NATIONAL WILD TURKEY FEDERATION

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June 17, 2004

FILE COPY

Bradley Nuremberg
County of Los Angeles Fish and Game Commission
500 West Temple Street, Room 383
Los Angeles, CA 90012

AGENDA ITEM 4a

JUL 15 2004

Dear Mr. Nuremberg:

Please find enclosed the final report on the La Brea wild turkey osteological comparison project. The results are interesting and prove conclusively the close relationship of the ancient California turkey and the modern wild turkey. We at the NWTF thank you very much for your participation and for your support of this project.

If you have any questions or comments, please contact me as listed below.

Sincerely,

Tom

Tom Hughes

NWTF Biologist

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enclosure:

Cc: Rick McLeod, Donna Leggett

THE EXTINCT CALIFORNIA TURKEY,

Meleagris californica

Interim Final Report on the Rancho La Brea Collection, California

Prepared For the National Wild Turkey Federation

By

Zbigniew Bochenski and Kenneth E. Campbell

1 April 2004

Of all the bird taxa known from Rancho La Brea, the extinct California Turkey, *Meleagris californica*, is the second most common species, outnumbered only by the Golden Eagle, *Aquila chrysaetos*. The California Turkey was first noted in a publication in 1909, and the description of the fossil turkey from Rancho La Brea and its possible relationships to modern turkeys have been the subjects of several important scientific studies. However, the difficulty and complexity of this task are reflected in the evolution of scientific names used to describe the very same species of bird over the past nearly one hundred years (i.e., *Pavo californicus*, *Parapavo californicus*, *Meleagris californica*). Until now the question of the systematic status of the extinct California Turkey has remained open despite the abundance of its remains from the Rancho La Brea tar pits, partly because the results of all previous studies were based on comparisons with relatively few modern specimens. The present study determined that the extinct California Turkey is definitively a distinct species, but one closely related to the living Wild Turkey, *Meleagris gallopavo*. Further, the relationships among the living species of turkeys and the recognized extinct species of turkey that lived in the late Pleistocene are very complex and suggestive of a common origin. This study also shows that individual variation in modern and fossil turkeys is very large, and, therefore, any reliable research on this particular group of birds should be based on a large series of specimens.

This study was carried out on the very rich and well-preserved collection of fossil turkeys from the tar pits at Rancho La Brea, California. Before conducting the research, the curation of the fossil material had to be completed. This included searching for turkey bones among the tens of thousands of unidentified remains stored at the Page Museum, identifying and labeling the newly found bones, checking off the old bones in the inventory, and updating the entire database. In all, the curation took approximately three months to accomplish, but without it the picture of the turkey from Rancho La Brea would be incomplete. Page Museum volunteers assisted in this effort, significantly reducing the time required to complete the task. As a result of this curation effort, the recognized size of the collection of fossil turkeys at Rancho La Brea increased by over 2,000 specimens, from about 9,000 specimens to more than 11,000 specimens representing at least 700 birds. Previously, the least number of birds represented was 599.

The collection of modern comparative skeletons comprised 50 specimens of the Wild Turkey *Meleagris gallopavo*, with all five living subspecies (i.e., *silvestris*, *osceola*, *intermedia*, *merriami* and *mexicana*) represented. These specimens were prepared by bacterial maceration, catalogued, and had all bones numbered prior to the initiation of the study. These specimens comprise the most numerous and best prepared collection of modern Wild Turkeys in the world, which means that all future osteological studies on turkeys will have to include the specimens from the Natural History Museum of Los Angeles County. In addition, 20 specimens of the Ocellated Turkey, *Meleagris* [*Agriocharis*] *ocellata,* were borrowed from five other US ornithological collections and included in the comparisons. However, most of the skeletons of the Ocellated Turkey were from zoo birds, rather than wild birds, and their osteological features might well have been affected by a "zoo lifestyle."

