

## RESOURCE UTILIZATION AND FOOD TABOOS OF SONORAN DESERT PEOPLES

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**ABSTRACT.**—Resource utilization and food taboos of 8 Sonoran Desert cultures (Riverine Pima, Papago, Sand Papago, Pima Bajo, Seri, Colorado River Yumans, Maricopa and Western Apache) are compared. Taboo (or dietary prohibition) herein is used in *general sense* (species banned to the entire community) rather than *specific sense* (species banned to a particular age and/or sex class at specific times). The purpose is to compare nutritive resources (plant and animal species) available to 2 or more cultural groups exploiting the Sonoran desert. Western Apache, with the greatest number of taboos, had access to more ecotone resources and to more than one major life zone. Within the Pima-Papago cultural complex there is a probable underlying adaptive (ecological) basis for the fact that most restrictions were found with Riverine Pima (resource-rich ecotone habitat) and the fewest restrictions with Sand Papago (most harsh habitat of groups considered). There is a probable adaptive basis for Seri and Sand Papago having few dietary prohibitions (harsh environment and no agricultural resources). Speakers of mutually intelligible languages, even though disjunct geographically, tended to observe the same animal taboos if the resource base was not impoverished. Plant use was cross-cultural. Taboos functioned as symbols of group identity.

### INTRODUCTION

A number of factors determine the dietary items any heterotrophic organism utilizes as food, including its own anatomical mechanism for obtaining the food, its physiological ability to assimilate the food, and the availability of the prey items themselves. All these factors play a major role in the dietary of man, an omnivorous animal. But we cannot stop there. Several factors radically alter the dietary categorization of man as an "omnivorous animal" and these are *culture* and *language*. It is almost an anthropological maxim that man's diet is not simply determined by his anatomical and physiological ability to handle prey items (both plant and animal) that happen to be available in the environment. All humans that we know live in a cultural context, speak at least one language, and practice dietary selectivity. (Our own culture provides examples of rigorously observed but unwritten, perhaps even unconscious, *rules* specifying dietary selectivity; see appendix.) In addition to culture and language, man, especially in "archaic" societies, differs from other animals in a dimension we might call a *sense of the sacred* (Eliade 1959; Rappaport 1971). All 3 modify diets.

Dietary selectivity has been discussed for a number of areas of the world, but to my knowledge there has been no intercultural comparison made of the aboriginal peoples living in the Sonoran Desert of the American Southwest (Fig. 1).

A number of questions came to mind when I decided to look at the variation in dietary resource utilization and taboos in desert peoples:

- 1) Did the utilization of plants as well as animals differ from one group to another?
- 2) Insofar as there were shared resources, were there dietary differences between groups speaking closely related (even mutually intelligible) languages, as between the Riverine Pima, Papago, Pima Bajo, and Sand Papago or between the Maricopa and the Colorado River Yumans?
- 3) Does agriculture modify the range of wild foods hunted and gathered?
- 4) Do dietary restrictions arise because of ecological determinism or do they arise and function as symbols of group identity?

A relatively greater amount of quantified subsistence data is available on Amerindians living in tropical areas (Carneiro 1968; Ross 1978; Chagnon and Hames 1979; others) even

