THE TULARE LAKE BASIN: AN ABORIGINAL CORNUCOPIA

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"Together with the Tulare Lake Basin the lower Kaweah River and its delta from Lemon Cove to below the town of Tulare was probably one of the most densely populated spots in California, or possibly even north of the Valley of Mexico."1

The Tulare Basin’s former ability to support unusually dense populations of California aborigines (known as Yokuts)2 has long been recognized by anthropologists.3 This consensus is based upon historical observation, ethnographic inquiry, and the recognition that the Tulare Basin (here defined as the Valley portion of Tulare and Kings Counties) once offered a cornucopia of resources for its prehispanic inhabitants (Figure 1).

Inconveniently, material evidence of the Yokuts and their lifeways has been almost entirely obliterated by the dramatic landscape alterations which have occurred since the first Europeans arrived in the Basin. As a consequence, efforts to assess the actual number of Yokuts who once dwelled there have been assisted only marginally by archaeological data. Similarly, due to those same environmental alterations, tangible evidence of the Basin’s natural fertility is equally scant. Post-European landscape changes have

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FIGURE 1. The Tulare Lake Basin
been of such magnitude that researchers—on the basis of the inordinately large number of Yokuts known to have lived in the Basin during the early historical period (i.e., after 1769)—have frequently assumed a rich environmental foundation. Initially, this assumption of environmental fecundity was strengthened by the few early descriptions of Basin landscapes. Later, it was reinforced by scholarly efforts to reconstruct the aboriginal environment.

These noteworthy attempts at environmental reconstruction, derived from historical recollection and ecological methodologies, tried to determine local detail (for purposes of quantifying nutritive resources) in a land where detail had all but vanished. Indeed, the sheer magnitude of change in the Basin leaves any attempt at precise reconstruction untestable and, as a consequence, questionable. Though admirable in their own right, these reconstructions commonly ignored the larger topographic and climatic influences which controlled the nature and content of biological resources available to the Yokuts. Thus they also often ignored the specific environmental variables which were most crucial to sustaining human populations. Even without detailed ecological reconstruction, however, a comprehension of these larger geographic processes leaves little doubt of the Basin’s special ability to nurture very large populations of foragers.

The intent of this paper is to examine these larger geographic processes and by doing so to demonstrate why the Tulare Basin’s geography was absolutely ideal for an aboriginal foraging society. When examined in light of such traditional geographical perspectives as relative position, proximity, and scale, the Basin is revealed as a lush land—a land containing an unsurpassed biological diversity that was complemented by climatic and hydrological conditions which optimized the harvesting of food. The combination of these variables proved to be ideal for the large number of Yokuts actually observed in the Basin, and probably for
many more who perished long before foreigners had the opportunity to observe and count them.

**Early Recognition of Geographic Uniqueness**

"... the woods here seemed to be swarming with Indians."5

Owing in considerable measure to its central position, the stubborn residual presence of Yokuts, and the quantity of Hispanic and American reports, the Basin figured prominently in efforts by early ethnographers to determine aboriginal populations for the state as a whole.6 The Basin was a land removed from most of the direct ravages of missionization, yet close enough to the mission strip to be readily observed by both initial Hispanic and later American forays. These early accounts often included remarks about the Yokuts who called this land home. More sophisticated efforts to refine the region's demographic landscape were first undertaken by Sherburne Cook and Martin Baumhoff.7

Recognizing the limitations inherent in the early ethnographic estimates,8 and given the paucity of archaeological evidence, Cook relied almost exclusively upon information gleaned from detailed and exacting analysis of historical documents. These were comprised primarily of Hispanic records for the years prior to 1840, and chronicles of the various efforts by Americans during the late 1840's and early 1850's to determine the number of souls residing in their new domain.9 Although never claiming to base his calculations on the carrying capacity of the land, Cook would attempt to fill observational voids by extrapolating population densities from areas of known populations (well documented) and then infer populations for Yokuts sharing similar but inadequately documented environments. To his credit, Cook's attempts at area comparison were wisely qualified with the recognition that "... the dry and arid plains of modern Kings, Tulare, and Kern counties bear little or no resemblance to the former region of rivers, sloughs, swamps, and lakes which once supported uncounted mil-
ions of game birds and animals, together with a luxurious vegetation capable of supporting a very dense human population.”