All major skeletal elements and several minor bones, such as some wing and leg phalanges, were included in the study. Each type of bone was carefully examined for unique morphological characters that would distinguish the three species involved, i.e., the California Turkey, Wild Turkey and Ocellated Turkey. The characters studied included size, shape, and position of bone structures and the attachment scars of muscles and tendons. Because of the very large degree of individual variation and an overall similarity between the species, it soon became apparent that finding good osteological characters differentiating each of the species would be difficult. Of the nearly 100 working characters initially identified as potentially useful for separating the various bones of the three species, only about half that number were considered valid at the end of the study. In most cases some exceptions (i.e., individuals with a condition at variance with most of the other specimens of a species) had to be recognized.

Valid differentiating characters were found on all bones but one, the exception being the pelvis. The Ocellated Turkey had the most unique characters, which served to distinguish that species from both the extinct California Turkey and the modern Wild Turkey. Somewhat fewer characters are unique to the California Turkey (with the Ocellated Turkey and Wild Turkey having a common, different condition). Very few characters were found that are unique to the Wild Turkey. The similarity of (and differences among) the three turkeys under study can be tentatively expressed as the percentage of the characters shared by each pair of species (Fig. 1).

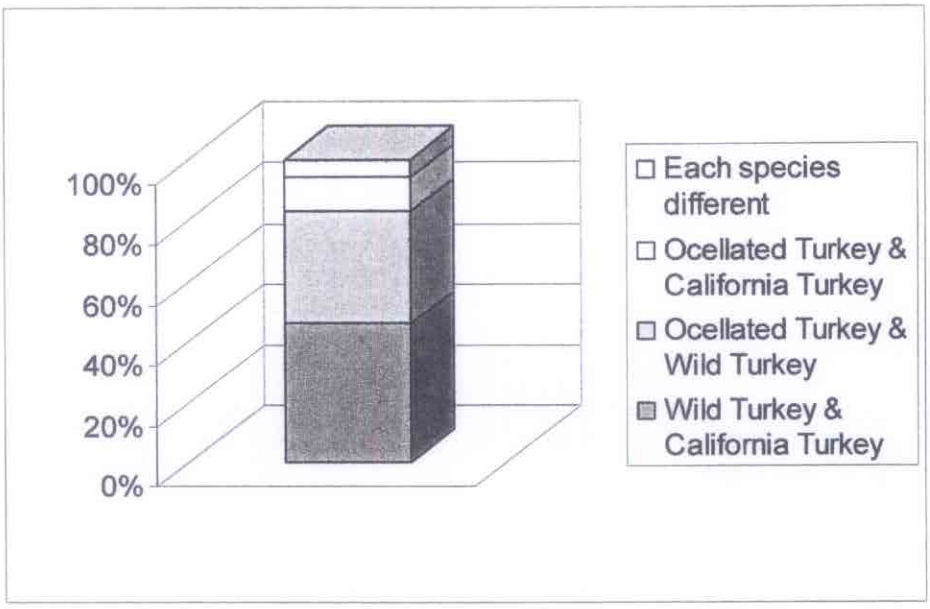

Fig. 1. Osteological characters (N=49) shared by pairs of species.

From the diagram it is clear that the extinct California Turkey is more similar to the modern Wild Turkey, with which it shares nearly 40 percent of all the characters, than it is to the Ocellated Turkey. What is rather dramatically illustrated, however, is that the Wild Turkey shares nearly the same number of characters with the Ocellated Turkey as it does with the California Turkey. This suggests a fairly close relationship among all three taxa, despite the fact that the Ocellated Turkey is the most unique of the three. Caution must be exercised in drawing too many conclusions from this single chart, however, because it reflects only numbers of characters, not the qualitative, functional significance of the observed character differences.

Not all skeletal elements of the extinct California Turkey are equally as readily distinguishable from the modern species. In this respect, the bones most easily distinguished include the premaxilla (beak), sternum (breastbone), and the furculum (wishbone). For these bones there are many highly reliable and easily recognizable characters present. Unfortunately, these skeletal elements are seldom preserved as fossils, especially at fossil sites outside of Rancho La Brea. On the other hand, depending on what part of the bone is preserved, there are some bones that are next to impossible to identify to species (e.g., scapula, skull, and phalanges). In these instances, the part of the bone preserved, the quality of the preservation of the specimen, and the combination of useful characters are particularly crucial for identification.