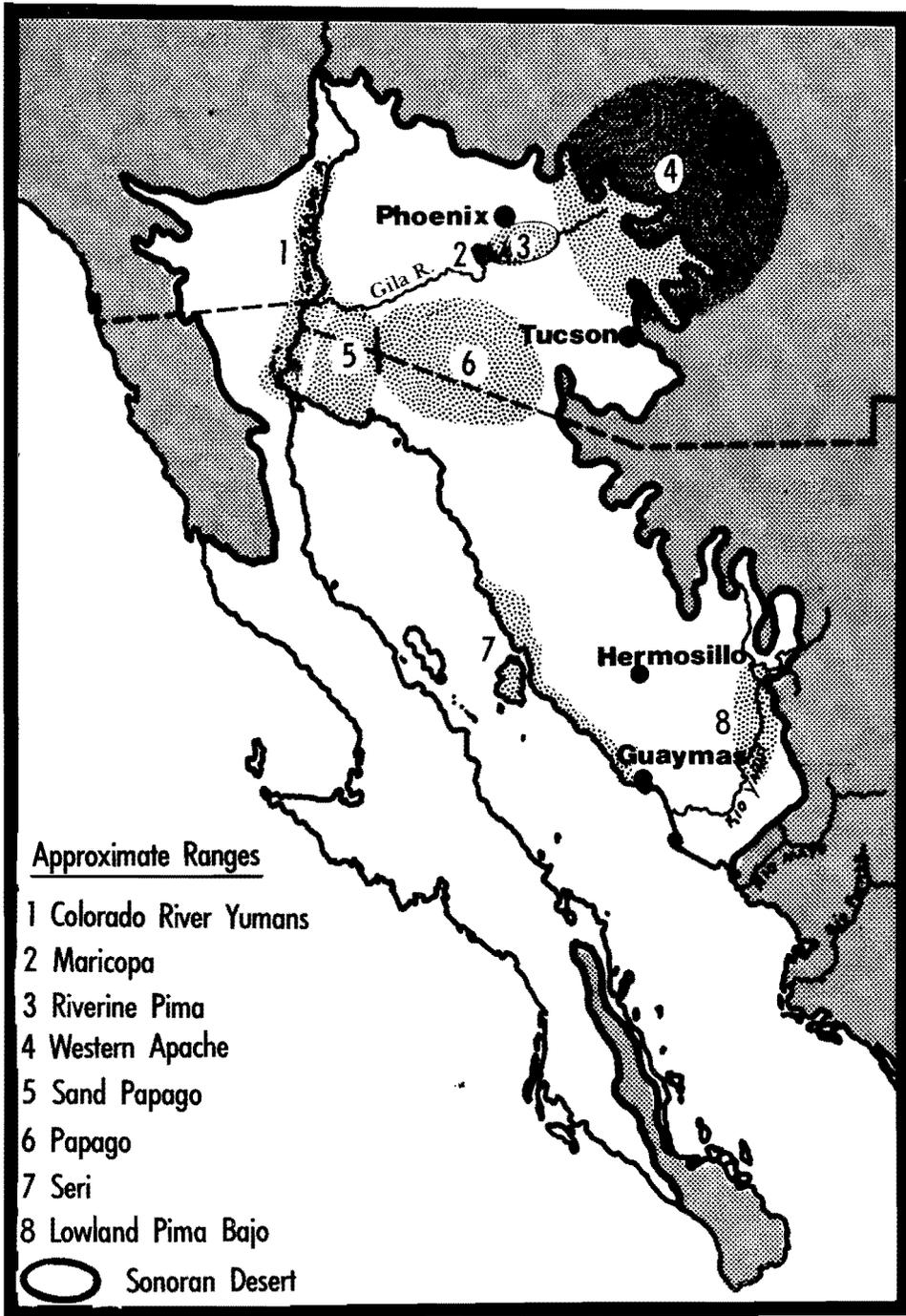


FIG. 1.—Localities (ca. 1850) of 8 groups discussed. (After Rea 1979a).

though considerable investigation remains (cf. respondents to Ross 1978). Tropical situations are characterized by high species diversity but low population numbers (i.e., there are more species but fewer individuals per species than in temperate forest communities). Relatively little is known of resource utilization in New World deserts where human cultures might be thought of as *marginal*. More is known of subsistence in Old World deserts (e.g., Kalahari, Australia). Even though absolute quantitative intercultural data from the American Southwest are now no longer retrievable, the comparative qualitative data presented here are probably largely valid and useful. (We must realize in *any* contemporary study that the Sonoran Desert today is an artifact; community structure since the Pleistocene has been radically altered due to loss of megafauna and associated animals [e.g., Rancholabrean birds] and, more immediately, a century of disastrous overgrazing by Eurasian herbivores. No matter how hard we try to close our eyes to the facts, Southwestern deserts have been *radically altered* by the last century of abuse!)

Some philosophical debate surrounds the topic of the origin and function of food taboos. That taboos are cultural inventions is incontestable. But do they function as cosmological symbols in a culture, maintaining as orderliness and structural identity? Are they understandable as daily, visible projections of *values* emanating from a common metaphysics? Or can they be reduced to some evolutionary fitness factor, fulfilling (unknown even to the adherents) a sanitary or hygienic function, or perhaps an ecological function of sustained yield or predator strategy theory? Can *why* man eats what he eats be understood in terms of nutrition and calories? Can *what* people hunt, gather, or grow be reduced to terms of cost-benefit? The dietary restrictions of Sonoran Desert cultures might suggest some answers.

#### METHODS

For comparative purposes only those plants or animals are considered here to which 2 or more cultural groups had access (see Table 1). Hence, Prairie Dogs (*Cynomys* spp.) of Western Apache are not taken into account here because no other group shared this resource. Comparisons are not to be taken in an absolute sense because (1) relative abundances of various prey items aboriginally are unknown, and there is good evidence that many species of plants or animals are now decimated or locally extirpated due to extensive degradation of the desert habitat (Hastings and Turner 1965; Rea 1977); (2) the relative importances of *specific taboos* are unknown; (3) the coverage of even absolute taboos is uneven, since some of the data (specifically for Western Apache and Yumans) are from the literature and have not been verified. Literature citations are sometimes limited by the investigator's incomplete understanding of his own Linnaean taxonomy and the ethnotaxonomies of his native informants, and (far too often!) incomplete interrogation. Also, Sonoran Desert peoples have had varying, usually long periods of contact with Europeans. This contact with a technologically dominant culture has resulted in a general abandonment of aboriginal food ways. Of the groups considered here, only the Seri preserve a viable native subsistence pattern (though all the others preserve parts). Data for the Riverine Pima, Papago, and Pima Bajo are based on my own field work. Table 2 gives the life zones and ecotones that the 8 groups exploited.

#### DISCUSSION

*Kinds of Taboos*—Food taboos are equivalent to dietary prohibitions. Food taboos considered here are only *general* taboos, that is, those imposed on the entire ethnic group at all times. Excluded from discussion are *specific* taboos that restrict a particular food species for a specific age/sex class of the population at a particular time. Such prohibitions may affect, for instance, only men while hunting, or women while lactating, pregnant or menstruating. (A study of these taboos here now would take us too far afield; but this practical restriction is not to imply the lack of importance, either symbolically or ecologically, of specific or temporal taboos.)