Cook’s estimated population for the Tulare Lake Basin—a startling 18,600—is regionalized in Figure 2. His cumulative estimate for the entire San Joaquin Valley was 83,820, astounding in comparison to the readily accepted population of 18,000 forwarded earlier by Kroeber or even the 52,800 suggested by Merriam. Ultimately on the basis of this, and subsequent studies, Cook proposed a statewide aboriginal population of 310,000.

In 1963, Martin Baumhoff published a work which tested both the validity of Cook’s demographics and the value of an ecological approach. Baumhoff proposed to establish the degree to which population size and density of hunters and gatherers were dependent on available amounts of certain food products. In order to accomplish his goal, a reconstruction of the aboriginal resource environment was required. A variety of sources were synthesized in order to re-create the vegetative environment of several California regions, including the Tulare Basin. From this, a faunal component was rationally inferred as a base for quantification of a carrying capacity. Using calculations based solely upon coefficients for acorn and game staples, Baumhoff was easily able to verify Cook’s numbers (considered the “actual”) for the Basin. Actually, Baumhoff’s calculations substantiated greater numbers than those forwarded by Cook; and he subsequently chose to roll back the environmental carrying capacity (by reducing the amount of acorns and game) until his numbers conformed with Cook’s. Baumhoff’s respect for the strength of Cook’s scholarship is understandable; but a more thorough re-construction of the Basin’s environments would suggest that, if anything, the acorn and game ratings should have been raised.

Both Cook and Baumhoff accepted two assumptions which not only reflected—and still reflect—contemporary
Although the Yokuts shared a common set of resource perceptions and technologies, the habitats of the basin responded differently to human attentions and thus afforded different carrying capacities.
conventional wisdom, but also had constraining impacts upon their demographic conclusions. In keeping with tradition based upon previous scholarship, both men accepted the thesis that aboriginal life persisted in a pristine state within California and the valley proper right up to missionization. The second assumption, based on the concept of Malthusian Equilibrium, was that pre-contact populations were in dynamic equilibrium at a stable maximum in relationship to their environment. The following analysis of the Basin’s geographic attributes demonstrates the inadvisability of accepting either of these assumptions or, for that matter, the demographic estimates which they constrain.

Optimal Foraging and Geographic Reconstruction

“In the entire San Joaquin Valley there was probably no more thickly settled district than that surrounding Tulare Lake and the Kaweah River branches, and certainly none more suited to the needs of primitive man.”

Baumhoff in 1963 did not agree with Latta’s assessment of the Basin’s aboriginal fertility. He had calculated much denser populations for the San Joaquin and Sacramento drainages, where a fish component was integrated into his calculations. Yet even without a thorough recognition of the Basin’s carrying capacity, Baumhoff, utilizing only the coefficients of game and acorns, clearly validates Cook’s revolutionary numbers. Taking a step beyond that to factor in the major geographic attributes of the Tulare Lake Basin not only reveals a land capable of sustaining a far greater number than either Baumhoff or Cook imagined, but also tends to substantiate Frank Latta’s assertion that the Basin had few rivals.

Our examination of the Basin’s aboriginal geography will focus on regional processes and conditions directly relevant to Yokuts’ subsistence. In large measure, these elements have been determined by documented evidence (archaeological, ethnographical, and historical) on the one
hand, and a perspective originating in optimal foraging theory on the other.23

Central to the optimal foraging approach is the assumption that hunting and gathering populations are limited more by the degree of nutritional intake than by cultural explanations such as birth control. In essence, any resource gathering decision, or environmental parameter, which effects procurement of food will in turn effect and determine survival and reproduction ("fitness" in the lexicon of the socio-biologists).

Although the model is controversial, even its detractors have little problem with the latter interpretation.24 This less controversial perspective is imminently useful and enormously valuable in an effort to pinpoint the environmental geographic variables most important to an understanding of aboriginal subsistence. Thus the following reconstruction emphasizes those variables which influenced the Yokuts' ability to acquire life sustaining resources and—through reasonable inference—their population size.