This study has focused on identifying the osteological characters useful for distinguishing the species of turkey. However, further studies are necessary to interpret the characters in terms of their possible importance for the living bird. That is, what do these osteological differences translate into in terms of different lifestyles for the different species? Do they indicate different feeding strategies, food preferences, flight capabilities, etc.?

Up to ten measurements were defined and taken on each bone. Thus, the mensural database consists of thousands of measurements. This database makes it possible to analyze differences in relative dimensions among the three species of turkeys involved in the study. Although absolute measurements of one species often overlap with those of the others, there are some useful ratios that can be employed to differentiate fossils of one species from those of the other two. These ratios can also be used to identify and draw some taxonomic conclusions about turkey fossils from other, non-Rancho La Brea, fossil sites. Such useful ratios were observed on several elements, including the premaxilla (beak), mandible (lower jaw), sternum (breastbone), tarsometatarsus (lower leg bone), and some of the wing bones. As with the morphological characters, most ratios serve to differentiate the Ocellated Turkey from the other two species of turkeys. The nature of the shaft of the ulna (i.e., one of the wing bones) is a good example of the usefulness of these ratios (Fig. 2).

A good example of ratios differentiating the California Turkey comes from the beak, which is clearly shorter, wider and flatter than that of the two modern species (Figs. 3,4). The shape and size of the beak can be correlated with diet and feeding habits. At this stage we can only speculate that the wider and flatter beak was an adaptation for pursuing the different foods available under the more arid conditions, relative to eastern forests, in the Southwest in the late Pleistocene.

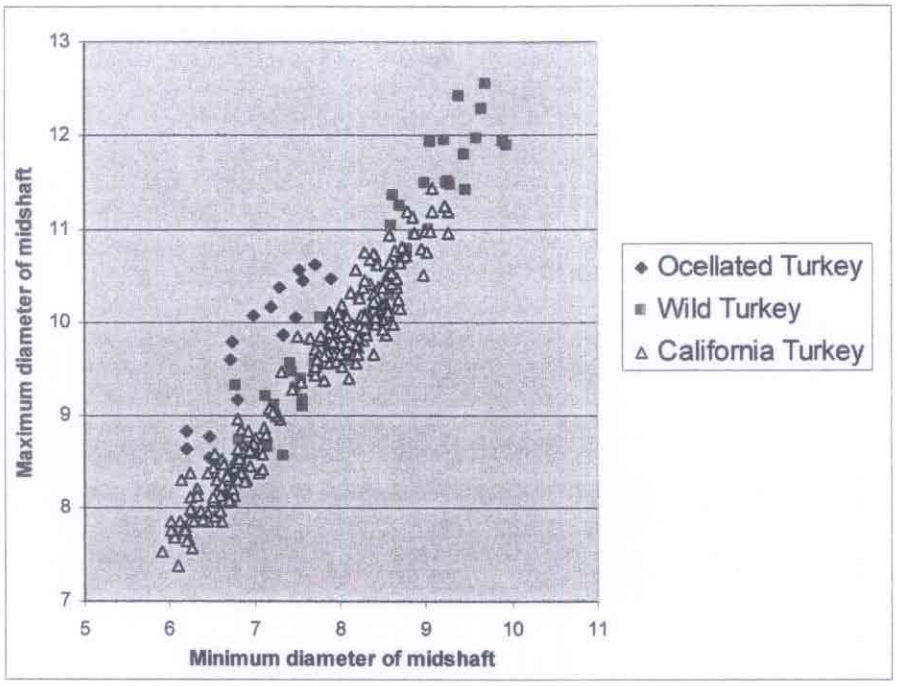

Fig. 2. Scatter diagram of the minimum versus maximum diameters of the mid-shaft of the ulna. The Ocellated Turkey stands out from the other two species.