TABLE 1 Continued

	RIVERINE PIMA	PIMA BAJO	PAPAGO	SAND PAPAGO	SERI	MARICOPA	YUMAN SPEAKERS	WESTERN APACHE
Graythorn <i>Condalia lycioides</i>	+	+	+		+	+	+	0
Saguaro <i>Carnegie gigantea</i>	+	+	+		+	+	+**	+
Organpipe cactus <i>Lemaireocereus</i>	0	+	+		+	0	0	0
Barrel cactus <i>Ferocactus</i> spp.	+	+	+		+	+	?	0
Prickley Pear <i>Opuntia</i> spp.	+	+	+		+	+	+	+
Cholla buds <i>Opuntia</i> spp.	+	+	+		+	+	+	+
Sandfood <i>Ammobroma sonora</i>	0	0+	+		0	0	+	0
Wolfberry <i>Lycium</i> spp.	+	0	+		+	+	+	0
Chiltepin <i>Capsicum annuum</i>	**	+	+		**	?	0	+
Broom-Rape <i>Orobancha</i> spp.	+	0	+		+	+	?	0
Wild gourds <i>Curcubita foetidissima</i> & <i>C. digitata</i>	-	T	+		0	+	+	T/+
Sunflower <i>Helianthus</i> spp.	***	0	***		0	?	+	+

## KEY TO SYMBOLS:

0	organism doesn't occur	*	explained in text
?	no information	**	trade item
+	utilized	***	low aversion non-utilization
T	absolute taboo	†	conflict in literature

<sup>1</sup>Data from Bahr et al. 1974; Buskirk 1949; Castetter and Bell 1942; Curtin 1949; Felger, field notes; Fontana 1974; Hrdlička 1908; Moser and Moser, field notes; Rea MS, field notes; Russell 1908; Spier 1933; Underhill 1946.

TABLE 2.—*Ecotone resources.*

GROUP	ECOTONE
RIVERINE PIMA	riparian floodplains/Sonoran Desert
PAPAGO	none (Sonoran Desert)
SAND PAPAGO	none (Sonoran Desert)
PIMA BAJO (lowland)	riparian floodplains/Sinaloa thornforest ( <i>monte</i> )
YUMAN SPEAKERS (Colorado River)	riparian floodplains/Sonoran Desert
MARICOPA (Gila River)	riparian floodplains/Sonoran Desert
SERI	Sonoran Desert/marine
WESTERN APACHE	*desert/coniferous forest (+riparian)

\*Multiple ecotones: mobile people harvesting resources from Lower Sonoran, Upper Sonoran, Transition, and even Canadian Life Zones, with riparian ecotones running through much of these, plus raiding.

Food taboos differ in their "incidence of horror" (Thurton 1978), an emic factor that reflects the amount of aversion expressed or felt by a member of a culture at the prospect of violating a dietary restriction. Aversion ranges from disgust to mere indifference. For instance, with Riverine Pimans the incidence of horror is very high for snakes and lizards, but relatively mild for kangaroo rats and mice. As might be expected, in times of real

nutritional stress (starvation), low aversion tabooed animals may be eaten (e.g., mice by the Papago; Castetter and Bell 1942). The usual reaction to the idea of consuming low aversion animals is simply "We don't eat them." I want to emphasize strongly that the emic decisions governing dietary rules in no way reflect the people's ideas of comestibility. A native consultant will often add, when discussing a tabooed animal, "Well, so-and-so (mentioning another tribe) eats them." I find no evidence in the Sonoran Desert for a clean vs. unclean categorization of foods, nor for an exclusion of animals based on their anomalous status in the native taxonomy (cf. Leviticus; Basso 1973).

A dietary restriction does not necessarily protect an animal from predation. The species may still be taken for its feathers, hide, or medicinal/religious value. Papago hunted Golden Eagles for feathers but never ate the meat, and the entire procedure was surrounded by rigorous sanctions (taboos) requiring purification of the eagle-killer (Underhill 1946).

Sanctions on dietary restrictions vary. With Pimans, violations of certain "dangerous objects" produce "staying sickness." "People contract *ka:cim* [staying] sickness because they have behaved improperly toward a dangerous object which was endowed with dignity at the time of creation" (Bahr et al. 1974: 22). Improper behavior may mean molesting the creature, mishandling its bones, or even accidentally treading on its tracks. Staying sickness of northern Pimans may be caused by such species as the badger, bear, Turkey Vulture, coyote, Golden Eagle, Gila Monster, horned lizard, and gopher. A typical response to a question regarding a potential item in the Piman dietary may be: "We never bother that animal; it makes you sick." Jimson weed (*Datura*) is apparently the only recorded plant that figures directly in a staying sickness taboo. Perhaps among Pimans taboos were associated with all psychoactive plants; this hypothesis needs to be tested.