A Fortuitous Position and Proximity

"Deer, rabbits, and gophers could be hunted in the mild winter as well as in summer."25

A unique blend of geologic and climatological processes combined to sculpt an environment in a geographic position which captured a great lake and also nurtured an enormous population of Yokuts.26

The Basin's geographic position has strongly influenced its climate and, by extension, its life-supporting environments. A southerly location (Latitude 36° N) on the western edge of a mid-latitude continent yields a climatic regime characterized by warm, dry summers and cool, moist winters.27

Removed somewhat (by the Coast Ranges) from the moderating influences of the sea, Basin Yokuts endured warmer summers and colder winters than their neighbors
on the coast. Yet the thermal and snow-free environment of this subtropical latitude permitted active and unimpeded year-round resource gathering. Both lakes and streams remained unfrozen and continued to yield an abundant winter return to talented Yokuts foragers. Thus the Basin’s Yokuts inhabited a land where exposure to seasonal vagaries of climate only rarely hindered their pursuit of nutrition or threatened their livelihood.

Lying as it does in a trough behind the Coast Ranges, which lie athwart the prevailing westerlies, a rainshadow is cast eastward, over the western portion of the Basin (Figure 3). This effect accentuates moisture differences between the dry west and moister east. In turn this moisture regime is the principle determinant of the Basin’s biological patterns. Disallowing, momentarily, for the exceptions created by

![Figure 3. Average Annual Precipitation. Annual rainfall on the floor of the basin varies from less than six inches near the trough to more than fourteen inches near the foothills.](image)
surface runoff, the vegetative environments are roughly aligned in a north-south direction, with species diversity and density increasing with precipitation toward the east (Figure 4). These conditions would have yielded a striking east to west decline in foraging potential if not for the convenient ameliorating affects of runoff.

The relative paucity of precipitation on the west side, and its complete absence during summer, is more than compensated for by the winter entrapment and storage of snowfall on the western slopes of the Sierra Nevada. As the snow thaws in spring and summer the water is conveyed to the Basin through a network of perennial streams (Figure 5). The amount and timing of discharge from the

![Figure 4. Biotic Zones, circa 1769. Natural vegetation zones roughly parallel the north south contours of precipitation, temperature and elevation. Diversity increases away from the valley trough, although vegetation patterns are complicated by surface and subsurface water availability.](image-url)
Fig. 5. Surface Hydrology, circa 1769. Fed primarily by melting snow in the wetter climates of the Sierra Nevada, basin streams empty into a large, shallow lake. Swamps and swampy sloughs border the lake, especially in spring and early summer.

east was fortuitous and had an immense impact upon the resource geography of the Basin. In essence, the volume of water was at a maximum during the high sun or growing season. Riparian and adjacent flood zones (overflowed lands) were naturally irrigated and supported a lush floral habitat for both animals and Yokuts. Resource disadvantages experienced by western Yokuts due to aridity were thus offset by these verdant tendrils of biotic richness which extended westward, crosscutting the general biotic pattern.

An even more important compensation for western aridity is Tulare Lake itself. By virtue of its position to the west of center, this teeming pool of resources wetted the most arid zone. Size and seasonal fluctuation exaggerated a resource bounty whose effects rippled beyond the realm of
shoreline Yokuts to habitats farther afield. The influence was even subterranean. The lake contributed to unusually high levels of groundwater which extended beyond its shores and helped to account for a larger concentration of acorn bearing oaks than elsewhere in the San Joaquin Valley.31

The average size of Tulare Lake, as it existed since circa 1500 A.D., is shown in Figure 5. However, during late spring and early summer the lake would expand enormously and usually spill over into the San Joaquin drainage through Fish Slough.32 This frequent occurrence allowed an intrusion of additional protein to the Basin and its Yokuts from a foreign environment (the Pacific Ocean). Noteworthy in this respect was the entry of migrating salmon, steelhead, and sturgeon into the lake and their subsequent entrapment as the lake receded in late summer and fall.33 In turn, these exotic species migrated into Basin streams and further enhanced the fish resource available to Yokuts living some distance from the lake shore.34

The seasonal waxing and waning of the shorelines was a function of both hydrology and low relief (the lake had a maximum depth of only forty feet during high water). This exceptionally shallow lake provided wide, biologically rich, and easily accessible shorelines.35 The seasonal shifting of these spacious shores exposed resources (mussels, eggs, fish, tules, cattails) of considerable abundance and worth to the Yokuts.