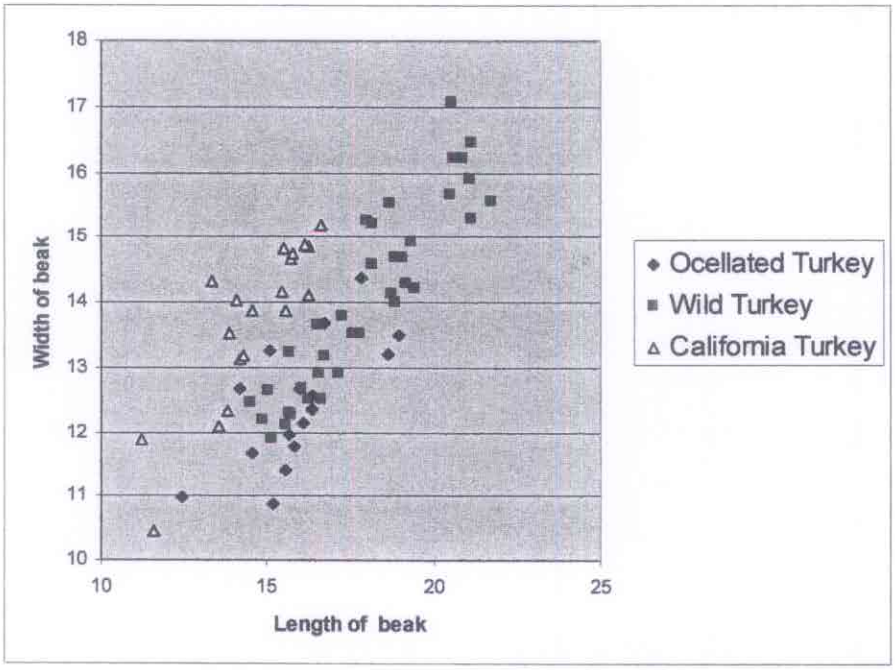

Fig. 3. Scatter diagram of the length versus width of beak. The California Turkey can be distinguished from the other two species.