Some animals are specially protected by their symbolic function in the cultural cosmology. The coyote is one of the 3 principal figures in Piman creation stories. The 2 sibs of the Pima are coyotes and "buzzards," so these animals are never harmed. Other animals are immune because they are reincarnations of the deceased (e.g., Great Horned Owls with the Pima and dogs with the Seri). Rain is an essential factor in the lives of desert agriculturalists, particularly dry farmers. Various plants and animals are incorporated into a complex rain symbolism. For the Papago, eagle down feathers represent rain clouds; saguaro wine, the summer rain. The songs sung during the summer wine feast help "pull down the clouds" (Underhill 1946, 1976). The Hopi of northern Arizona preserve a complex ceremonial rain symbolism. Barton Wright (personal communication) states that the Hopi taboo any animal associated with rain: snakes (lighting symbols), Killdeer, frogs and tadpoles. White Mountain Apache also hold tabooed a number of birds that figure in rain symbolism.

### *The People*

*Riverine Pima*—These Uto-Aztecan people live on the middle Gila, practicing irrigation agriculture and double (if not triple) cropping, at least since the introduction of wheat. Their area receives 25.5 - 38 cm annual rainfall. Aboriginally, much of their resources probably came from the desert/riparian ecotone, though there were low desert mountains nearby for exploitation. Although agriculture was an important aspect of their economic base, they relied heavily on hunting and gathering wild resources. Their hunting categories are complex (Rea 1979b), consisting of local garden hunting (cf. Linares 1976) and communal hunting as well as limited big game hunting.

*Papago*—These Uto-Aztecan people, living to the south of the Gila River and west of the Santa Cruz, were heavily dependent on gathering-hunting, with *ak chin* or *temporal* agriculture during the summer (monsoonal) rains. They lacked access to permanent streams or ecotones. Some Papago were symbiotic with the Riverine Pimans, working for them during harvest time in exchange for food (Russell 1908). The Papago occupied an area receiving 12.5 - 25.5 cm annual rainfall. They were 2-village people, living on the bajadas of desert ranges near water holes in winter, moving to their flood plains fields in summer and

fall. Actually, the "Papago" are a collection of peoples speaking related dialects and sharing a similar subsistence economy. I will consider Sand Papago separately.

*Sand Papago*—The western-most Pimans, the Sand Papago or Sand People, lived nomadically in an area of 0-12.5 cm of annual rainfall where agriculture was virtually impossible. I am considering these separately from the agricultural (*temporal* or *ak chin*) Papago because their subsistence ecology and resource utilization was so radically different (Fontana 1974). Although speaking one of the Papago dialects, the Sand Papago had more in common ecologically with the Seri, and like them, utilized marine and other resources severely tabooed by the other northern Pimans. These are unfortunately the least known of the Pimans, linguistically and ecologically, and the few remnants today appear to be assimilated with other Papago or non-Indians.

*Pima Bajo (lowland)*—This category includes Pimans from south and east of the Papago and Riverine Pimans. At present, most Pima Bajo inhabit montane areas of the northern Sierra Madre Occidental. But at the time of contact and during early missionization they no doubt occupied most of the fertile floodplains of the lowlands. My investigations are entirely with the remnants of the lowland people living on the Rio Yaqui in the village of Onavas, Sonora. Lowland Pima Bajo hunt in the surrounding *monte* (Sinaloan thornforest; see Brown and Lowe 1978) and *temporal* (*ak chin*) farm the narrow floodplain of the Rio Yaqui. Many of their riparian resources are the same as those available to northern Pimans. Lowland Pima Bajo have had 3 centuries of contact with hispanic culture and have almost disappeared as an ethnic/linguistic entity.

*Yuman speakers*—I have lumped in this category 3 related Hokan-speaking groups (Cucupá or Cocopah, Yuma or Quechan, and Mohave) living along the lower Colorado River between Arizona and California. The subsistence biology of these peoples is described by Castetter and Bell (1951). They were floodwater agriculturalists (until the construction of dams) and had available to them perhaps one of the richest floodplains in North America. They were also hunter/gatherers, though most of their resources were probably obtained very locally, as with the Riverine Pimans. At the time of first contact they ranged also up the Gila, their villages interdigitating with these of the Riverine Pimans. I am considering the Yuman-speaking Maricopa (a collection of tribes) separately, even though originally they were Colorado River people.

*Seri*—On Tiburon and the adjacent Sonoran mainland live a hunting-gathering-seafaring people speaking a Hokan language. Their territory has a scanty rainfall and they were totally non-agricultural. In spite of the extreme harshness of the desert they (as well as the Sand Papago) occupied, they exploited the coastal ecotone, rich in protein resources. And as with the Sand Papago, their population limiting factor was probably available fresh water (from springs and *tinajas* or rock tanks). Both Seri and Sand Papago existed as nomadic bands of very low densities, and both were probably hostile to other humans. A considerable body of ethnobiological data exists on the Seri through the work of Moser and Moser, Felger, and others.

*Western Apache*—This group of Athabaskan speakers includes the White Mountain, Cibicue, and Tonto Apache, all of which exploited desert resources for at least part of the year. I have lumped the ethnobiological data for the 3 groups assembled by Buskirk (1949). The Apache arrived in the Southwest fairly late, occupying territory vacated by Puebloan peoples around the fourteenth century.

