).

In testimony regarding idolatrous practices at Sotuta and Homun, dogs were stated to be the most common sacrificial victims next to humans. It is perhaps significant that they were also sacrificed in the same manner as humans, with the heart excised, and the blood smeared on the faces of the idols. The dog's body was often cooked and eaten following the ceremony (testimony quoted in Tozzer 1941:114-115, n.528).

In another document, the native practise of sacrificing animals, as well as the associated rites, are described in the course of a series of ordinances declaring such activities illegal. This document, emanating from the Royal Audiencia in Guatemala upon request by the Spanish friars of Yucatan to grant them the power to prohibit a number of native practices they considered undesirable, interdicted the sacrifice of animals, as well as bloodletting or burning incense in connection with any native (i.e., non-Christian) rite.

> No baptised person shall possess idols, sacrifice any animals, draw blood by piercing their ears or noses, nor perform any rite, nor burn incense thereto, or fast in worship of their false idols (The Ordinances of Tomas Lopez...1552; In Landa, Gates 1978:157).

Class III.B: In a letter to Hernando Cortes dated 1524, Pedro de Alvarado described the sacrifice of a dog in a Guatemalan town:

> ...and when I was entering the town I saw certain Indians cutting a dog in quarters in the manner of a sacrifice...(quoted in Feldman 1974:10).

Animals were also routinely presented as secular offerings to Maya rulers, a practice similar to that of the later tributary offerings required by the Spanish overlords. Offerings of fish and birds were common.

Class I.B.: The Titulo de los Indios de Santa Clara de Laguna mentions offerings of fish and crayfish made to the local lord (Recinos 1957:175), and further states

> ...they paid honor to Senor Quicab, presenting to him doves and quails (Recinos 1957:177).

The honorific nature of these offerings is here made clear. Among the Quiche, a variety of species, as well as artifacts employed in hunting, were used for this purpose:

> The female deer, the female birds, the game of the shooter of deer, the traps and the cord (to catch birds) were the gifts [i.e., offerings] of the people of Raxcich and

> Mipohom...(Annals of the Cakchiquels, Recinos and Goetz 1953:66).

> Oh Lord, I will give you the meat of the deer and honey, I who am a hunter, who own the honey...(Recinos and Goetz 1953:68).

Class III.B: Animal blood sacrifice was reported among the Lacandon Maya of Chiapas and Guatemala, in a firsthand account written in 1695 (Tozzer 1913). Turkey blood was of great importance as a sacrificial offering among the Lacandones at this time. The usual practice was to pour the blood over sticks of pitch-pine (ocote), which were then burned. Such rites were performed on a variety of occasions, including ceremonies in honor of lightning, the "feast of the cigarettes" (probably a 'first-fruits' ceremony), and the naming of a new-born child (Tozzer 1913:504-506).

2. Rituals for Hunting and Fishing

For the Maya, as for many peoples, ritual was an essential step in the food procurement process, important to the successful outcome of a hunt or fishing expedition. In addition, general ceremonies were held for hunters and fishermen at regular intervals, according to the ceremonial calendar of the sacred 260-day year.

Class I: The Actun Balam vase, described by Pendergast (1969:41-52), illustrates a ceremonial (or perhaps mythological) hunting scene involving two deer, four hunters, two priests, a woman and a dwarf. This ceremonial vessel, recovered from a cave in Belize, displays a number of unique pictorial elements, the most striking being the fact that the woman in the scene is seated astride the shoulders of one of the deer, grasping the antlers, and appears to be riding the animal. Since the vessel is now incomplete, details of the ceremony and its significance can only be guessed at. I know of no other instance of a human riding a deer in native Maya art or literary sources.

Class III.A: Landa has left us a number of descriptions of rituals performed by hunters, involving sacrifice, sometimes bloodletting by the hunters themselves, and ceremonial intoxication:

> On the next day the hunters came together in one of the houses..and brought their wives...The priests came and drove away the evil spirit...After he had been driven out they placed in the middle the apparatus for the sacrifice, incense and new fire, and the blue bitumen [i.e., the clay pigment known as "Maya blue"]. And the hunters devoutly invoked the gods of the chase,...and others, and distributed the incense which they threw into the brazier. And while it was burning, each took an arrow and the skull of a deer, which the <u>Chacs</u> anointed with the blue bitumen. And some danced, holding these thus anointed in their hands, while others pierced their ears and others their tongues, and passed through the holes seven rather wide blades of a kind of grass called <u>ac</u>. This done, the priest first, and then the officers of the festival, offered the gifts; and so dancing, the wine was poured out, and they got drunk until they were overcome (Landa, Tozzer 1941:155).

Rites for fishing were similar:

> ...on the following day the fishermen celebrated the festival in the same way as the others, except that the things which they anointed were their fishing implements, and they did not pierce their ears, but they cut

> them round the edges and they danced...When this festival was ended in the towns, the lords were accustomed to go to celebrate it with a large number of people on the shore, where they caught a large number of fish with rejoicings, for they carried a large supply of trammel nets, hooks and other instruments for fishing (Landa, Tozzer 1941:155-156).

Cogolludo wrote of a fishing rite in the province of Tizimin:

> It is also said of the Indians of the province of Tizimin, that before they go fishing along the coast of Choaca, before beginning to fish they first have their sacrifices, and offerings to their false gods, offering them candles, reales of silver, and cuzcas, which are their emeralds, and precious stones in particular places, Kues [temples], and places of sacrifice, which can still be seen on the arms of the sea, and the salt lagoons, that are on this coast near the Rio de Lagartos (Cogolludo 1955, v.I:335).

The remains of what may have been fishermen's shrines are still visible in some places along the Yucatan coast.

Class III.B: Diego Garcia de Palacio, in his 1576 letter to the Spanish king describing the native customs of the Maya of Guatemala, has left us an extraordinarily detailed description of one of these rituals:

> We come now to their sacrifices for hunting and fishing. They took a living deer to the courtyard of the cue or temple...where they strangled and skinned him, collecting all his blood in a vase, and cutting in small pieces the liver, lungs and stomach. These were put aside, with the heart, head, and feet. They next cut up and cooked the deer by itself, and the blood by itself, and while these were cooking they had their dances. Next the high priest and his assistant took the head by the ears, and each of the four priests one of the feet, and the mayordomo put the heart in a brazier and burned it, with copal and rubber, as incense to the idol of the god who was held to be protector of hunting and fishing. When the dance was finished, the head and feet were

scorched in the fire before the idol, as an offering, and afterwards taken to the house of the high priest and eaten. The flesh and blood were then eaten before the idol; and the same was done with all the animals which they offered in sacrifice. When they sacrificed fish, the entrails were burnt before the idol (Diego Garcia de Palacio, Extracts from a letter sent to the King of Spain, 1576; quoted in Feldman 1974:24-25).

F. METHODS OF COOKING AND PRESERVING FISH AND GAME DESCRIBED IN THE ETHNOHISTORIC LITERATURE

1. Preservation Techniques

The extreme temperatures and humidity of the regions inhabited by the Maya necessitated the development of techniques for preserving animal foods, not only those that were to be transported over long distances in trade, but also those intended for short-term storage pending redistribution. Several methods are described in the literature.

Drying:

Class II: Drying was used as a method of preserving the abundant flesh of the manatee, according to Oviedo, who says that this meat tasted like the best veal, and was especially good when dried (Stoudemire 1959:113).

Class III.A.: Landa mentions drying, as well as salting, as methods of preservation used by Yucatan Maya who were enagaged in fishing as a commercial enterprise, to prepare it for long distance trade:

> ...others pursue their fisheries on a very large scale, by which they eat and sell fish to all the country. They are accustomed to ...dry it in the sun without salt...(Landa,

Tozzer 1941:190).

> The Indians more than any people in the world are inclined to barter, sell and trade things. Their dugouts go from one place to another, and they carry salt where it is needed, and in exchange they receive ...fish, or other things (Oviedo, Stoudemire 1959:105-106).

Salting:

Class III.A.: Salting, as well as drying, was one of the techniques favored for preservation by the commercial fishermen of Yucatan. Landa reports that the particular method selected was determined by the variety of fish that was to be preserved:

> They are accustomed to salt the fish, to roast it and to dry it in the sun without salt and they take into account which of these methods each kind of fish requires, and the roasted keeps for days, and is taken twenty or thirty leagues for sale, and for eating it they cook it again, and it is well flavored and sound (Tozzer 1941:190).

> They kill some very large fish, which look like devil fish, and they cut [it] in pieces and put in salt (Tozzer 1941:190).

During his 1519 entrada into the town of Nato in the Province of Coiba, Gaspar de Espinoza found, in the course of looting local native storehouses for supplies,

> about three hundred deer carcasses, rather more than less, dried and salted (en cecina), and the finest meat to eat that has ever been known (quoted in Sauer 1966:274).

Although this area lies far to the south of the Maya region, on the Isthmus of Panama, and outside the Mesoamerican culture area per se, the fauna utilized here seems to have been basically the same as that exploited by the Maya, and the deer of Panama are of the same species as those of Yucatan and Guatemala (Odocoileus virginianus). It is quite possible that deer carcasses may have been preserved by the Maya in a similar fashion, and even similarly "warehoused" for redistribution.

Ximenez refers to the practice of drying and salting the meat of very large turtles "just as if it were beef" (Ximenez 1967:212), suggesting these may have been preserved in the same manner as the deer of Coiba, and possibly for similar purposes.

The drying and salting of insects for trade in Panama, as described by Peter Martyr, has been mentioned above (see species list, Insecta).

A preservation technique combining drying and salting was observed among twentieth century Maya by Benedict and Steggerda, during the course of their dietary study of the modern Yucatan Maya in the 1930's (Benedict and Steggerda 1936). Their report described a method in which meat to be preserved was cut into strips, thoroughly salted, and left for a day, then broiled over a fire, and subsequently hung from the ceiling to dry. This method was said to preserve the meat for several weeks, and may well represent a practice dating to prehistoric times.

Smoking:

Fuentes y Guzman briefly referred to smoking, as well as sun-drying, the meat of the manatee in order to preserve it for long periods of time in Colonial Guatemala (Fuentes y Guzman 1933, V.2:329-330).

2. Methods of Preparing Animal Foods for Human Consumption

In addition to data concerning the preparation of animal carcasses for transportation to the location of consumption, some information has survived on ways in which carcasses were butchered, cleaned and cooked. Some of this information is described from ritual contexts, such as García de Palacio's detailed account of the treatment accorded the sacrificial deer (see above), while in other instances the preparations were more utilitarian.