Resource disturbances caused by the climatic anomalies (droughts and floods) characteristic of Mediterranean regimes were cushioned by these same hydrologic and geomorphic properties. During unusually dry conditions a contracting lake would have exposed once inaccessible portions (new marshy shorelines) of the lake floor and concentrated aquatic species for easier capture.36 On the other hand, the inconvenience of floods produced expanded lakeside edges which extended the resource bounty onto the eastern plains and up the streams.37
The Basin’s geographic position, in combination with a unique hydrologic setting, brought the Yokuts even greater subsistence advantages by way of the atmosphere. Situated beneath the major west coast flyway, countless migrating waterfowl (geese, ducks, swan, pelicans) found the Basin’s mild temperatures and unfrozen water bodies (streams as well as lake) ideal for resting, nesting, and feeding. Waterfowl and non-aquatic migratory species (dove) arrived from the north and south by the millions. In fact, no season of the year was devoid of arrivals and departures. Many of the species were gregarious and provided a ready source of protein (meat and eggs) for the Yokuts, who demonstrated considerable expertise as fowlers.

Augmenting this longitudinal stream of resources was a latitudinal flow of both atmospheric and terrestrial species whose migratory cycle exhibited a shorter range of movement between mountain and Basin habitats. In this fashion diets were seasonably embellished by gregarious species such as wild pigeons, deer, and antelope. Due to their close proximity to the adjacent highlands, the Basin’s Yokuts could and did do more than wait passively for the seasonal arrivals of these sources of protein. Relatively short upslope forays yielded a great variety of life-sustaining resources (flora and fauna). Even when direct access to such resources was hampered by territorial restraints involving foothill tribes, the resources were usually available through trade.

Territorial Sufficiency on a Small Scale

"The distances ranged over were minute."  

There can be little, if any, doubt that the Basin’s Yokuts benefitted from the proximity of relatively exotic materials on the flanks of nearby mountains. These were, however, supplemental. The diversity and quantity of resources in the Basin proper was more than sufficient to sustain not just the accepted aboriginal numbers but many more. The existence
of an overall sufficiency does not imply that the subsistence potential was uniform throughout the Basin. Certain environments (lake shores and riparian zones) were considerably more productive than others (grassy plains), and that reality is expressed in Yokuts' demography (see Figure 2).

Various regional and seasonal shortcomings were easily overcome as a function of scale. Environments ranging from arid plains to verdant lake shores were all concentrated in a compact region of approximately fifty by fifty miles. Owing in part to this pattern of resource diversity, a quilt work of sixteen self-sustaining tribes, each with access to numerous biotic zones, emerged within this rich environmental matrix (Figure 6).43

When one set of resources was diminished by seasonal

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**Figure 6.** Known Yokuts Villages, Territories, and Language Areas, circa 1769. Tribal territories and settlement patterns varied in accordance with the carrying capacities of Yokuts habitats. Villages were close together and territories small in the Kaweah Delta, more widely spaced elsewhere.
climatic change or over exploitation, Yokuts would switch to another environment within their tribal boundaries where chosen resources were ripening or more seasonally abundant.44 If a preferred commodity was not locally available within a given tribal area, arrangements (trade and sharing) would be made to provide access to resources beyond tribal boundaries.45 If the appropriate season was at hand, numerous species (elk, antelope, fish, waterfowl) ignored tribal sovereignty and migrated across tribelet boundaries, making external arrangements and forays unnecessary.

Indeed, whether the quest for life-sustaining resources involved internal circulation within tribal boundaries or external exchanges, the enormous environmental diversity available within short distances kept movement by Yokuts to a minimum. Thus energy which might otherwise have been expended on travel could be conserved or diverted to other resource pursuits close to home.