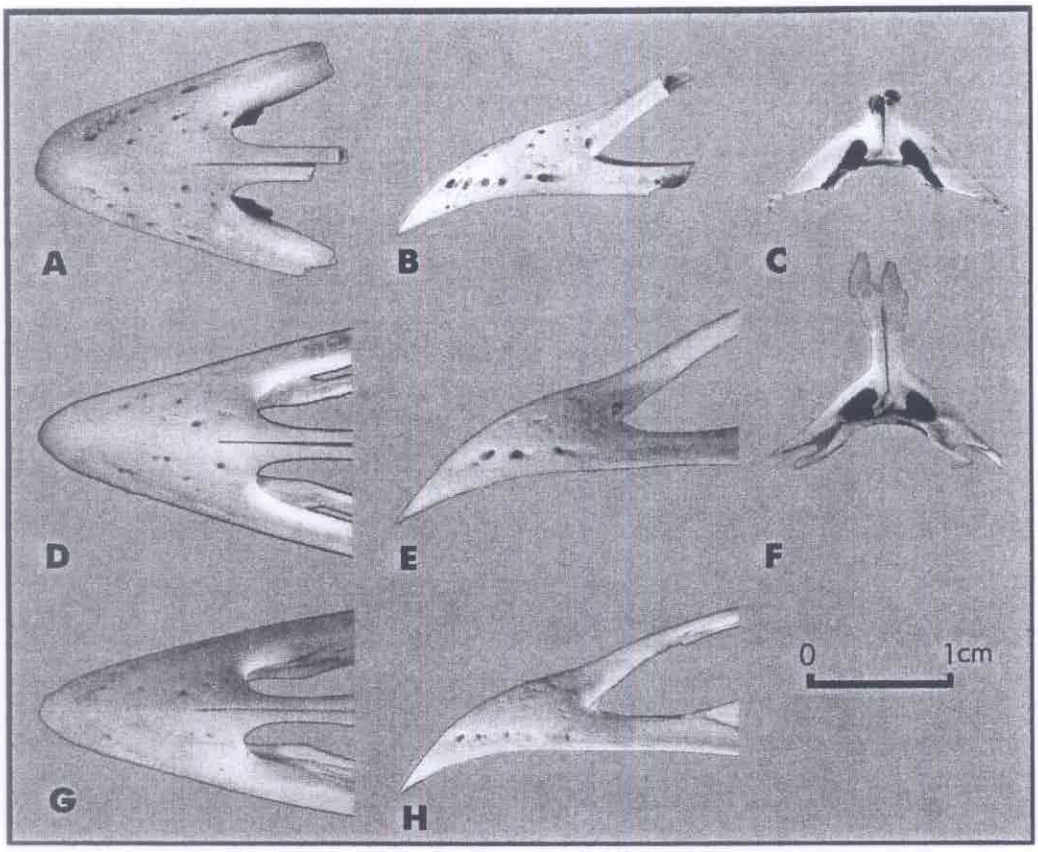

Fig. 4. The premaxilla (beak) in dorsal, lateral and posterior views (left, middle and right columns, respectively). **A-C**, California Turkey; **D-F**, Wild Turkey; **G-H**, Ocellated Turkey (posterior view could not be illustrated without damaging the bones because in all available specimens beaks were attached to the braincase). The end of the beak in the California Turkey (**A**) is shorter and wider than that in the two modern species (**D** & **G**). Also, the relative height of the beak at the end of nostrils (ratio of height to width) is smaller in the California Turkey (**B**) than in the two modern species (**E** & **H**), which translates into a flatter beak in the fossils. Finally, the two internal openings in the beak are clearly narrower, or more obscured by bone, in the California Turkey (**C**) than in both modern taxa, although only one is illustrated (**F**).

Finally, four aspects indirectly connected with the present project are worth mentioning. First, the Rancho La Brea fossil collection at the Page Museum has a unique collection of immature bones of the California Turkey. Bones of young birds representing all stages of development – from few-day-old chicks to nearly adult individuals – are present. The material has a great potential for scientific research, but it has not yet been studied in detail. To effectively study these fossils it is necessary to have comparative skeletons of very young to juvenile and sub-adult birds, all of known age. Such a comparative series is not available in any collection anywhere.

Second, the late Pleistocene remains of *Meleagris crassipes* from San Josecito Cave, Mexico, show a combination of characters that are otherwise typical of one or another of the three species studied in this project. This is a very promising avenue of research to follow in that it might help resolve the question as to the origin of the California Turkey. To do this, a more detail study of the *M. crassipes* specimens would be necessary.

Third, the osteological characters that distinguish the Ocellated Turkey from the Wild Turkey would suggest that there must be differences in the functional anatomy of these two species, especially in the cranial musculature. A study of the anatomical differences between these two species would lead to better understanding of just what the observed osteological differences between the species mean in terms of function. In turn, this would provide vital information that would allow a more informed interpretation as to what the differences observed between the skulls of the Wild Turkey and the California Turkey mean.

Fourth, time constraints did not permit a search for fossil turkey specimens in other museum collections in the western states. Isolated occurrences of turkeys have been reported in the past from various localities, and it is quite possible that other specimens lie undetected in local museum collections.

General conclusions:

- The California Turkey, *Meleagris californica*, is a valid species, differing from the two modern species. However, it is very similar to the Wild Turkey, *Meleagris gallopavo*, with which it shares many characters and to which it is probably closely related.
- The Ocellated Turkey *Meleagris* [*Agriocharis*] *ocellata* is a more distinctive taxon, more easily separable from the other two species. Nonetheless, it shares many characters with *M. californica* that are not seen in *M. gallopavo*. The systematic position of this species needs to be analyzed; at this stage we are unsure whether it is more appropriately placed in the genus *Meleagris*, or whether it should be placed back into the separate genus *Agriocharis*.
- The results of this study enable reliable identification of turkey remains from other sites in California and neighboring states. Specifically, characters have been identified that make it possible to distinguish most bones of the extinct California Turkey from those of the modern Wild Turkey and the Ocellated Turkey. Consequently, future studies may prove the presence of these species outside their currently known distribution.
- Further studies on the immature bones of the California Turkey, the specimens of *Meleagris crassipes*, and the anatomical differences between modern turkeys are necessary to get a complete picture of the origin and development of the turkey in California.

The formal scientific results of this study, which will be the Final Report for the project, will provide a breakdown of the details of the study, including, to the extent possible, observations on the role of the California Turkey in the late Pleistocene paleoecosystem of the Los Angeles Basin. It will be published in *Contributions in Science*, a serial publication of the Natural History Museum of Los Angeles County. In the interim, if there are specific questions as to the results we can try to address them.