Class I.A: In the Codex Tro-Cortesianus, the body of a hunted animal is carefully tied up with cord, presumably in preparation for transport (Codex p. 40; pp. 304-305 in Villacorta Calderon 1930). The manner in which this is done strongly recalls the stylized depictions of bound animals, or animal heads, appearing in the "capture" glyphs of the Maya hieroglyphic script (e.g., T684; Kelley 1976:45, 219-221), as do the many representations of animals caught in snares that appear in the codices (e.g., Codex Tro-Cortesianus, Villacorte Calderon 1930:44, 48, 49).

Class III.A: Landa described how the Yucatan Maya cooked deer carcasses, in preparation for their presentation as tribute to the local ruler, and for redistribution among themselves:

...they roast the flesh of the deer on

> gridirons, so that it shall not be wasted, and when they reach the town, they make their presents to their lord and distribute the rest as among friends. And they do the same in fishing (Tozzer 1941:97).

Class III.B. Southern Maya descriptions of procurement and preparation include that of killing domestic fowl, and removal of the feathers:

> They kill them by twisting their heads, and putting a foot over them pulled (the heads) off the turkey. And later they threw them into a fire to burn off the feathers. Deplumed, they washed them and put (them) to cook (Hellmuth 1977:427, paraphrasing Valenzuela 1695).

Class I: Methods of cooking are also occasionally described in the native accounts of the Quiche Maya. In the _Popol Vuh_, the twins roast birds, quarries of their blowgun hunt, over an open fire:

> Then the sons arranged their fire, and they roasted their birds before the fire...Then they roasted the birds, and the roasting was done to a golden (brown). They were done; they dripped with grease--the birds' backs, and the odor was becoming absolutely delicious (_Popol Vuh_, Edmonson 1971:55-56).

Benedict and Steggerda (1936) found modern Yucatecans roasting small animals whole over an open fire, after first singing the hair off, scraping the body, and wrapping it in a banana leaf for baking it in the coals (Benedict and Steggerda 1936:164). Armadillo were baked in a ground oven (_pib-tah_) of hot stones in a similar manner. Both practices may possibly have prehistoric precedents.

G. DOMESTICATION AND ANIMAL MANAGMENT

There is perhaps no aspect of Maya subsistence whose description has been so neglected by the ethnohistoric writers as that of animal domestication. Although several species are described as "domesticated", often this term merely refers to the practice of taming wild animals and raising them as pets in a domestic setting, rather than the pursuit of a complete strategy for animal management that includes confinement in enclosed spaces and controlled selective breeding. Such a strategy is necessary to bring about desired physical and temperamental changes, ultimately leading to the creation of new domestic subspecies, as well as to increased animal productivity via the "Krebs effect", (Pohl 1976).

Aside from the domestic dog, who appears to have been present throughout the New World in prehistoric times, animals most frequently described as Maya "domesticates" by the early European writers are various avian species. Among these are turkeys, the curassow, and other galliform birds, as well as doves and ducks. Unfortunately, ethnohistoric writers are frustratingly vague both with respect to the manner and degree of human control, as well as to the species involved, e.g.:

> They prepare stews of vegetables and flesh of deer and of wild and tame birds, of which there are great numbers...(Landa, Tozzer 1941:91).

> They have domestic fowls, which they raise in great quantities in their houses like their hens and cocks, though they are

troublesome to raise...Some people raise doves as tame as ours and they multiply rapidly. They raise a certain kind of large white mallard ducks, which I think came to them from Peru for the plumage, and so often pluck their breasts, and they want that plumage for the embroidery of their garments. There are some birds in all respects like the partridges of Spain except that they have very long legs, although red, but they are very poor eating, though they are wonderfully tame, if they are raised in the house (Landa, Tozzer 1941: 201).

They raise partridges and other birds... (Tozzer 1941:203).

The mammalian species most frequently mentioned as partially domesticated is the white-tailed deer, Odocoileus virginianus. Landa's description of Maya women suckling young deer is quoted above (p. 175); Diaz del Castillo's account of the "tame" deer of the Mazatecas suggests they were kept in deer parks or game preserves:

On asking...why the deer ran so little, and why they were not frightened at the horses ...they replied that in those pueblos...they are considered to be gods,...and their idol has commanded them not to kill or frighten them, and they have not done so, and this is the reason why they do not run away (Diaz del Castillo, Maudslay 1908-16, V.1:31).

The collared peccary, another likely candidate for domestication because of its gregariousness and herding characteristics (Lewis 1970), as well as its relatively larger biomass than most other species available in the Maya regions, is not mentioned as being tamed or "domesticated". The archaeological evidence of its domestication from Cozumel, including the possible development of a new domestic subspecies on that island, has been previously discussed (see above, pp. 18-19, and Hamblin 1980). Pohl (1976) cites a report by Edwards stating that in the original, only "true" copy of Diaz del Castillo's account, from which Maudslay's translation was made, a section appeared regarding the keeping of peccaries in corrals, which was omitted from the Maudslay edition (Pohl 1976:203). Pohl also mentions a Maya folk tradition at San Antonio Rio Hondo, Belize, that peccaries were raised in pens in ancient times, as archaeological evidence indicates they may have been on Cozumel.

All in all, the ethnohistoric material on domestication, while intriguing, is largely nonspecific and circumstantial. Perhaps the best clues to the basis of animal domestication among the Maya, as well as to species involved in the process, lie in the native literature, with its references to rearing and nurturing the young of birds and deer, who are to be held in trust as future offerings to the gods (Edmonson 1971, Pohl 1976). In a paper published when the present study was nearing completion, Pohl independently reached a similar conclusion, based upon her reading of passages in the <u>Popol Vuh</u> and other ethnohistoric works (Pohl 1985:138, 140).

H. EVIDENCE FOR SPECIALIZED ANIMAL PROCUREMENT OCCUPATIONS IN ETHNOHISTORIC DOCUMENTS

There is some suggestive, although oblique, evidence of specialized occupations involved exclusively with animal procurement, suggesting that hunters, and perhaps fishermen, directed their energy entirely towards procuring animal protein resources, and did not engage in farming. In addition, there is some rather obscure information that implies hunting was probably a higher-status occupation than fishing, which was a commercial activity customarily carried out by Maya slaves as a service to their owners (Landa, Tozzer 1941:155, 156, 190).

The fact that hunters used weapons also employed by warriors, an occupation that carried a relatively high status among the Maya in the Classic period, may have contributed to enhancing the social position of specialized hunters. By the mid-Classic, hunting seems also to have become a leisure activity of the elite, as suggested in the _Popol Vuh_ and elsewhere. If such activities were carried out in game parks, it is possible that by this time hunters had also become gamekeepers, who tended the stock maintained by rulers for sport, as well as for sacrificial purposes.

The most specific mention in the ethnohistoric literature of specialized occupations involved with tending animal species concerns the practice of apiculture. Bee-keeping appears to have been an activity of considerable economic and commercial importance, since honey and wax were products involved in trade prior to the conquest, as well as in the tribute later imposed by the Spaniards. The existence of periodic rituals for beekeepers, similar to those for hunters and fishermen, testifies to the importance of this specialized enterprise (Landa, Tozzer 1941:98, 100, 193).

In Guatemala, some fifty years after the arrival of the Spanish, Miranda described bird hunters who appear to have specialized in the trapping and plucking of quetzal birds. Quetzal feathers were sold and used to manufacture fans, as well as in ceremonial clothing and ornaments for ritual use. Miranda states that the trees where the birds fed, and their sources of drinking water where the Indians placed birdlime to attract them, were the private property of certain Indians, and could be sold or inherited (Miranda 1954:350). This suggests that feather procurement and sale was an activity practised only by certain individuals, as a matter of proprietary right. If this were the case, it would constitute a highly specialized procurement occupation. Although it may have been a part-time activity, the volume of quetzal feather production, which Miranda states exceeded ten thousand large plumes per year in the province of Verapaz alone, would seem to suggest a full-time industry, though perhaps one in which relatively few people were engaged.

VI. DATA ANALYSES

A. Evaluation and Analysis of the Ethnohistoric Data

The method of sampling used to collect the material presented in Chapter V can only be called "grab" sampling. Since it was not possible to predict in advance how many sources might contain relevant information, nor which documents would be the most likely to yield such information, the search for information in the ethnohistoric literature may, like the processes involved in sampling an archaeological site, be described as sampling from an unknown universe. For this reason, and because of the relatively limited size of the database to be sampled, all documents were treated as being of potentially equal usefulness for yielding data relevant to the study.

Since the annotated summary of faunal descriptions and/or depictions presented in Chapter V represents an uncontrolled sample of species descriptions appearing in the Maya ethnohistoric literature, rather than an exhaustive list, statistical manipulations using the frequencies obtained from this sample are very likely to be invalid, especially in view of the small numbers involved, and will not be attempted.

Not all of the located descriptions of some species were recorded in Chapter V. Descriptions of animals that could not be definitely identified were not included, which accounts for the paucity of feline species descriptions. Spanish writers frequently refer to "lions and tigers" in the Maya area. Such descriptions as these were included in the sample only when it was possible to make a definite identification with species known to be present, e.g., the jaguar, ocelot, or mountain lion.

In addition, when species the Spanish writers found exotic, such as the iguana, armadillo, and manatee, elicited a superabundance of descriptions, those that were repetitive of others were not reproduced in Chapter V, and have been omitted from the analysis.

The method of sampling used in collecting the ethnohistoric data recorded here (i.e, that of using whatever sources could be located as the database, and scanning their contents for relevant information) unavoidably introduces an indeterminable amount of bias. Therefore the numerical information derived from the resulting data and presented in this chapter will be confined to attempts to identify some apparent patterns in the incidence of ethnohistoric descriptions of various orders and species. Tabulations utilizing presence/absence data, frequencies, and ranks are given; areas where these data reveal the most obvious error will be identified in the following analysis.

In interpreting Tables 1-3, it should be borne in mind that of the ethnohistoric materials examined in the course of this study, approximately 80 percent were written by Europeans, while roughly 20 percent were native documents. Given this fact, and the foregoing reservations, the following observations can be made.

1. Invertebrates tend to appear relatively rarely in ethnohistoric documents, although with greater frequency than in the archaeological record. As will be seen from the frequency table (Table 1), only three descriptions of mollusks and one of worms were found. In view of these small numbers, it is hard to evaluate the fact that all of the mollusk descriptions were by Europeans, or that the only descriptions of worms and myriopods were found in native documents.