Western Apache exploited a broad base of resources, ranging from the Lower Sonoran and Upper Sonoran desert, up through the coniferous forests of their mountain retreats. In addition to these Life Zones, they had available the riparian ecotone resources running from mountain to desert as well as other foodstuffs obtained by raiding sedentary agriculturalists (Pima, Papago, Pueblo). Of the 8 cultural entities considered here, the Western Apache had the richest economic base.

*Maricopa*—The so-called "Maricopa" Indians are in reality a collection of Hokan-speaking peoples who took refuge with the Riverine Pima some time early last

century (Spier 1933). They were an agricultural-hunting-gathering people, farming the Gila floodplains near its confluence with the Santa Cruz and later near its confluence with the Salt. In spite of long contact with the Pima, they maintain their Yuman language. They are a poorly studied group as far as their ethnotaxonomies are concerned.

*Major Taboos found in the Southwest*

Below is a culture-by-culture list of dietary prohibitions from the 8 groups of southwestern desert peoples. Certainly these data are not complete, and there are bound to be errors, due primarily to incomplete investigation and faulty understanding of native ethnotaxonomies. Some of the literature has been difficult to interpret, particularly where it was contradictory or gave English glosses of animals that do not occur in the area (e.g., "prairie dogs" and moles in the lower Colorado River Yuman area).

*Riverine Pima.*—Tabooed animals include: skunk, dog, coyote, gopher, Round-tailed Ground Squirrel, kangaroo rat, *Peromyscus*, *Perognathus*, porcupine, herons and egrets, coots, ducks and geese (though these were hunted and eaten more recently, after the introduction of firearms, apparently as a result of Anglo influence), all hawks (including eagles), roadrunner, all owls (especially Great Horned Owl), all lizards and snakes without exception, and grasshoppers. Cicadas were widely eaten by children of a generation past, but older people say this was not an original food. The Pima ate a number of granivorous song birds (Passeriformes), especially Abert's Towhee, White-crowned Sparrow and Lark Bunting, species which proliferated, especially in winter, as a result of land-use practices (Rea 1979a,b). When a Pima dies, he or she becomes a Great Horned Owl, so that animal is never molested.

*Pima Bajo (lowland).*—The data are all from 2 native consultants, a man who hunts and dry farms, and a woman. Ethnotaxonomies are still being investigated, so this is not a definitive list. The positive utilization data are correct but incomplete. Food avoidances include Great Horned Owl, vultures, aquatic turtles, snakes, lizards, but not gophers, which both consultants said were eaten.

Both their ethnotaxonomies and their techniques of preparation of floodplain plants are very similar to those of the northern Pimans. Pima Bajo and Southern Tonto (Buskirk 1949) appear to be the only groups to eat skunk.

*Papago.*—Most aquatic resources available to the Riverine Pima and lowland (also riverine) Pima Bajo were unavailable to the desert Papago: waterbirds (Ardeiformes, Anseriformes), fish, mollusks, raccoon, beaver, muskrat, and aquatic plants. Taboos included bear, dog, coyote, mice, gopher, kangaroo rat, all hawks (including eagles), turkey (shot for feathers but not eaten), Great Horned Owl, roadrunner, all lizards and snakes, aquatic turtles, most insects, and bird eggs. The Papago made an annual pilgrimage to the Gulf of California to obtain salt. The entire endeavor was surrounded by the most stringent sanctions (Underhill 1946). All marine foods (fish, mollusks, marine mammals, crustaceans) were rigorously tabooed.

*Sand Papago.*—This westernmost dialectical branch of the Papago lived in the lowest, hottest, driest territory of any of the Pimans. They dispensed with many of the regular Pima-Papago animal taboos, even the high aversion ones: desert iguana, small lizards, snakes, and probably most small rodents. Marine resources were utilized: clams, oysters, sea turtles, fish, shrimp, and perhaps marine mammals (Fontana 1974). Unlike the Seri, the Sand Papago lacked boats or rafts for more efficient exploitation of marine resources, and some bands ranged far from the gulf coast. Unfortunately, no ethnotaxonomies have been recorded for Sand Papago. They shared with other Pimans taboos on vultures, hawks and eagles (Fontana 1974).

*Colorado River Yuman Speakers (Quechan, Cocopah, Cucupá, Mohave).*—Tabooed animals include: skunk, dog, bobcat, puma, porcupine, peccary, hawks, desert tortoise, mud turtles, perhaps coyote, and probably all snakes. Information on entomophagy is incomplete, but they avoided grasshoppers. Probably all utilized bird eggs except from

tabooed birds. Hrdlička (1908:24) notes that the Mohave ate dogs and occasional badgers, a species of lizard (chuckwalla or desert iguana?), and "even coyotes" but tabooed beaver (utilized by Quechan). Eggs, particularly duck and quail, were an important resource.