**Approaching the Demographic Optimal**

“*There is plentiful game, such as deer, antelope, mule deer, bear, geese, cranes, ducks and many other species of animals, both terrestrial and winged.*”46

Like most California aboriginal groups, the Yokuts were extremely omnivorous.47 The Basin’s geographical attributes of position, proximity, and scale provided a rich and accessible environmental *smörgåsbord*, which yielded great nutritional returns for a people engaged in foraging. Given the lack of intensive geographic reconstructions elsewhere in the state, it is difficult to assert categorically that the Basin was more advantageous to prehispanic foragers than other regions. Nevertheless, the special geographic advantages discussed in this paper were largely responsible for the inordinately dense populations generally accepted for the Basin.

This treatment does suggest that previous estimates—most notably Cook’s and Baumhoff’s—of the Basin’s ab-
original carrying capacity fell far short of what actually existed. In nearly every broad category of foodstuff (acorns, game, grass seed, birds, fish) the quantity and spatial distribution was greater than previously recognized. Important as well were the ideal conditions which facilitated relatively easy year-round access to these foodstuffs. How this might translate into numbers of additional Yokuts is essentially a futile exercise in conjecture, except on one point—fish. As noted earlier, the only quantitative attempt at reconstruction was undertaken by Martin Baumhoff. Using only acorns and game as staples, he was able to substantiate more than the "actual" numbers (18,600 Yokuts) calculated by Cook. In areas where fish were factored into his calculations, such as the San Joaquin and Sacramento drainages, densities of aborigines were higher than in the Basin.48 In retrospect, Baumhoff's failure to identify a fish component is unfortunate; for analysis of the archaeological, ethnological, and historical evidence clearly demonstrates both the presence and importance of anadromous species in the Tulare Basin.49 This account of the Basin's peculiar hydrologic regime only reinforces that assessment. By factoring the fish component into Baumhoff's formulations (treated in another paper), the carrying capacity of the Basin is radically raised from 18,600 to 35,000 Yokuts.50 By accepting the higher number, the Basin's aboriginal densities easily match—and in most cases surpass—all other regions in the valley and state, just as Cook and Latta long ago surmised.

The immediate implications for the aboriginal demography of other regions within the state where resources may have been underestimated are profound. Yet the anomaly still exists. Why are the numbers derived ecologically (35,000) inconsistent with Cook's calculations (18,600) based upon historical observation and reasonable inference? Was Cook's methodology unsound? I believe not. Cook's methodology and estimates are not inconsistent with the revised estimates. His assumptions are, however.
Conclusions

"From the extreme northern part of the Sacramento Valley to the Tulare Lake, death had obtained a victory as unequalled, as it was unknown by nearly all, except the recording angel."

The assertion that Basin Yokuts were in equilibrium with their environment and were in a pristine state until 1769 is questionable. Conventional wisdom, adopted by both Cook and Baumhoff, holds that the Yokuts were somehow maintaining their population well below carrying capacity. Conscious, cultural limitation of growth in the face of relative resource bounty, however, has little precedence. The glaring absence of population curtailment in the ethnographies would seem to indicate that Basin Yokuts displayed little concern for controlling their population in order to prevent future resource shortages.

Yet the dilemma remains. Even if the Yokuts were not living at a stable equilibrium with their environment, they evidently had not filled the Basin's demographic capacity by historical times. If cultural curtailment of population is eliminated, how then can the difference between the observed and potential be reconciled? Could it be that the Yokuts viewed by the first Europeans—the basis of Cook's estimates—were simply remnant populations? It is, in fact, quite probable that Cook was estimating demographics for a population long since culled by the ravages of European disease.

Given the large differences between observed populations and the Basin's enormous carrying capacity, the widely held view that California aborigines remained unaltered until mission times is at best tenuous. Nor does this view sit well in light of the documented spread of disease elsewhere in the New World. The rapid dispersal and catastrophic impact of European-induced diseases throughout Central America and eastern North America during early colonial times is well documented, as is the spread of rapacious diseases in Baja California and northwestern Mexico from
the sixteenth through the eighteenth centuries. The view that epidemic diseases rippling northward from Mexico somehow stopped at the frontier of Alta California at the very least is questionable, if not unbelievable. Similarly the assumption that landings by such voyagers as Cabrillo (1542), Drake (1579), and Viscaíno (1602-1603) occurred without demographic consequences goes against colonial precedence. In light of densities, sedentism, and frequent intertribal exchanges, California’s aboriginal populations were in all probability highly susceptible to disease transmittals. The simple circumstance that interior Yokuts were first observed at numbers substantially lower than the environment would allow provides strong evidence that they were neither pristine nor in equilibrium at the time of the founding of Mission San Diego in 1769.