It is likewise difficult to interpret the fact that, of 23 descriptions of insects appearing in the systematic species list in Chapter V, seven (30 percent) were in native sources. While this exceeds the proportion (20 percent) of native documents in the total sample, the fact that this is true may or may not be significant as an indicator that the Maya attached greater importance to insects than did their European contemporaries.

The greater frequency of mention by Europeans of various flies is very likely because the Europeans perceived them as pests. However, the fact that the only mention of Lepidoptera (and their grubs) appears in the native literature may be significant, since it is quite possible that caterpillars were used as food by the Maya, at least in times of resource stress, as they are by Tzeltal Maya of the present time (Hunn 1977:13).

2. The data on fishes are likewise hard to interpret. Even taking the small numbers into consideration, however, it is difficult not to attach some significance to the fact that of 20 descriptions of fishes found in the sample of ethnohistoric literature examined, only one, describing an eel, was found in a native Maya source. In contrast with this finding, however, fishes appear with great frequency in Maya hieroglyphic writing, where their symbolic significance is only beginning to be decoded (Thompson 1944; Proskouriakoff 1973; Schele 1984, 1987). What this may reveal concerning the importance of fish to the Maya, both economically and ritually, is therefore somewhat problematical.

3. The highest-ranked mammals and birds, based upon their frequency of description in ethnohistoric sources, are deer, canids, and galliform birds, which are also among those most often encountered archaeologically.

In Table 2, fauna have been assigned ranks according to the frequencies with which they are described in the ethnohistoric sample. This has been done to facilitate comparison with faunal data from a sample of Maya archaeological sites (see below).

4. Table 3 records the frequencies with which each of a number of key mammalian and reptilian/amphibian species are discussed in native Maya documents and in works by European historians. Of the total of 80

descriptions of mammals, 65 (80 percent) were in European accounts, and 15 (19 percent) in the native literature. This closely reflects the relative proportions of these two categories in the ethnohistoric sample as a whole. However, the numbers of descriptions of reptiles and amphibians are very nearly equal in native and European sources, which may indicate that reptile and amphibian species were more important to the Maya than to their European conquerers.

5. It is noteworthy that frogs and toads were described or discussed by Maya writers four times as often as they were in the European accounts. Iguanas, on the other hand, were discussed three times as often by European writers compared to native writers, which is in accordance with expectation, since the iguana was an exotic animal not previously encountered by Europeans. The same applies to the tapir, and to the armadillo.

6. Unfamiliarity may be a factor contributing to the much higher incidence of European descriptions of native dogs, since the hairless and "barkless" varieties found among the Maya were previously unknown to the Spaniards. The unfamiliarity factor may likewise be involved in the greater number of European descriptions of the brocket deer, which was confused with the goat by European authors of Conquest-period accounts because of the shape of its horns.

B. COMPARISON OF ETHNOHISTORIC AND ARCHAEOLOGICAL SAMPLES

The archaeological material used for comparative purposes in this analysis has been derived from published reports of faunal remains obtained from two northern Maya sites (Dzibilchaltun, Mayapan) and three southern lowland sites (Seibal, Cerros, Lubaantun), representing occupations from the Preclassic through Postclassic periods (Pollock and Ray 1957; Wing 1975; Wing and Steadman 1980; Pohl 1985; Carr 1985). Supplementary data on Mollusca recovered from Mayapan and Dzibilchaltun have also been incorporated (Andrews 1969). The sample of sites includes one in a coastal location (Cerros), as well as two located within a short distance of the seacoast (Dzibilchaltun, Lubaantun). All of these sites appear to have been linked with with a pan-Maya trading network, and faunal species recovered from any of them may therefore be of either local or extra-local origin.

In Table 4, faunal remains recovered from these five sites are recorded as presence/absence data; presence/absence scores have been used to derive the ranks assigned in Table 5. In Table 6, ranks for selected key mammalian, amphibian and reptilian species represented in the archaeological sample are compared with their corresponding ranks in the ethnohistoric sample.

It should be noted that the ethnohistoric ranks reflect some sampling error, as pointed out above. This becomes apparent in Table 6, where two of the species listed (peccary and opossum) show a wide discrepancy between their ranks in the archaeological and ethnohistoric samples, in the opposite direction to that we would expect, given the known biases of the Spanish writers.

The most striking difference between the faunal pattern displayed in the ethnohistoric sample (Table 2), and that encountered in the archaeological sample (see Tables 4 and 5), is the presence of invertebrate species in the ethnohistoric sample, which are missing from the archaeological record.

Because of their exotic qualities to sixteenth century Europeans, several species are, as has been noted, described by the European writers with far greater frequency than their economic importance would merit. These include the anteater, as well as the opossum, peccary, manatee, and iguana. Species of lesser interest--e.g., the gophers--are described ethnohistorically with less frequency than they appear in the archaeological record, a fact reflected in Table 6.

The archaeological data presented in these tables also reflect immeasurable amounts of various kinds of sampling bias. Most of these faunal samples were collected without benefit of such field techniques as fine-screening and flotation, reducing the likelihood that remains of very small species, such as fishes and invertebrates, are adequately represented in the assemblages. Furthermore, twentieth century Maya traditionally have collected bones from archaeological deposits for offerings to the gods (Pohl 1985:136), sometimes returning them later to their original environment--e.g., fish bones to water, deer bones to the forest (Dave Kelley, personal communication 1986). Such practices further augment the amount of sampling bias attributable to various diagenetic processes.

Aside from the distortions due to ethnohistoric sampling error mentioned above, Table 6 reveals no startling discrepancies between the incidence with which the most common mammals, reptiles and amphibians are found in the archaeological record and the ethnohistoric literature, since most species occupy the same or adjacent ranks in both samples, with the exception of the turtles and gophers. This cannot be said of smaller species, such as birds, fishes, and invertebrates, which are unlikely to survive archaeologically in representative numbers, and for this reason they have not been included in the comparative table. Such species do occur quite frequently in the ethnohistoric literature, as is apparent in Chapter V, as well as in Tables 1, 2, and 7, where their incidence may possibly provide a basis for predicting their probable archaeological occurrence in fresh, undisturbed deposits in the Maya area.

C. COMPARISON OF THE ETHNOHISTORIC SAMPLE WITH DATA FROM ETHNOLOGICAL FIELD STUDIES

In contrast with the zooarchaeological material, most of the ethnologic material used here for comparative purposes was collected more than half a century ago, when traditional Maya lifeways were far more likely to have been preserved and available to the ethnologist for study than is true at the present time.

In earlier years of this century, traditional hunting and fishing practices were still observable in some Maya folk communities (Tozzer 1907; Gann 1918; Thompson 1930; Redfield and Villa Rojas 1934). Since that time game resources have declined, both in the Yucatan (Press 1975) and in the Maya highlands (Hunn 1977; Carmack 1981; Tax 1958; Vogt 1969), where native hunting of large game species has become much less common. No doubt this is attributable in part to the systematic slaughter carried on by commercial hunters, whose unregulated game harvests are disposed of in the markets of Guatemala's commercial centers (Lewis 1970), as well as catering to the Mexican restaurant trade.

Because of these conditions, ethnographies based on field studies performed near the beginning of the present century are likely to report data more closely approximating traditional Mayan food procurement practices, and may demonstrate some degree of continuity with the prehistoric and early historic past.

The ethnological database used here for comparative purposes consists of reports of field studies that include data on Maya hunting, fishing and animal use obtained in the early 1900's. Among these are Tozzer's investigation of the Lacandon and Yucatan Maya (1907); Gann's study of the Maya of Belize (1918); Eric Thompson's somewhat later work with Maya of the same geographical area as those described by Gann (Thompson 1930); and the Redfield and Villa Rojas study of several traditional Maya communities in Yucatan (Redfield and Villa Rojas 1934; Redfield 1941).

One recent specialized ethnological study, performed by Eugene Hunn in the Chiapan highlands during the 1970's (Hunn 1977), will also be drawn upon, because of its importance as a contemporary record of traditional Maya "folk" zoological classification. While it is true that, at the time this study was carried out, many of the faunal species whose names and ethnozoological classifications Hunn recorded were no longer present in their environment, these Mayas were still familiar with these species from traditional lore and, in the case of some informants, from direct contact. Hunn's report constitutes a unique corpus of rapidly disappearing and irreplaceable information.

Hunting is mentioned as the most important subsistence activity after milpa farming in some early twentieth century Maya communities (Thompson 1930:87;

Tozzer 1907:53), and is still practised by the Tzeltal Maya, although some of the larger varieties of game have virtually disappeared (Hunn 1977:13; see also Tables 7 and 10). The animals hunted for food by the modern Maya are essentially the same as those described ethnohistorically, and whose remains have been recovered from archaeological sites. Although in recent years the supply has dwindled, such smaller mammals as rabbit, opossum, raccoon, and paca are still hunted, as noted by Hunn, who also points out that insects and larvae are gathered and eaten, as well as snails.

Beekeeping remains an important activity to the Tzeltals, and wild honey is still collected, illustrating how "animal husbandry shades into categories of hunting and gathering" (Hunn 1977:13) among present-day Maya:

> Besides wild honey, certain large larval Lepidoptera...are highly prized. Wasp larvae,... a large flying ant...various Orthoptera, and certain aquatic invertebrates such as hellgrammites (see <u>spalu ha?</u>/waterbug) and crabs...are also considered edible, as is one type of snail...Their dietary role is clearly quantitatively marginal, though they may serve as emergency rations during poor crop years, and some are used to remedy pathological conditions...(Hunn 1977:13).

The situation described by Hunn, and the resulting dietary pattern engendered by it, may well resemble that of some classes of Maya during the Late Classic, as well as in other times of resource stress throughout Maya history.

With the exception of the Mollusca, data on invertebrate species from the Maya area are very scarce. Insect remains have not been recovered from archaeological sites; pedological and climatic factors have prevented the preservation of human coprolites in which remains of any insect species consumed as food may have been present.

Mollusk shells of both marine and freshwater species, as well as of some terrestrial forms such as Pachychilus and Pomacea, are fairly abundant in many archaeological sites, but these remains have not always been reported by faunal analysts. This is perhaps due in part to the frequent recovery of mollusk shells from midden dumps. Others have been converted into artifacts, and are therefore lacking in primary contextual associations. For these reasons, the pattern and extent of Maya utilization of invertebrate species remains difficult to determine.

The Uses of Aquatic Species

It is apparent from all three categories of data considered in this analysis that the Maya made extensive use of marine resources in coastal areas, and of freshwater aquatic fauna in inland areas. Moreover, marine species were transported inland via trade routes, as is evident from their presence in archaeological deposits far from the seacoasts.