*Maricopa*.—The Maricopa are a collection of about 5 Yuman tribes who have lived immediately west of the Gila River Pima since the early part of last century. Their animal avoidance pattern is interesting in that it follows closely that of the Yuman speakers from the Colorado River, rather than the Riverine Pima they have been intimately associated with for a century and a half. The taboos in common with the Colorado River people include: skunk, dog, coyote, bobcat, puma, and bird eggs. They share with the Pima (but not with their Yuman ancestors) taboos on Round-tailed Ground Squirrel and foxes (Kit and Gray). Also like the Riverine Pima (and unlike the rest of the Yumans) they ate peccary or javelina. Maricopa reportedly hunted turkey north of the Salt River (Spier 1933). There are unfortunately a great many holes in the data, particularly with regard to the smaller animals (birds, rodents, reptiles) and Maricopa ethnotaxonomies have never been satisfactorily investigated. Eggs were generally tabooed though one source says they ate quail eggs (Castetter and Bell 1951).

*Seri*.—The Seri ate the eggs of various aquatic birds including gulls, herons, and pelicans. The only birds completely tabooed were the roadrunner and the raven. Owls (even the Great Horned Owl) were occasionally taken. Vultures were eaten only at stress times. Quail and doves were not normally hunted, but might be taken by boys. Coyote meat was eaten during whooping cough epidemics (hence a medicine rather than a food as such?), but none ate domestic dogs, which were considered reincarnated Seri. Two small lizards, the Banded Gecko (*Coleonyx variegatus*) and the night lizard (*Xantusia* sp.) were considered toxic. The northern Pimans also consider the gecko a dangerous animal. The Seri ate 2 large species of rattlesnakes, but not sidewinders nor non-venomous snakes. Low aversion non-utilization categories include grasshoppers, cicadas, mud turtles, and mice. Much of the major protein supply of the Seri comes from marine resources (sea turtles, fish, shellfish, crustaceans).

*Western Apache (White Mountain, Cibicue, and Tonto Apache)*.—Western Apache tabooed bear (generally), dog, coyote, fox, apparently gopher (except in stress times), peccary (as well as pork later), herons, all hawks and eagles, all owls, vultures, all *Corvus* spp., all small lizards and snakes, all fish, and apparently grasshoppers. Southern Tonto might take skunk. Western Apache still eat a great many song birds such as juncos and robins, but certain others are rigorously avoided. If a bird species were tabooed, so were its eggs. All other species were vulnerable to egg predation. My own field experiences of bird collecting with Western Apache indicate that they have more numerous and more rigorous avoidances than any other group in the desert. The absolute restriction of fish eliminated a potentially important food resource, for all the Western Apache country is well supplied with rivers and creeks. The Apache periodically went into the lowlands to harvest plants such as mesquite and saguaro that were unavailable at higher elevations. It would be interesting to know what animals they ate during their forays into the desert.

#### *Observations and Discussion*

No major game animal is tabooed by any desert culture: deer (both species), pronghorn, desert bighorn, jackrabbits, and cottontails. There are proscriptions, of course, on the manner in which certain game may be taken and how the meat, bones, antlers or horns may be handled and disposed of. With the Papago on certain occasions deer have to be strangled or suffocated and numerous restrictions prevent insult to the sacrificed animal (Underhill 1946).

The only animal that might be considered in the category of a major game species which some desert cultures completely taboo is the javelina or collared peccary. Its utilization is problematic. One might even wonder at its range fluctuations during the Holocene. Peccary bones occur in no Southwestern archaeological site, to my knowledge. It is tabooed by Western Apache and Colorado River Yumans but not by Gila River Yumans. But the species

is truly marginal in both of these areas. Western Apache extended the peccary taboo to include the domestic pig (Buskirk 1949). Though an important resource in recent decades to both Desert and Riverine Pimans, it does not figure in their songs or myths (as other game animals do so prominently) and may even be a recent (post-contact) addition to the dietary, if not to the local fauna as well.

Some animals were not sought directly by hunters, but were shot and brought home as food when encountered on hunts. For the Riverine Pima these include: bear, puma, bobcat, jaguar. A similar explanation is given by most of the other desert cultures (cf. Buskirk 1949).

The dog was tabooed by all the desert tribes except apparently the Mohave (*fide* Hrdlička), though it was an important food resource with various other native North American tribes. It is not known whether the San Papago had dogs. The coyote was almost universally tabooed in the desert, the only exceptions being among the Mohave and Southern Tonto (Western Apache). Coyote is one of the most prominent characters in Piman legends. Though he is considered a mischievous trickster and the rest of the community suffers from his behavior, he is never molested. The Kit Fox and Gray Fox (which each have primary unanalyzable names in Pima-Papago) were also not molested, except by the Mohave.

Eurasian herbivores (horse, burro, cow, sheep) as far as I know, were adopted as food items by all the desert cultures, even though the first 2 (horse, burro) were generally tabooed by the cultures that introduced them to the Southwest.

The larvae of the White-lined Sphinx (*Celerio lineata*) were used by all the desert tribes. The host plants for this species are summer annuals that appear during the monsoonal season. This is a large caterpillar, several inches long. It was the only insect regularly taken by desert groups. Its importance might be judged by the facts that there were many preparation methods, the larvae were dried for storage, and the eating of these caterpillars has persisted to recent times, in spite of the aversion of the dominant English- and Spanish-speaking cultures.