The Tulare Basin’s advantages of relative position, proximity, and scale were truly optimal for those aboriginal foragers who dwelled there. Their dense numbers were illustrative of these geographic advantages. The true potential of the Basin as a foraging cornucopia, however, was known only by Yokuts prior to 1492.

NOTES


2. The Yokuts were the aboriginal inhabitants of the San Joaquin Valley first encountered by people of European ancestry. Their ancestors, who belonged to the larger Penutian language family, entered the valley around five thousand years ago and through time became proficient harvesters of the valley’s natural resources. See Melvin C. Aikens, “The Far West,” Ancient Native Americans, edited by Jesse D. Jennings (San Francisco: W. H. Freeman, 1978), p. 139.


6. As a function of its position within the Central Valley, the Basin with its curious fluctuating lake has long straddled an important pathway for people originating in foreign lands. See Merriam, op. cit., note 3, p. 594; and Alfred L. Kroeber, *Handbook of the Indians of California* (Berkeley: California Book Company, 1925), pp. 490-491.

7. Cook, op. cit., note 1; and Baumhoff, op. cit., note 4.

8. Ethnographic estimates were proposed by several individuals, among them: Stephen Powers, *Tribes of California* (Berkeley: University of California Press, 1976; reprint of 1877 original) p. 419; Merriam, op. cit., note 3; and Kroeber, op. cit., note 6, pp. 490-491.

9. Cook, op. cit., note 1, p. 32.


11. See Kroeber, op. cit. note 6, pp. 488-491 and 880-891; also Merriam, op. cit., note 3.


15. As a fundamental data base, Baumhoff relied heavily upon Wieslander and Jensen's 1945 map of vegetation types and Levi Burcham's ground-breaking reconstructions produced in 1957. See A. E. Wieslander and H.A. Jensen, *Vegetation Types of California* [map] (Washington D.C.: U.S. Department of Agriculture, California Forest and Range Experiment Station, 1945). See also Burcham, op. cit., note 4, pp. 79-96. These sources were complemented by soil and irrigation surveys.

17. Baumhoff, op. cit., note 4, pp. 216 and 221.


20. Cook addressed the possibility of pre-mission influence; but lacking definitive data concerning the impact of disease, he chose to adhere to prevailing conventional wisdom. See Cook, op. cit., note 1, p. 31.


23. The thinking behind optimal foraging is based upon the premise that humans are genetically programmed to exploit resources in a fashion similar to other organisms and, therefore, will forage with the sole purpose of maximizing nutritional intake. Conventional wisdom, on the other hand, has always held that foragers strive to minimize their foraging time, an alleged trait applicable only to humans. Perceived in this fashion, the forager is always predicted to choose the "optimal" or best strategies that maximize nutritional gain and minimize the costs relative to gain. See Gary E. Belovsky, "Hunter-Gatherer Foraging: A Linear Programming Approach," *Journal of Anthropological Archaeology*, Vol. 6 (1987), pp. 31-32. It is argued that optimal behavior increases survival chances and releases valuable time for other important life-supporting activities. For a discussion of this argument see G. A. Smith, "Human Adaptation and Energetic Efficiency," *Human Ecology*, Vol. 7 (1979), pp. 53-74; see also David Webster and Gary Webster, "Optimal Hunting and Pleistocene Extinction," *Human Ecology*, Vol. 12 (1984), pp. 275-289.

24. In the 1970's and 1980's numerous groups of foragers have been re-examined through the perspective of optimal foraging. To the distress of purveyors of conventional wisdom, an unsettling accordance between the predicted (by the optimal foraging perspective) and the observed (concerning the concept of limited


26. Topographic down warping structurally differentiates the Tulare Lake Basin from other Central Valley environments. The resulting interior drainage of this basin-within-a-valley would impound the waters of the Kings, Kaweah, Tule, and White Rivers, as well as Deer Creek, to form Tulare Lake.