Frederick Lange was one of the first to draw attention to the importance of marine resources to the Maya, and to suggest that these had been exploited extensively in prehistoric times (Lange 1971). As indicated in the preceding chapter, a number of accounts from the early post-Conquest period describe Maya fishing techniques and the species for whose capture they were utilized. Prior to the appearance of Lange's paper, Stephan de Borhegyi had discussed techniques of pre-Columbian shark fishing in Mesoamerica, and the archaeological and ethnohistoric evidence for this activity (Borhegyi 1961). Borhegyi suggested that, in addition to the use of their teeth as bloodletting implements, sharks probably also contributed to the diet of the inhabitants of Yucatan and other coastal areas of the Maya region, providing a rich source of A, B and D vitamins (Lange 1971:284).

Remains of marine fauna have been reported from Maya archaeological sites since at least the 1930's. Marine molluscs were recovered from the site of Uaxactun by both the Ricketsons (1937) and Kidder (1947). J. Eric Thompson described several species of fishes, as well as crab, lobster, manatee and mollusca among the faunal remains he recovered at San Jose in Belize (Thompson 1939).

Marine faunal assemblages have been reported from sites in the Maya lowlands with increasing frequency since 1970 (Wing and Hammond 1974; Wing 1975, 1980; McKillop 1984, 1985). Although sample sizes are too small to allow statistical treatment, a generalized overall pattern of marine faunal utilization may be discerned, as well as some localized variation.

Although present in less abundant quantities, freshwater species were also important in prehistoric Maya economy. Some ten species of freshwater mollusca have been identified from lowland sites, including Dzibilchaltun ~~and~~ Mayapan in the northern Yucatan, and Tikal, Piedras Negras, Barton Ramie and San Jose in the southern Peten-Belize area (Andrews 1969:32-33). Freshwater shellfish and land snails were more common than marine species at Seibal (Willey et al 1965); large quantities of shell remains of jute (Pachychilus) were found at Lubaantun (Hammond 1975:384-388), a species eaten in modern times as an "emergency food", whose shells are also used to temper pottery (Wing 1975), and in the lime processing of maize (Nations 1979a). The jute may well have been used as a supplementary source of animal protein by prehistoric Maya groups as well (Moholy-Nagy 1978), and Nations has suggested that powdered lime from the shells of this species could have been traded throughout the Maya area from centers where it is indigenous, such as the eastern Chiapas sites of Palenque, Piedras Negras, Bonampak, and Yaxchilan (Nations 1979a). When used in maize processing, the powdered shells of the jute would have provided an important source of calcium and trace minerals, in addition to facilitating the synthesis of essential amino acids to enhance the protein quality of maize (Katz et al 1974).

Another species of mollusk that may have been utilized in significant quantities is the freshwater aquatic species Pomacea flagellata, which comprised some 83 percent of the Swasey Phase sample of freshwater molluscan species at the site of Cuello (Hammond et al 1979). Aquatic species of all kinds appear to have been very important at this site, constituting one-fourth of the total MNI of the faunal assemblage.

Crustacean remains have been found at some Maya sites, documenting their utilization in pre-contact times. Ethnologists have reported the modern use of crabs (Tozzer 1907, Hunn 1977) and crayfish (Hunn 1977; see also Table 7) as food species. Iconographic evidence for possible crayfish "farming" among the Olmec predecessors of the Maya has been explored by Stross (1987), who also finds suggestions of such a practice in the Maya language and hieroglyphic script.

In the absence of archaeological remains, the uses to which insects may have been put by the Maya must be inferred from ethnohistoric and ethnographic information. As noted in Chapter V, insects are described as species utilized for medicinal purposes in such Maya documents as the Ritual of the Bacabs. Hunn found this usage retained among modern Tzeltal Maya of Chiapas, where cicadas are collected, baked and fed to children to encourage fluent speech, and a drink containing roasted and ground up cockroaches is imbibed to cure "whooping cough" (Hunn

1977:120). The dietary importance of insects to this population with the decline of game resources has also been documented by Hunn.

D. SYNTHESIS OF COMPARATIVE DATA

Results of analysis of the ethnohistoric, archaeological and ethnonological data reviewed here, documenting animal species utilized by the Maya from pre-contact to modern times, have been synthesized in Table 11.

In this table, faunal resources are listed in descending order of their overall importance to the Maya, based upon their averaged ranks in the three samples. This table no doubt contains some errors--e.g., quail and grouse, as well as fishes, may be ranked too low, and some others are perhaps ranked too highly, due to distortions resulting from sampling error. However, the overall pattern of faunal utilization reflected in this table is highly similar to that emerging from comparative zooarchaeological studies now being undertaken (e.g, Wing 1981) as a characteristically Mayan one.

Hunting and Fishing Methods and Rituals

With respect to Maya hunting and fishing techniques, rituals, and associated animal sacrifice, as well as preservation methods for animal foods, these can be inferred only indirectly from the archaeological record, in the form of appropriate artifacts and features.

Storage facilities and remains of preservation activities have not been documented archaeologically in the Maya area. However, the ethnological sample examined here provides a valuable means of checking the information on preservation and ritual activities reported in the ethnohistoric literature.

As may be seen in Table 9, the methods and artifacts of both hunting and fishing documented in ethnological reports are very similar to those described in ethnohistoric sources, as are methods of preservation.

Hunting and fishing rituals were found to be still present among the Maya of Belize by Thompson in the 1920's, and hunting rituals in Yucatan were reported by Redfield in the 1930's (see Table 10).

Beekeeping continues to be economically important to the modern Maya (Redfield and Villa Rojas 1934; Hunn 1977), and animal sacrifice has remained a part of the traditional Maya religious observances associated with food procurement activities in the twentieth century (Gann 1918, Thompson 1930).

Table 1:

Frequency of Faunal Descriptions in Ethnohistoric Sources, by Type of Source

Fauna: Class/Order/ Family	Class I: Native Documents	Class II: European Hist. Syntheses	Class III: Span.Conquest Accounts	Total No. Desc. Reported
Invertebrata:				
Mollusca	0	1	1	3
Gastropoda	0	0	1	1
Pelecypoda	0	0	0	0
Bivalves	0	1	1	2
Lamelli-branchia	0	0	0	0
Brachiopoda	0	1	1	2
Vermes	1	0	0	1
Annelida	1	0	0	1
Arthropoda	3	2	2	7
Crustacea	3	1	1	5
Myriopoda	2	0	0	2
Chilopoda	2	0	0	2
Insecta	7	13	3	23
Orthoptera	0	3	0	3
Isoptera	0	1	0	1
Homoptera	1	1	0	2
Cicadidae	1	1	0	2
Lepidoptera	2	0	0	2
Diptera	1	3	1	5
Culicidae	0	2	0	2
Tabanidae	0	1	1	2
Calliphoridae	1	0	0	1
Sarcophagidae	1	0	0	1
Hymenoptera	3	5	1	9
Formicoidea	0	2	0	2
Vespoidea	2	1	0	3
Apoidea	1	2	1	4
Unclassified	0	0	1	1
Coccidae	0	0	1	1
Vertebratra:				
Pisces:				
Chondrichthyes	0	1	1	2
Squaliformes	0	1	~~0~~	1
Rajiformes	0	0	1	1
Osteichthyes	1	7	5	13
Anguilliformes	1	0	1	2

Table 1 - continued

Fauna:	Class I	Class II	Class III	Total
Carangidae	0	2	1	3
Gerridae	0	1	1	2
Cichlidae	0	1	1	2
Siluriformes	0	0	2	2
Scombridae	0	1	0	1
Clupeidae	0	2	0	2
Sparidae	0	1	0	1
Unclassified Pisces	0	1	4	5
Amphibia:				
Gymnophiona	0	0	1	1
Anura	4	1	0	5
Bufonidae	2	1	0	3
Hylidae	1	0	0	1
Ranidae	1	0	0	1
Reptilia				
Crocodilia	1	0	2	3
Alligatoridae	1	0	2	3
Testudinata	1	0	1	2
Cheloniidae	0	0	1	1
Squamata	1	1	2	4
Iguanidae	1	1	2	4
Unclassified	1	0	1	2
Aves				
Tinamiformes	0	1	1	2
Pelicaniformes	1	2	2	5
Fregatidae	1	2	2	5
Ciconiiformes	0	1	1	2
Ardeidae	0	1	1	2
Anseriformes	0	0	5	5
Anatidae	0	0	5	5
Falconiformes	4	1	3	8
Galliformes	1	2	7	10
Cracidae	0	1	4	5
Phasianidae	0	0	2	2
Meleagridae	1	1	1	3
Gruiformes	0	0	1	1
Rallidae	0	0	1	1
Columbiformes	0	0	3	3
Psittaciformes	1	1	5	7
Strigiformes	2	0	2	4
Trogoniformes	1	0	0	1
Piciformes	1	2	1	4
Passeriformes	0	1	3	4

Table 1 - continued

Fauna	Class I	Class II	Class III	Total
Mammalia				
Marsupialia	0	1	1	2
Chiroptera	2	1	0	3
Primates	0	1	1	2
Cebidae	0	1	1	2
Edentata	1	2	3	6
Myrmecophagidae	0	1	0	1
Dasypodidae	1	1	3	5
Lagomorpha	2	1	2	5
Leporidae	2	1	2	5
Rodentia	0	1	6	7
Sciuridae	0	1	2	3
Geomyidae	0	0	1	1
Erethizontidae	0	0	1	1
Dasyproctidae	0	0	2	2
Carnivora	7	6	12	25
Canidae	3	3	7	13
Procyonidae	0	0	1	1
Mustelidae	0	0	4	4
Felidae	4	3	*0	7
Pinnipedia	0	1	1	2
Sirenia	0	4	3	7
Manatidae	0	4	3	7
Perissodactyla	0	3	2	5
Artiodactyla	2	3	9	14
Tayassuidae	0	1	2	3
Ruminantia	2	2	7	11
Cervidae	2	2	7	11

*Descriptions of Felids in Spanish accounts are numerous; only a sample of these were recorded, due to the frequent impossibility of classifying the animals described, since they are most often referred to as "tigers" or "lions". When not more specifically identified, these were omitted from the summary in Chapter V.