Smaller animals (other than lagomorphs) were selectively tabooed or eaten by desert tribes. There appears no ecological imparative here. Let us look at the Riverine Pima for whom the ethnotaxonomies and utilizations are best worked out (Russell 1908; Rea MS). All species of fish, if of sufficient size, were eaten. The ethnotaxonomy of fish probably corresponds one-to-one with our Linnaean species concepts. All lizards and snakes are tabooed, regardless of size. Piman folk taxonomy of lizards, and probably also of snakes, corresponds to our Linnaean species. (I mention this as an aside to point out that ethnotaxonomies do not necessarily reflect utility, at least with Pimans.) Animals with strong totem, moiety or reincarnation symbolism are tabooed: coyote, vulture, owls.

Rodent utilization by the Riverine Pima is instructive and should caution against any simplistic deterministic approach to understanding their dietary restrictions. Round-tailed Ground Squirrels and Pocket Gophers are tabooed and the prohibitions are strong enough to have sanctions (staying sickness and birth defects) attached to them. This makes no sense from an ecological or practical point of view. Irrigation agriculturalists should have benefited by killing and eating the 2 most troublesome species in their ditches and fields. Heteromyid rodents (*Dipodomys* and *Perognathus*) as well as *Peromyscus* (and by extension, introduced *Mus musculus*) are tabooed. But 2 other rodents, the cotton rat, *Sigmodon*, and the woodrat, *Neotoma*, are the most prized of all the Pima animal foods. Metaphysical or symbolic selection of cultural foodways is shown here, not ecological or nutritional dictates.

An ecological factor is involved in what contributed the bulk of animal protein to the Riverine Pima diet. The most frequently taken game included: fish, jackrabbits (2 species), cottontails, cotton rats, woodrat, quail, doves (4 species), and sparrows (2 species). With the exception of the fish, these species have one thing in common: they proliferate as a result of the Pima agricultural and land use practices (Rea 1979a). The overall effect was to have the bulk of the animal hunting taking place close to settlements and fields, rather than in the mountains or bajadas. (There also may be a defensive factor involved here.)

Plant resources appear to be used transculturally by Sonoran Desert peoples. They serve no symbolic function for emic identity. Pan-cultural utilization was probably even more widespread in aboriginal times, but some plant resources (e.g., cattail pollen, ephemeral and wild grass seeds) probably dropped from the dietary because of tedious gathering or preparation methods or habit changes (Bohrer 1975). Among the Pima-Papago, Seri and Western Apache, many native plant foods are regularly prepared by at least the more traditional families, but other plant foods (e.g., *Orobanche*, *Phoradendron*, *Allenrolfea*, *Prosopis pubescens*, *Cercidium*, and *Olneya*) have completely fallen from the dietary.

Even though some of these plants, such as agave, mesquite, and cholla buds require a rather elaborate preparation technology to render them edible, they were important staples in desert diets.

The technology for the storage of seasonally available foodstuffs was probably a major key to survival in the desert.

Plants were undoubtedly an important protein source, at least to the agricultural peoples. Mesquite pods, corn, beans, teparies, and various other seeds appear to have been combined in the diet in such a manner as to supply many essential amino acids (Nabhan 1978).

At least 3 plant products (acorns, saguaro fruit and chiltepinines) were traded to groups that did not have direct access to the plants themselves.

The idea of a 'hand-to-mouth' subsistence economy of nomadic gatherer-hunters (or hunter-gatherer-agriculturalists), maximizing their predation time (at the expense of other cultural elaborations) on marginal resources in tropical forests, deserts or savannas, is a *misconception* foisted on us by frenetic theoretical ecologists or by superficial observers. This concept is utterly false, as has been demonstrated by Lee (1968), Woodburn (1968), Chagnon and Hames (1979), and others who have studied real people living in marginal habitats. The work loads may be sexually disproportionate (as they assuredly are in western cultures!). Survival in harsh environments is not so much a matter of enormous input of *time* into the subsistence economy. Rather survival requires a thorough knowledge of the behavior of culturally selected "acceptable" animals and knowledge of the productivity of and preparation techniques for edible plants.

Taboos are a luxury. I think there are ecological limitations. The relatively rich riverine peoples with agriculture (Pima Bajo, Riverine Pima, Yumans, etc.) could afford to sacralize a good number of animal species, whereas those from the more harsh areas (Sand Papago and perhaps Seri) had to be more generalized in their dietary selections. For instance, the Sand Papago survived because they relaxed a strong reptile taboo of their ecologically richer eastern relatives. A strictly ecological approach (cost/benefits, optimum yield) fails to explain the function and maintainence of taboos, but I think does explain their limitations. Simoons (1967) has warned against the acceptance of facile "biological" explanations for the major meat taboos of the Old World. I would agree with Thurton (1978): "Food taboos will show a certain minimum degree of fit with ecological and technical 'realities.' It is, of course, useful to have such an empirical demonstration, but it does not amount to an explanation of the taboos themselves."

Southwestern Amerindians are *not* the ecologists that some romantic writers would like to make them out to be. They have no qualms about exploiting a species to extinction and undoubtedly *have* in many instances in the past (cf. Paul Martin's Pleistocene overkill theory). The Zuni hunt flickers and orioles extensively to obtain feathers for ceremonial prayer sticks, I am sure with little regard to whether they are decimating the local population. I find it impossible to accept the idea (contra Ross 1978) that an Indian culture invents a taboo in order to protect a game species from extirpation. When the last sea turtle is harpooned in the Gulf of California, the Seri will enjoy the feast just as much as they have its predecessors for centuries.