27. Although the seasonal regime of moisture and drought resembles Mediterranean conditions, the low rainfall and cooler winters qualify most of the Basin for a semi arid classification; and the western portion is virtually a climatic desert.

28. Winter temperatures rarely drop below freezing (mean January temperatures range between 32° and 56° F). Therefore, foraging time is not unduly constrained by the physical environment because a forager’s thermal equilibrium is easily maintained. See Belovsky, op. cit., note 23, p. 38.

29. Once again the Basin’s location is optimal. The highest peaks of the Sierras (exemplified by Mount Whitney at 14,494 feet) are situated directly to the east, which endows them with a heightened moisture catchment potential from passing storms. In addition, elevational changes between valley and mountains are more pronounced on the eastern margins of the Basin than elsewhere in the Central Valley. This exceptional change in relief produced sharper biological differences over short but accessible distances from the Basin’s flatlands. For a good study of Tulare County’s physical geography, see James T. Scofield, “Physical Geography: A Study of Tulare County, California” (Unpublished M.A. thesis, California State University, Fresno, 1967).
30. The axis of the San Joaquin Valley lies to the west of center and is relatively close to the Coast Ranges. The streams which descended from the Sierra foothills fed lakes (Buena Vista, Kern, Goose, and Tulare) which were impounded along the western edge of the southern valley.


32. Even during the early American period when colonists were busy diverting and blocking runoff to the lake, it continued to overflow in all but eight years between 1852 and 1879. See Frank F. Latta, "Little Journeys in the San Joaquin," a 1937 compilation of newspaper accounts held in the California State Library, Sacramento, (no page numbers).


34. The presence of these anadromous species would seem to qualify the Basin for the fish coefficient which Baumhoff failed to attribute to the land in his attempt to quantify carrying capacity. See Preston, op. cit., note 18, p. 26.

35. Not only do shallow lakes produce far more biomass than do deep lakes of equal spatial extent, but also they facilitate harvesting over extensive shoreline areas. See M. L. Weide, "Cultural Ecology of Lakeside Adaptation in the Western Great Basin" (Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles, 1968). Uncle Bud Askers (early 1850's) observed Yokuts wading in for a mile or more in their quest for clams [mussels], and yet they were treading waters only six to eight inches deep. See Latta, op. cit., note 32.

36. The Yokuts displayed a sophisticated variety of fishing techniques but owing to the lake's shallowness were often able to take fish in a most simple manner. In 1854 and 1855 Hank Hawn observed Yokuts catching lake trout of up to 40 pounds with their bare hands. See Latta, op. cit., note 32.


38. For information concerning the Basin's diverse variety of birds,


40. Gayton, op. cit., note 39, p. 56; and Latta, op. cit., note 32.


42. Kroeber, op. cit., note 6, p. 524.

43. Kroeber, op. cit., note 6, p. 474.

44. In stark contrast to the arduous seasonal migrations of native Americans who lived in less diverse environments (e.g., plains tribes) the longest seasonal migrations conducted by the Yokuts rarely exceeded ten to twenty miles—a day’s walk. See Kroeber, op. cit., note 6, p. 480.

45. Kroeber, op. cit., note 6, p. 480.


47. Kroeber, op. cit., note 6, p. 523.


49. Preston, op. cit., note 16, pp. 91-95.


51. Quoted is the 1832 observation of “Trapper” as he surveyed the consequences of a malarial epidemic which swept the valley. In S. F. Cook, “The Epidemics of 1830-1833 in California and Oregon,” *University of California Publications in American Archaeology and Ethnology*, Vol. 43 (1955), p. 319. In this author’s view the epidemic was only the latest in a series which may have first devastated California aborigines as early as the 1500’s.

52. Some contemporary researchers have simply discarded the concept of equilibrium. Closer examination of hunting and gathering peoples reveals constant change in the interaction between popu-
lation and environment. Generally, populations are found to increase even when cultural mechanisms are utilized. See Mark Cohen, *The Food Crisis in Prehistory* (New Haven: Yale University Press, 1977), p. 420.

53. Gayton, op. cit., note 39, p. 101. There is no mention in the ethnographies of widespread birth control being used by the Yokuts.