Table 2:

Fauna in Ethnohistoric Literature Sample, Ranked by Frequency of Description (based on frequencies recorded in Table 1)

Rank	Descriptions	Invert. Spp.	Amphibs./ Reptiles	Fishes	Birds	Mammals
1	9+	Hymenoptera	none	none	Galliformes	Cervidae Canidae
2	7-8	Arthropoda	none	none	Falconiformes Psittaciformes	Felidae Rodentia Manatidae
3	5-6	Diptera Crustacea	Anurans	unclassified	Anatidae Cracidae Pelicaniformes Accipitridae	Perissodactyla Leporidae Edentates
4	3-4	Mollusca Vespoidea Apoidia Orthoptera	Crocodilia Iguanidae Bufonidae	none	Passeriformes Piciformes Strigiformes Columbiformes Meleagridae	Chiroptera Tayassuidae Sciuridae Mustelidae
5	2	Myriopoda Bivalves Formicoidea Tabanidae Homoptera	Testudinata Unclassified	Clupeidae Gerridae Siluriformes Anguilliformes	Tinamiformes Phasianidae Ciconiiformes	Pinnepidae Cebidae Marsupialia Dasyparoctidae
6	1	Gastropoda Vermes Isoptera	Cheloniidae Gymnophiona Hylidae Ranidae	Squaliformes Rajiformes Scombridae Sparidae	Rallidae Trogonidae	Myrmecophagidae Geomyidae Erithizontidae Procyonidae

Table 3:

Comparative Frequency of Description of Key Mammalian and Reptilian/Amphibian Species in Maya and European Documents

Species	# Descriptions in Maya Sources	# Descriptions in European Sources
Mammals:		
Canids	3	10
Deer	2	9
Tapir	0	5
Rabbit	2	3
Opossum	0	2*
Squirrel	0	2
Felids	4	3*
Monkey	0	1
Manatee	0	7
Seal	0	2
Bats	2	1
Weasels	0	4
Agouti	0	2
Gophers	0	1
Anteater	1	4*
Paca	0	2
Armadillo	1	4
Total Descriptions.:	15	63*
Reptiles & Amphibians		
Anurans	4	1
Crocodilia	1	2
Turtles	1	1
Sea Turtle	0	1
Iguana	1	3*
Unclassified Reptile	1	1
Total Descriptions:	8	9

*More descriptions were found in European sources for these species than are recorded in Chapter V, making the total number of European descriptions somewhat too low.

Table 4

Archaeological Faunal Species from Five Maya Sites: Presence/Absence Data*

Class/ Order/ Family:	Site: Seibal	Cerros	Mayapan	Lubaantun	Dzibil-chaltun	Total +'s
Mollusca:		−	+	+	+	3
Gastropoda		−	+	+	+	3
Pelicypoda		−	+	+	+	3
Bivalves				+		1
Arthropoda	−	−		−		0
Crustacea	−	+		+		2
Callinectes	−	+		−		1
M. mercenaria	−	+		−		1
Insecta	−	−		−		0
Pisces:						
Chondrichthyes	−	+		+	+	3
Squaliformes	−	+		+	+	3
Rajiformes	−	+		−	+	2
Osteichthyes	+	+		+	+	4
Muraenidae	−	+		−	−	1
Serranidae	−	+		+	+	3
Sciaenidae	−	−		−	+	1
Carangidae	−	+		+	+	3
Lutjanidae	−	+		−	−	1
Gerridae	+	+		−	−	2
Cichlidae	+	+		−	−	2
Scombridae	−	?		+	−	1
Scaridae	−	+		+	−	2
Siluriformes	+	+		−	−	2
Centropomidae	−	−		+	−	1
Amphibia:						4
Anura	−	+	+		+	3
Bufonidae	+	+	+		+	4
Reptilia:						
Alligatoridae	+	+		+	+	4
Testudinata	+	+	+	+	+	5
Testudinidae	+			+	−	2
Kinosternidae	+	+		−	+	3
Emydidae	−	+		−	+	2
Cheloniidae	−	+		+	+	2
Squamata	+	+		+	+	4
Iguanidae	−	−	+	+	+	3
Crotalidae	+	−		−	−	1
Colubridae	−	−		−	+	1
Aves:		+				
Tinamidae	−	−			−	[illegible]
Pelicaniformes	−	−			+	1
Ciconiiformes	−	−	+		+	2

*Blanks indicate no data available

Table 4 - continued

	Seibal	Cerros	Mayapan	Lubaantun	Dibil-chaltun	Total +'s
Anseriformes	-	-			+	1
Falconiformes	+	-	+		+	3
Galliformes	+	+	+		+	4
Phasianidae	-	+	+		+	3
Meleagridae	+	+			-	2
Gruiformes	-	-			-	1
Rallidae	-	-	+		-	1
Columbiformes	-	-	+		-	1
Psittaciformes	+	-			+	2
Strigiformes	-	-			+	1
Passeriformes	-	-			+	1
Mammalia:						
Marsupialia	+	-	+	+	+	4
Insectivora	-	-		-	-	0
Chiroptera	-	-		-	-	0
Primates	+	-	+	-	-	2
Cebidae	+	-	+	-	-	2
Edentata	+	-	+	-	-	2
Dasypodidae	+	-	+	-	-	2
Lagomorpha	+	+	+	-	+	4
Leporidae	+	+	+	-	+	4
Rodentia	+	+	+	+	+	5
Sciuridae	-	-		-	+	1
Geomyidae	+	-	+	-	+	3
Erethizontidae	+	-		-	-	1
Dasyproctodae	+	+		+	-	3
Carnivora	+	+	+	+	+	5
Canidae	+	+	+	+	+	5
Procyonidae	-	+		-	-	1
Mustelidae	-	-		+	+	2
Felidae	+	-	+	+	+	4
F. onca	+	-			-	1
F. concolor	+	-			+	2
F. pardalis	+	-	+		-	2
Pinnipedia	-	-		-	-	0
Phocidae	-	-		-	-	0
Sirenia	-	-	+	-	-	1
Manatidae	-	-	+	-	-	1
Perissodactyla	+	-	+	-	+	3
Tapiridae	+	-	+	-	+	3
Artiodactyla	+	+	+	+	+	5
Tayassuidae	+	+	+	+	+	5
Ruminantia	+	+	+	+	+	5
Cervidae	+	+	+	+	+	5
O. virg.	+	+		+	+	4
Mazama	+	+		+	+	4

* Blanks indicate no data available

Table 5:

Fauna from Five Archaeological Sites,

Ranked by Presence/Absence Scores

Rank	# Sites Present	Invert. Spp.	Amphibs./ Reptiles	Fishes	Birds	Mammals
1	5	none	Testudinata	none	none	Canidae Tayassuidae Cervidae
2	4	none	Crocodilia Squamata Bufonidae	none	none	Marsupialia Leporidae Felidae
3	3	none	Anurans Testudinata Cheloniidae Iguanidae	Squali- formes Carangidae Serracidae	Galli- formes Falconi- formes	Geomyidae Dasyproc- tidae
4	2	Crus- tacea	Testu- dinae Emydidae	Rajiformes Gerridae Scaridae Siluri- formes	Phasianidae Melleag- ridae Ciconii- formes Psittaciformes	Cebidae Dasypodidae Mustelidae
5	1	Portu- nidae Veneridae	Crotalidae Colubridae	Scianidae Lutjanidae Scombridae Centro- pomidae	Pelicani- formes Anseri- formes Rallidae Columbi- formes Strigiformes Passeriformes	Sciuridae Erithozon- tidae Procyonidae Manatidae
6	0	----------- all others ---------------				

Table 6:

Ranks of Key Mammalian and Reptilian Species

in Ethnohistoric and Archaeological Samples

Species	Ethnohistoric Rank	Archaeological Rank
Dog	1	1
Deer	1	1
Peccary	4	1
Tapir	3	3
Rabbit	3	2
Opossum	5	2
Squirrel	4	5
Felines	2	2
Monkeys	5	4
Manatee	2	5
Seal	5	6
Bat	4	6
Weasels	4	4
Agouti	6	5
Gophers	6	3
Edentates	3	4
Paca	5	3
Armadillo	3	4
Anurans	4	3
Toads	4	2
Crocodilia	4	2
Turtles	5	1
Sea Turtles	6	3
Lizards	4	2
Iguanas	4	3

Table 7

ETHNOGRAPHIC DESCRIPTIONS OF ANIMAL SPECIES HUNTED

Species	Tozzer (1907)	Gann (1918)	Redfield (1934)	Thompson (1930)	Hunn (1977)	Total +'s
Mammals:						36
Canids					+	1
Deer	+	+	+	+		4
Tapir	+	+		+		3
Rabbit					+	1
Opossum					+	1
Raccoon					+	1
Squirrel		+	+			2
Peccary	+	+	+	+		4
Felids	+	+				2
Monkey	+	+		+		3
Weasel					+	1
Agouti		+	+			2
Coati			+			1
Gopher			+		+	2
Paca	+			+	+	3
Armadillo	+	+		+		3
Badger	+					1
Cane rat		+				1
Amphibians & Reptiles:						6
Turtles	+	+				2
Iguana	+	+				2
Constrictor		+				1
Rattlesnake		+				1
Birds						32
Wild turkey	+	+	+	+		4
Qualm		+		+		2
Partridge	+	+		+		3
Quail, grouse	+	+	+			3
Dove			+			1
Parrot	+	+		+		3
Pigeon		+	+			2
Curassow		+	+	+		3
Toucan		+		+		2
Duck		+				1
Chachalaca		+	+	+		3
Tinamou			+			1
Unidentif. Bird		+	+	+	+	4

Table 7 - continued

Species	Tozzer (1907)	Gann (1918)	Redfield (1934)	Thompson (1930)	Hunn (1977)	Total +'s
Fishes						13
Sardine:	+					1
Tarpon		+				1
Cazone		+				1
Skipjack		+				1
Snapper		+				1
Eel		+				1
Barracuda		+				1
Bass		+				1
Snook		+				1
Jewfish		+				1
Cobarli		+				1
Tuber		+				1
Unidentif. Fish	+					1
Invertebrates						
Mollusca						
Snails	+				+	2
Crustacea						
Crabs	+				+	2
Crayfish					+	1
Insecta					+	1

Table 8

Fauna in Ethnographic Literature Sample, Ranked by Frequency of Description

Rank	#Descriptions	Invertebrates	Amphibians/ Reptiles	Fishes	Birds	Mammals
1	4	none	none	none	Wild turkey, Unidentif. bird	Deer Peccary
2	3	none	none	none	Partridge Quail Parrot Curassow Chachalaca	Tapir Monkey Armadillo Paca
3	2	Snails Crabs	Turtle Iguana	none	Qualm Pigeon Toucan	Squirrel Felids Agouti Gopher
4	1	Crayfish Insects	Constrictor Rattlesnake	Sardine Tarpon Cazone Skipjack Snapper Eel Barracuda Bass Snook Jewfish Cobarli Tuber	Dove Duck Tinamou	Canids Rabbit Opossum Raccoon Weasel Coati Badger Cane Rat