On the other hand, the native Southwestern people have a strong sense of the sacred. Some animals are sacred, just as are some feathers, some shrines (spaces), some songs, and some ceremonies. This sense of sacred permeates the Southwestern cultures, as anyone who has

had close contact with the still intact societies can hardly fail to notice. Hunting is a prayerful experience, and some animals are attributed powers so great that no person would want to abuse them. The Pima organizer of a rabbit drive will mention the sought after prey only obliquely, for to speak of jackrabbit or cottontail directly would be an insult to them. The Apache demands sexual continence before the hunt. While apparently all the desert peoples felt free to use all available plant resources, animal resources were a very different matter. Each culture (and even sub-culture) selected a repertoire of animals it considered too special for eating. In trying to understand desert food restrictions I am reminded of Eliade's (1959:13) observation:

The *completely* profane world, the wholly desacralized cosmos, is a recent discovery in the history of the human spirit . . . desacralization pervades the entire experience of the nonreligious man of modern societies and, in consequence, he finds it increasingly difficult to rediscover the existential dimensions of religious man in the archaic societies.

### CONCLUSIONS

With the presently available data, incomplete though they are for some Sonoran Desert groups, some tentative answers regarding dietary resource utilization can be given to the 4 questions asked at the beginning of this paper.

(1) Intercultural selectivity appears to be a matter of differential usage of *animal* species with few or no differences in *plant* usage. However, there appears to be a core group of game animals common to the diets of all desert groups.

(2) Generally, dietary selection follows linguistic lines. A Piman pattern is evident between the ecologically dissimilar Pima and Papago, the (unconscious?) rules arising from their shared concept of "staying sickness." The lowland Pima Bajo probably correspond, but the data are yet incomplete. The resource-poor Sand Papago show the greatest departure from the Piman pattern. The Maricopa show many parallels to the Colorado River Yuman pattern, but there are a great many holes in the data preventing a rigid comparison. There appears to be some Piman influence on the Maricopa dietary.

(3) It appears that agriculturalists in the desert can afford more taboos than non-agriculturalists (Sand Papago and Seri), but it is not really possible to isolate the agricultural factor from the ecotone resource factor. Non-agriculturalists appear more opportunistic, maintaining a broader animal resource base. Sonoran Desert agriculturalists still maintained as many wild plant species in their food base as did the non-agriculturalists (though there undoubtedly were differences in importance values). Stated differently, agriculture is superimposed on gathering, rather than supplanting it as in Anglo-American culture.

(4) The origin of dietary restrictions is problematic, but I believe they function first as symbols of group identity and cosmology. (Note that non-Piman Amerinds cannot contract staying sickness!) Contra Ross's hypothesis for Amazonian groups (i.e., that perpetuation of animal taboos can be resolved in terms of cost-effective strategy of optimum yield), I believe there is no ecological determinism in the Sonoran Desert, but that there are ecologically imposed limits to dietary selectivity.

The most important biological question about any group of people is: How did they make a living within the constraints of the ecological environments? We have only just begun to study the cultural adaptations of these various desert peoples. Pioneer ethnobiologists such as Lyndon L. Hargrave and Alfred F. Whiting have pointed us in the right direction. But we must work fast to learn what we can about these precious remnants of native desert cultures before they are totally assimilated (linguistically and ecologically) into the mainstream of the maladaptive technological societies temporarily occupying (but not adapting to) the desert.

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## APPENDIX: Animal Taboos in Anglo-American Culture

Some people seem unaware of their own rules of dietary selectivity. The bulk of Americans living in the United States follow a powerful (though perhaps unconscious) set of rules which in concert govern animal taboos. These may be formulated as follows:

1) *Vegetarian animals are acceptable; non-vegetarian species are tabooed.* (e.g., cows and chickens vs. coyotes and hawks.) Non-vegetarians include scavengers, predators, and carnivores.

2) *Vertebrates are acceptable; invertebrates are tabooed.* (e.g., fish, birds, mammals vs. insects, worms.) Marine crustaceans (which also violate rule 1) and marine shellfish are standard exceptions.

3) *Non-pets are acceptable; pets are tabooed.* (e.g., cow, chicken, perch vs. horse, pigeon, duck, goldfish.)

4) *Domestic animals are acceptable; wild animals are tabooed.* (e.g., cow vs. deer.) An arbitrarily defined category of "game" animals may be taken by some (but never sold), yet much wild game (bobcat, mountain lion, rodents, coyote, bear, doves) never reaches an American table.

5) *Muscle tissue is acceptable; organs are tabooed.* (e.g., roasts and other meat cuts vs. intestines, pancreas, gonads, brain.) Liver is the standard exception. Note that in the Anglo-American folk taxonomy "meat" when referring to food is synonymous with "muscle tissue."

As a result of these rules, strictly tabooed for the vast majority of U.S. Americans are: dog, cat, horse, burro, rodents, crayfish, bear, songbirds, insect larvae, snakes, lizards and many so-called game species. Rigorous legal sanctions prohibit commercial establishments (markets and restaurants) from violating these cultural taboos.

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