Table 9

HUNTING AND FISHING METHODS AND ARTIFACTS, RITUALS, AND PRESERVATION TECHNIQUES REPORTED IN THE ETHNOHISTORIC LITERATURE

Methods & Artifacts	Class I Sources	Class II Sources	Class III Sources
Hunting:			
Atlatl	+		+
Bird line	+		
Blowgun	+		+
Bow & Arrow	+	+	+
Communal hunting			+
Decoys	+	+	
Dogs			+
Nets		+	+
Spears	+		+
Stratagems	+	+	
Traps	+	+	+
Birdlime	+		
Cage trap	+		
Pitfall	+		
Snare, noose	+		+
Hunting Rituals:	+		+
Fishing:			
Bow & Arrow		+	+
Harpoon		+	+
Canoe	+	+	
Hook & Line		+	+
Nets		+	+
Drag nets		+	+
Trammel nets			+
Poisoning			+
Fishing Rituals:			+
Animal Sacrifice:	+		+
Preservation Techniques:			
Drying		+	+
Smoking			+
Salting			+
Beekeeping:			+

Table 10

HUNTING AND FISHING METHODS AND ARTIFACTS, RITUALS, AND PRESERVATION TECHNIQUES REPORTED IN ETHNOGRAPHIC SOURCES

Methods & Artifacts	Ethnographic Sources by Author					Total
	Tozzer (1907)	Gann (1918)	Redfield (1934)	Thompson (1930)	Hunn (1977)	No. +'s
Hunting:						
Bow & Arrow	+					1
Musket or shotgun	+	+		+	+	4
Deer Whistles	+	+	+			3
Milpa platforms ("watch towers")		+	+			2
Traps		+			+	2
Snare, noose		+	+	+		3
Cage trap			+			1
Deadfall				+		1
Sling		+			+	2
Blowgun				+		1
Communal hunting			+	+		2
Dogs			+			1
Hunting Rituals:			+	+		2
Fishing:						
Bow & Arrow	+			+		2
Harpoon		+				1
Canoes	+	+				2
Hook & Line	+	+			+	3
Nets	+	+				2
Spear	+	+		+		3
Fish traps		+				1
Poisoning				+	+	2
Fishing Rituals:				+		1
Animal Sacrifice:		+		+		2
Preservation Techniques:						
Smoking (deer, birds, peccary)		+				1
Salting		+				1
Beekeeping:			+		+	2

Table 11

COMPOSITE RANKS OF FAUNAL SPECIES IN MAYA SUBSISTENCE

(Combined Ethnohistoric, Ethnographic, and Archaeological Ranks),

(Descending Order of Importance)

Species:	Averaged Rank
Deer	1
Dog, Canids	1
Turkey	1
Peccary	2
Tapir	2
Felids	2
Turtles	3
Armadillo	3
Rabbit	3
Iguana	3
Manatee	3
Chachalaca, Curassow	3
Parrot, Toucan	3
Crustacea	3
Paca	4
Agouti	4
Gopher	4
Opossum	4
Monkey	4
Squirrel	4
Weasel	4
Mollusks	4
Toads	4
Crocodile	4
Dove, Pigeon	4
Partridge	4
Duck	4
Quail, Grouse	4
Raccoon	5 or below
Insects	5 " "
All fishes	5 " "

VII. CONCLUSIONS

A. Fulfillment of Investigation Objectives

The data derived from systematic examination of ethnohistoric evidence for Maya animal utilization, as proposed at the beginning of this investigation (p.1), have met the overall objectives defined in Chapter I in varying degrees.

First, with respect to determining the importance of animals in Maya diet and economy, relative to cultivated agricultural products, this has not been possible to achieve quantitatively from the data produced by this study. While the investigation demonstrates the importance of animal resources in Maya subsistence and economy, it has not provided a basis for assessing their relative significance, vis a vis vegetable products, in absolute numerical terms.

Ethnohistoric materials have provided some evidence in support of specialized occupations devoted to the procurement of animal foods. The strongest evidence for this is that supporting the existence of commercial fishermen and beekeepers, whose occupations were of sufficient importance to merit their own rituals. While hunting rituals were at least as elaborate as those for fishermen and beekeepers, specific mention of specialized hunters or herdsmen was not found. Although the practice of loose herding of deer in well-defined range areas is suggested by some early Spanish accounts, implying the presence of gamekeepers or herdsmen, such an occupation as this is nowhere specifically mentioned.

Species subject to human management and control at the time of Spanish contact included a variety of fowl and other avian species, although exactly which of these were managed and to what extent is not clear from the ethnohistoric record. There is unquestionable evidence for domestication of the honey bee, and suggestions of incipient deer domestication as well.

Evidence for the differential consumption of various animal species according to social distinctions is indirect, consisting primarily of suggestions that certain animal foods, such as venison and turkey, were offered to Maya lords and to the gods, thereby indicating a higher status for such foods than for other animal products. The native literature is more specific on this point, indicating that grubs and insects were foods fit only for "wretches", i.e., for consumption only in emergencies, or by the destitute, while fish was considered fare fit for a prince.

How ideology and world-view affected Maya subsistence decisions can be assessed indirectly, from evidence contained in ethnohistoric sources; this will be discussed in terms of the model outlined below. Ways in which superstructural factors may have affected Maya population movements, settlement decisions, and attitudes towards resource exploitation can be inferred from some of the native ethnohistoric documents, as will be demonstrated below.

B. Results of Hypothesis Tests

Contrary to traditional assumptions concerning the scarcity of animal protein in tropical environments, the evidence found in this investigation indicates that animal protein foods in the Maya region were (a) relatively abundant, and (b) constituted a favored category of food resource, one widely utilized in the prehistoric period as well as at the time of Spanish contact.

Birds, deer and fish appear from the ethnohistoric record to have been especially favored as food species; but a variety of other faunal resources, including such invertebrates as insects, worms, grubs, snails and crabs, and a diversity of aquatic species, were also eaten. Caymans and crocodiles, as well as fish, were procured from aguadas, and crocodilians were hunted in creeks. Irrigation canals in wetland agricultural field systems very likely served the additional purpose of providing a medium for fish culture.

In addition to their dietary use, a variety of faunal species had medicinal and other economic uses. Among these were various galliform birds, offered in rituals for curing that formed an important part of traditional Maya medicine (Roys 1967:122); the frigate bird, whose fat had medicinal uses; and the eagle, whose flesh was eaten to cure "buboes" (i.e., syphilitic lesions) (Roys 1967:129). Woodpecker beaks also had a medicinal use, for bleeding the gums to relieve toothache (Roys 1967:141). The eye of the shark was used in a cough remedy (Roys 1967:106).

In addition to the turkey, a number of galliformes were apparently domesticated, including duck and curassow. Macaws and trogons were managed in order to pluck their colorful plumage, which was used in making fans, as well as to decorate rulers' headdresses and ceremonial garb.

Of the twelve hypotheses presented in Chapter IV, tests against the ethnohistoric record provided evidence supporting seven, in varying degrees. No evidence could be found to support the remaining five. On the other hand, no evidence was produced by this investigation that tended to refute any of the twelve hypotheses.

Hypothesis 1:

The findings of this study show that the Maya, like other tropical peoples, exploited a vast range of faunal species to meet their requirements for dietary animal protein, including a number of invertebrate species, both freshwater and marine aquatic species, reptiles and amphibians, and a variety of birds and mammals.

Hypothesis 2:

The importance of such larger mammalian species as deer, and the preference for deer as a sacrifical or honorific offering to rulers as well as gods, is made quite clear in the ethnohistoric literature. However, there is also evidence indicating that other species than large terrestrial mammals, including turkey, fishes and the domestic dog, were similarly favored, although their energy costs would have been considerably lower. Support for this hypothesis is therefore somewhat equivocal.

Hypothesis 3:

Ethnohistoric data support the suggestion that in the Maya social hierarchy, the most desirable categories of animal foods, such as the haunch of venison, were likely to have been reserved for offerings to priests or lords. In some instances, the entire carcass of a sacrificed deer, including the blood, head and feet, was ritually consumed by the priest and the sacrificers, as attested in the Palacio letter. Ethnohistoric evidence suggests that deer and venison had special significance as ceremonial offerings.

Hypothesis 4:

No evidence was found that any animal protein food was exclusively reserved for the consumption of any particular category of persons, although the elite (including the priesthood) apparently received first preference in the allocation of the most desirable animal products, especially venison.

While fish is mentioned as a high-status food category, this was certainly not restricted to the elite, since fish were consumed in great numbers by Maya of all social classes, and are still an abundant and favored food source in the Maya area (Mexico, Secretaria de Pesquero, 1981; Belize, Central Statistics Office, 1985; El Salvador, Direccion General de Estadistica y Censos, 1982). An extradordinary variety of piscean species are available in the Maya region, although only a few of these (including jack, grouper, sea bass, pompano, snapper, perch, catfish, snook, tuna, sardine, shad, cod, bream, trout, pollock, and eels) are documented as food species in the ethnohistoric record.

Hypothesis 5:

As mentioned above, "high status" animal protein foods included deer meat, turkey and other fowl, and fish, while insects and larvae appear to have been "emergency" foods consumed when no other animal protein was available, as in times of famine. While there is evidence of famine and resource pressure in the Postclassic (Roys 1967), there are also indications that famine and periods of severe resource stress were common occurrences throughout Maya history (see below); the Maya had ample opportunity to devise ways of dealing with scarcity, and the ethnohistoric record indicates that their inventory of "starvation foods" was a fairly extensive one, which included various faunal species as well as plant foods (Roys 1967). It appears likely that the use of such foods signalled scarcity or poverty, and would therefore have been associated with low status in normal times, as is suggested by some native Maya documents.

<u>Hypothesis 6</u>:

Prohibition of sexual relations prior to planting the maize has been reported ethnographically among the modern Maya (Thompson 1930), but no mention of such a restriction for hunters was found in either the ethnographic literature or the ethnohistoric record.

Conservation measures, in the form of protecting deer by restricting them to certain areas and controlling their hunting, were reported by Diaz del Castillo (Maudslay 1908-1916). Religious sanctions appear to have been invoked as a rationale for this practice, observed in the Mazatecas by members of Cortes' army. In addition, the injunction of the god Tohil is cited in the native literature to justify the capture and domestication of young deer and turkeys, and raising them in a controlled environment to insure an adequate supply for offerings to the gods and the priesthood, highlighting the importance of ideological justification for any change in subsistence strategy among the Maya.

Hypothesis 7:

Specialized occupations devoted to the procurement of animal products specifically discussed in the ethnohistoric literature include beekeeping and commercial fishing, the latter carried on to support a widespread trade in dried and salted fish that continued to flourish at the time of the Conquest (Landa, Tozzer 1941). Evidence for gamekeepers or specialized hunters is, however, indirect and relatively weak.

Hypothesis 8:

Ethnohistoric evidence for fission and relocation as a specific result of animal resource depletion is tenuous at best. While the wanderings from place to place of the Quiche tribes described in the Popol Vuh are attributed in part to a scarcity of animal foods, leading these nomads to resort to the consumption of insect larvae, no specific data were found connecting Maya abandonment of complex urban sites to local depletions of game resources. The native literature does, however, provide some indirect evidence supporting such an inference (see below).

Hypothesis 9:

The Maya trade in fish is documented in the ethnohistoric record, from Oviedo's descriptions of trading baskets filled with dried bream to Landa's reports of salted fish being taken 20 or 30 leagues for sale

(Tozzer 1941:202). In addition, there are accounts stating that salted and dried insects were traded in areas adjacent to the Maya region. The dietary and medicinal uses of insects by the Maya, documented both ethnohistorically and ethnologically, may have led to similar trading activities among the Maya themselves, although this is not explicitly stated in the ethnohistoric record. Landa indicated that some other species, including turtle, deer and manatee, may also have been among Maya food products involved in trade (Landa, Tozzer 1941:203-204).

Non-dietary animal products whose importance in trade has been documented both archaeologically and ethnohistorically include stingray spines and sharks' teeth, both employed ritually as bloodletters.

Hypothesis 10:

The possible existence of Maya sumptuary rules restricting consumption of animal protein resources to members of any particular social class was not documented ethnohistorically, nor was any reference found to significant differences in health between social classes that could be attributed to such rules. Such evidence as exists in support of this hypothesis is confined to that produced by a limited number of zooarchaeological and paleopathological studies of remains from the Maya area (see Chapter II.C).

Hypothesis 11:

No direct ethnohistoric support was found for an increased tolerance of environmental degradation, and consequent game depletion, accompanying the development of intensive Maya agriculture, and no ethnohistoric evidence could be found to test this hypothesis.

Hypothesis 12:

There was likewise no evidence found in the ethnohistoric record to test whether a hypothesized military monopoly on animal protein ever existed.

C. A Model of Maya Resource Use

The following model is based upon the ethnohistoric evidence found in the course of the present investigation, including the results of testing the twelve hypotheses outlined above. In addition, the data obtained through comparison and synthesis of ethnohistoric evidence with samples of available archaeological and ethnonological data on Maya subsistence, and presented in Chapter VI, have been drawn upon.

The following suppositions, all of which can be supported by ethnohistoric and/or archaeological evidence, form the framework of the model.

1. Maya subsistence practices encompassed the exploitation of an extremely varied and complex resource base, including faunal species occuring in marine, coastal, estuarine, freshwater riverine and lacustrine, tropical rainforest, savanna, and mangrove swamp micro-

environments, in addition to a diversity of agricultural products.

2. Large populations, documented archaeologically in the Maya area, led to periodic local resource exhaustion, a factor very likely implicated in the abandonment of large complex settlements, a Maya phenomenon observed from Preclassic through Post-classic times.

3. Ritual played an important role in Maya subsistence, as is evident in the variety and elaborate nature of ceremonies associated with hunting, fishing, and the agricultural cycle.

4. Famine and ecological crisis are important themes in Maya literature and mythology, discernible in documents produced in such different temporal, cultural and geographical contexts as the Popol Vuh and the Books of Chilam Balam.

5. The concepts of ecologic disaster, and of the repetitious and cyclic nature of time and human history, apparent in such Maya documents as the Books of Chilam Balam, indicate a specific complex of psychological predispositions that appears to have been instrumental in affecting subsistence choices and settlement decisions made by the Maya throughout their career. The most important of these are:

a. A strong and persistent anxiety concerning the continuing availability and sufficiency of natural resources. This is reflected in the variety and number of rituals associated with hunting, fishing and other food procurement activities. These ceremonies frequently required such extremes of behavior as human sacrifice, blood sacrifice, and the destruction of scarce animal resources, demonstrating a willingness to expend considerable investments of human life and energy in the effort to achieve some degree of control over what were apparently perceived as quixotic events occurring in the natural world, and over the supernatural beings held responsible for them.

b. Related to resource anxiety was a preoccupation with major ecologic disasters. This is a pervasive theme in Maya creation mythology, which features a number of successive creations and destructions of human life and the physical universe. Typically, destruction of the world resulted from some disastrous natural event, e.g., a massive flood, attributed to the whim of the gods, who therefore required constant propitiation and manipulative influence by human priests in order to avoid the repetition of such an event (Thompson 1970).

The relative powerlessness of human beings in the Maya world-view is in striking contrast to the perceived power of the supernatural. This would have placed the priests, in their role as intermediaries between humanity and the supernatural, and persuaders of the gods on man's behalf, in a position of considerable social power and influence. These were men whose words were listened to with respect, and whose advice was heeded.

c. A certain flexibility, apparent in Maya willingness to undertake innovative measures when needed in order to avert ecological crisis, is evident as another significant characteristic. This would have been very important when new methods of intensive agro-technology were adopted, since these often required considerable investments of human energy and, in some instances, of raw materials, which had to be diverted (at least temporarily) from directly productive efforts.

d. A readiness to accept change and innovation may be reflected in Mayan willingness ness to seek out new resource areas, which does not appear to have been diminished by the energy investment made in permanent urban settlements with monumental architecture and large populations. Such settlements, ranging in size from such relatively small complex communities as Cerros, to massive cities such as El Mirador, were precipitately abandoned during the Late Preclassic, while others of comparable size and complexity were abandoned in great numbers in the Late Classic (Freidel 1978; Matheny 1987).

Ideology was no doubt an important factor implicated in Maya relocations, since all important decisions seem to have been undertaken with a strong need to avoid offending those deities perceived as controlling natural events. The invocation of supernatural sanctions would therefore have been an indispensable prerequisite to any major decision, such as a change of settlement or of subsistence strategy. Supernatural approbation or injunction may, by the same token, have constituted sufficient reason to carry out major changes, if a trusted priest or prophet stated that these were mandated by the gods who controlled human fortunes.

The Maya belief that past events would be repeated in the future produced an expectation that the ecologic crises and uncertainties experienced in the past would be reexperienced by present or future generations. This is expressed in the prophecies of events anticipated in forthcoming katuns set down in the Books of Chilam Balam. It was believed that the calendric name assigned to a katun, composed of the name and numerical coefficient of its governing day in the ceremonial calendar, in itself gave a clue to its nature. The name of a katun thus provided a kind of shorthand prognostication, indicating whether a particular twenty-year period would be a time of prosperity or adversity. Katuns with the designations 4 Ahau and 6 Ahau tended to be times of misfortune. Since this was recorded in the Maya records of past events, the auguries for similarly designated future katuns tended to be negative.

> In Katun 6 Ahau they shall eat trees and rocks as they shall be dying of starvation...the dying governors...shall speak of food...wishing that the trees would fructify. Three times it has happened this way and three times it has been

> necessary to make bread with the cup-root because of the famine (Book of Chilam Balam of Mani, Craine and Reindorp 1979:84-85).

> [Chichen Itza] will establish a Katun 4 Ahau... There will be a scarcity of squash and ears of corn...lack of bread and water...[and a] plague of ants that threaten the beehives in their care (Craine and Reindorp 1979:85).

The Katun 13 Ahau was also a time of famine:

> ...Coba will establish a Katun 13 Ahau...There shall be much famine...there will be three years when a plague of locusts will devour the plants and flowers and lay their larvae by the millions...(Craine and Reindorp 1979:86).

As Ralph Roys pointed out in his translations of some of these prophetic works (Roys 1960, 1967), a large proportion of the forecasts are of a negative character; and many of these focus upon such ecologic crises as severe droughts, accompanied by crop failure, the death of game animals, and the resulting famines. Predictions of famine appear at least eight times in the Chumayel (Roys 1967:103, 115, 120, 122, 133, 134, 158, 183). Drought is predicted ten times, and its devastating consequences made clear: the prophet urges the people to "submit to the unhappy destiny of the katun which is to come", when "it shall be as when the deer die"--i.e., a time when drought becomes so severe that water holes dry up and the deer die of thirst (Roys 1967:122, note 4). Other predictions describe drought so intense that "the rocks shall crack with the heat" (Roys 1967:183).

Among other negative forecasts are plagues of locusts, war, and pestilence. Chilam Balam's prophesy for the _katun_ 3 Ahau is a good illustration of Mayan expectations in the Late Postclassic:

> The skin of the jaguar shall be spread out in the market-place [a metaphor for going to war]... There are rains of little profit...rains from a parched sky...There is fighting; there is a year of locusts. The diminished remnant [of the population] is driven far away. They are defeated in war (Roys 1967:154).

This appears to foretell further relocations, when a population already diminished by famine will be forced to abandon its homeland and move to a remote place.

In other passages, times of starvation and pestilence are foretold when the numbers of the dead would cause "the vultures [to] enter the houses"--i.e., so many would die that no one would remain to bury the dead, a state of affairs that may have occurred in the Conquest period as a result of diseases introduced by the conquerors.

In the prophecy of Nahau Pech, another Yucatec Maya prophet who lived about the time of the fall of Mayapan (ca. 80 years before the Conquest), ecological disaster was attributed to the depredations of animal pests, including that ineffable beast, the _bob-och_ (see Chapter V above):

> The food...shall be destroyed because of the _bob-och_...the great hawks...the ant...the cowbird, the grackle, the blackbird, the mouse (Roys 1967:166).

As Roys points out, the majority of predictions seem to have been catastrophic; and since the future was presumably a repetition of the past, this reveals a considerable Mayan heritage of misfortune related to subsistence. The late Precolumbian predictions of the imminent arrival of bearded strangers, who would bring a new religion, along with war, pestilence and widespread destruction, are in keeping with a long Mayan tradition of upheaval and its consequences, which could have affected subsistence decisions in some of the following ways.

A willingness to change basic strategies when necessary may have led to the creation of new habitats for game animals when their natural ones were destroyed by _milpa_ fires, or by the construction of intensive agricultural systems and urbanized settlements. Diversified _milpa_ plots that attracted wild animals, and loose herding of large mammals in protected reserves, are only two of the possible responses that may have been employed to restore game habitats.

A readiness to specialize in animal procurement activities had ample precedent in economic specialization of other kinds. Maya society produced an array of specialized occupations, including warriors, administrators, priests, artisans and craftsmen, and traders. The ability to accommodate new occupational groups was another aspect of Maya social flexibility.

Such changes as these were adaptive, and would have remained so in their overall effects, until such time as population growth may have overtaken and cancelled out the benefits derived from these innovations.

D. A NOTE ON THE POTENTIAL OF ETHNOHISTORIC RESEARCH FOR RECONSTRUCTING SUBSISTENCE

Ethnohistoric literature is now being utilized in conjunction with archaeological research in the Maya area in highly productive ways. Archaeological sites whose locations were formerly unknown have been identified through the use of information obtained from ethnohistoric documents (Graham, Jones and Kautz 1985). Recognition of the value of this body of literature to archaeological studies has been enhanced by recent efforts to interpret the often obscure native sources in the light of recent archaeological and linguistic research, and new translations of traditional Maya literary documents have begun to appear (Tedlock 1985; Edmonson 1982; Edmonson 1985; Brotherston 1979).

The implications of these trends are of great importance to the future of Maya research. The long-neglected body of ethnohistoric literature is proving to be a mine of useful information, both confirming and acting as a check upon archaeological discoveries and their interpretation.

Knowledge derived from the plethora of recent iconographic and hieroglyphic studies of Maya inscriptions and their associated art is another area of activity complementing ethnohistoric research, and contributing to a rapid expansion of knowledge concerning the nature and development of Maya civilization (Dutting 1979a, 1979b; Schele 1976; Stuart 1979, 1983; Porter 1987; Parsons 1987; Sedat 1987).

The potential of Maya literature as a source of information on prehistoric subsistence has only begun to be fulfilled. The present investigation has been a modest effort in this direction, whose findings may be supported, or perhaps invalidated, by future discoveries. In either event, it is hoped that it may serve as a stimulus to further ethnohistoric work contributing to our knowledge of the economic basis of an important indigenous American civilization.

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Appendix

THE QUESTIONNAIRE OF FELIPE II: AN ENGLISH TRANSLATION

(The following translation of the questionnaire, distributed by the Spanish Crown in the late 1570's to Catholic bishops and local officials in the New World, was made from the Spanish version appearing on pages 27-34 of the Coleccion de Documentos Ineditoso relativos al Descubrimiento, Conquista y Organizacion de las Antiguas Posesiones Espanolas de Ultramar, Tomo 11: Relaciones de Yucatan, I, Madrid, 1898. The Relaciones Geograficas, of which the Relaciones de Yucatan comprise a portion, were written in reply to this questionnaire.)

1. First, for the towns under Spanish rule, the name of the territory or province in which they lie, and the meaning of the said name in the language of the Indians, and why it is called thus.
2. Who was the discoverer or conqueror of the said province, and upon whose order and command it was discovered, and the year of its discovery and conquest, so that all shall be conveniently known.
3. In general, the climate and character of the said province, or territory, whether it be very cold, or hot, humid or dry; whether water is scarce or abundant, and when it is most or least available; and the winds that blow within it, how strong they are, and in what parts

they occur, and at what seasons of the year.

4. Whether the terrain is easy or rugged, level or mountainous, of many or few rivers or streams; and whether the waters of such streams be scarce or abundant; whether the land is fertile or lacking in pasturage, productive or sterile of fruits and sustenance.

5. Whether there are many or few Indians, and whether there were more or fewer of them in times other than the present; and the things that are known about them, and whether or not they have permanently populated and organized towns; and the mode and manner of their knowledge, iniclinations, and way of life; and if there are different languages in all the provinces, or whether there is some general language spoken by all.

6. The latitude in which the said Spanish town lies, if it should be known, or if someone is able to learn it, or on what day of the year the sun casts absolutely no shadow at noon.

7. The distance in leagues (leguas) of each Spanish city or town from the city in which the Audiencia for that district resides, or from the town where the governor to whom it is subject resides, [or] whatever other official of the said cities or towns there may be.

8. Likewise the distance in leagues (leguas) separating each Spanish city or town from the others with which it shares territory, declaring into which portion each of them falls, and whether the leagues are large or small;

and whether the ways of approach are flat or mountainous, straight or twisting, and if easy or difficult to travel.

9. The name and patronymic held by or associated with each city or town, and why it is called thus (if this be known), and who gave it this name and was the founder of it, and by whose order and command it was founded, and the year of its foundation, and the number of settlers with which its population was begun, and how many there are at present.

10. The site and location where the said towns lie, whether this be high or low, or level; with a written description and plan of the streets and plazas and other marked places, [and] the locations of monasteries, as it is wished insofar as possible to sketch these easily on a paper in which [it] is stated which part of the town faces north.

11. In the towns that are solely Indian, the extent of the town, in which jurisdiction or corregidor's district it lies, and its capital or seat of doctrine...

12. And likewise, how distant from other Indian or Spanish towns each lies, declaring them one or the other; in which district these lie, and whether the distances are in large or small leagues, and the approaches through level or mountainous terrain, and whether straight or twisting.

13. Also, what is the meaning in the Indian language of the name of the said Indian town, and why it is so called,

if this is or can be known; and what the language spoken by the Indians of this town is called.

14. Who the nobility were in former times, and what dominion their lords had over them; and what tribute was paid to these, and the ceremonies, rituals and customs, good or bad, that they had.

15. How they were governed, and with whom they carried on warfare; and how this warfare was conducted; and the clothing and attire they wore and now wear, and the methods of gaining a livelihood they practised in former times and that they practise now; and whether their health was better or worse in ancient times than it is at present, and the cause of this as they understand it.

16. In all the Spanish and Indian towns listed as being inhabited, whether the land is high mountain ridge, valley, or open flatland, and the name of the mountain or valley and the boundary given to it, and the meaning in their language of their names in each case.

17. And whether the land is a healthy or unhealthy place, and if unhealthy, the cause of this (if it is understood), and the illnesses that commonly occur there, and the remedies that they have devised for them.

18. How far or near lies some mountain or landmark that is nearby, and how closely situated, and what it is called.

19. The principal river or rivers that pass nearby, and how distant they are from the town, and where situated,

and how much water they carry; whether anything notable is known of their origins, waters, rapids, and the uses of these rivers, and whether there exist or could be constructed irrigation works that would be of benefit.

20. The named lakes, lagoons or springs that lie in the environs of the towns, with any notable facts concerning them.

21. The volcanoes, caves, and all other notable and admirable works of nature that occur in the surrounding area that are worthy of note.

22. The trees of the forests that generally grow in the said territory, and their fruits, and their uses and those of the woods extracted from them; and for what ends these are or might be useful.

23. The cultivated trees and fruit-bearing trees of the said lands, and those that have been introduced from Spain and elsewhere, and which of these do and do not yield well here.

24. The grains and seed crops, and other garden crops and grasses that serve, or have served, to sustain the natives.

25. Those [crops] that the Spanish have introduced here, and whether wheat, vines and oil (?) have been brought to this land; in what quantities these may be found; and whether there is silk, or cochineal in this land, and in what quantity.

26. The herbs or aromatic plants which the Indians use

for curing, and their medicinal virtues, or their poisonous qualities.

27. The animals, and wild and domestic birds of the land, and those brought from Spain, and how they have bred and multiplied here.

28. The mines for gold nad silver and other metal minerals...that may be found in the environs of the said town.

29. The quarries for precious stones, jasper, marbles, and those of other names and of similar worth.

30. Whether there are saltworks in the said town, or near it, or from what place salt is procured, and all other things required for the maintenance of life, or for clothing.

31. The form and structure of the houses; and the materials they have for construction in the said towns, and in other parts, from which these are obtained.

32. The fortifications of the said towns, and their distant outposts lying on their borders or boundaries.

33. The agreements and contracts of trade and enterprise by which the Spanish as well as the Indian natives live and are sustained, and concerning in what manner tribute shall be paid.

34. The diocese of the archbishop or bishop, or abbey, in which each town is, and in which part of it it lies, and how many leagues away; and in what part of the town the cathedral is located, and where the <u>cabecera</u> of the

district resides; and whether the distances are in great or small leagues, and by roads straight or torturous, and through land flat or mountainous.

35. The church seat and the parochial school or schools that are found in each town, with the number of their benefactors, benificiaries and their provisions; and whether these are associated with some chapel or designated establishment, and what this is, and who founded it.

36. The monasteries of brothers or nuns of each order that may be found in each town, and by whom and when they were founded, and the number of the holy and important things in each of them.

37. Likewise the hospitals, seminaries and charitable institutions in the said towns, and by whom and when they were instituted.

38. And if the towns are maritime, of which more were said to exist formerly than now in proportion to others, and who follow the way of the sea, whether this sea is calm or stormy, and its storms and perils, and in which season these occur most and least.

39. Whether the coastline is sandy beach or rocky, and the known rocky underwater reefs and dangers to navigation that lie along it.

40. The tides, tidelands and floodlands of the ocean that are the largest, and in which seasons these are greatest and least, and on which days and at which times

of day they occur.

41. The marked cays, points, coves and bays that are found in the said region, with the names and sizes of them, in so far as it is possible to describe this.

42. The ports [of entry] and ports of embarcation lying along the said coastline, and the shape and tracing of them in outline on paper, by which it will be possible to see their form and shape.

43. The size and extent of these, with the measures and dimensions that they have in width and length, more or less, if these can be ascertained; and how many ships they would be able to hold.

44. The depth in fathoms of these, their clearness from silt, and the places in them where a ship may run aground, and where these are; and whether they are clear of shipworms (broma) and other annoyances.

45. Their entrances and exits, and in which direction these face, and the wind directions with which entrance and exit may be made.

46. The commodities and shortages that they have in wood, water and refreshment, and other things both good and bad for entering and remaining in them.

47. The names of the islands lying along the coastline, and why they are called thus; their form and outline in a drawing, if possible, and their length aad width; and what their bottom clearance is, and what lies upon them; the soil, pastures, trees and advantages they afford, the

birds and animals that are on them, and the rivers and springs.

48. And in general, the sites of any abandoned Spanish towns, and when they were peopled and when abandoned, and what is known concerning the reason for their depopulation.

49. Any and all other noteworthy and interesting things occurring naturally here, whether the effects of earth, air or sky, which in their totality are worthy of being known.

50. And here is concluded the said report, signed with the names of the persons who have observed and completed it, and without exaggeration, remit it with this set of instructions to the person who has ordered it to be sent.