Heron, ducks, and smaller shore birds. Likely during clear weather these water birds follow the Price River northward through the narrow winding Price Canyon. During stormy periods, the fog in this area would discourage such movement.

During storms along other streams much farther south in Castle Valley, as well as elsewhere in Utah, the writer has not found concentrations of migrating birds to the same extent as that which seems to be caused by the combination of cloudbanks and a long east-west range of mountains in the Book Cliffs region.

Weber College
Ogden, Utah

AN ANCESTRAL GOLDEN EAGLE RAISES A QUESTION IN TAXONOMY

BY HILDEGARDE HOWARD

IN studying the eagles of the Rancho La Brea Pleistocene several years ago (1932), I noted certain size discrepancies between the limb bones of the fossil and the modern Golden Eagle. However, as there were available for study, at that time, only a very few skeletons of modern Golden Eagle for comparison with the great series of fossils, no conclusions were drawn on the basis of these observations.

After Harvey Fisher's discovery (1944) of the small but important differences between the fossil and living California Condor, it appeared wise to review the subject of the Golden Eagle in more detail. A considerably greater number of modern bones are now available for comparison, numbering from 20 to 30 for all important limb elements, and about 18 skulls. The available fossil bones, however, still far exceed the modern, in most instances.

With regard to limb elements, the most outstanding distinction between fossil and Recent bones lies in the fact that, whereas the fossil humeri and ulnae average larger than the modern, and attain a maximum of 10 mm. greater length, the tarsometatarsi average shorter, and none of the 660 bones equals the maximum for the Recent eagle. Unfortunately, in no instance in the fossil series are wing and leg elements of individual birds associated. It is hardly proper, therefore, to state definitely that the Pleistocene eagle had relatively shorter legs and longer wings than the living bird, although the evidence from disassociated bones points in that direction.

Examination of individual bones in series of each limb element does not show any proportional or structural differences between fossil and modern bones.

It is in the skull that the most marked distinctions occur between the Pleistocene and Recent eagles. The fossil bird has a heavier mandibular structure, and both upper and lower mandibles show greater sturdiness. Associated with the strong mandibles is evidence of more powerful jaw muscles. The temporal area of the skull is enlarged by the outward extension of the postorbital processes, and by the encroachment of the temporal scars farther toward the middorsal line. (This condition is best expressed by a measurement of the distance between the scars at the posterodorsal line of the cranium.) The outward-protruding postorbitals give the skull the appearance of being low as well as broad through the cranium, although the measurements of height of cranium are the same in the two series.

The rostrum averages markedly broader in the fossil series and there is a slight tendency to greater height as well. The lower mandibles display a distinct bowing outwardly, and the individual rami appear heavy, whereas the modern jaws are relatively straight and slender. Unfortunately, however, the series of complete fossil mandibles is small (only 15 complete specimens), so that a full range of size is probably not represented.

The following measurements demonstrate the differences between the Pleistocene and Recent skulls. Measurements are in millimeters.

	Fossil			*Recent*			*Number of specimens*		*Percentage of overlap*
	max.	*mean*	*min.*	*max.*	*mean*	*min.*	*fos.*	*Rec.*	
Breadth of cranium across postorbital processes	71.0	68.1	63.7	66.0	63.1	61.0	31	18	30
Height of cranium	41.6	40.5	39.0	41.8	40.5	38.8	33	17	100
Height of cranium relative to breadth across postorbital processes (per cent)	61.6	59.9	57.2	66.4	64.3	62.6	25	17	none
Distance between temporal scars	36.0	31.1	27.4	39.0	36.0	32.3	71	18	27
Distance between temporal scars relative to breadth of cranium back of postorbitals (per cent)	74.5	66.6	55.5	85.3	79.0	73.6	71	18	3
Breadth of rostrum below nares	22.7	20.3	18.2	18.3	16.6	14.7	49	15	9
Breadth relative to length of rostrum	62.8	58.9	54.2	55.5	51.0	46.8	42	15	7
Breadth across rami of lower mandible	46.8	43.3	38.8	37.4	33.7	31.6	15	18	none

Reviewing the skull characters, a typical Pleistocene Golden Eagle had a relatively low, flat, and broad skull with heavy, broad beak and strong jaw. Though the 'typical' specimens can be easily distinguished from Recent skulls, there are a number of fossil skulls which tend toward the modern in one or more characters. Considering this intergrading of skull characters, as well as the impossibility of distinguishing individual limb elements, it seems apparent that the *Aquila* which frequented Rancho La Brea in the Pleistocene was directly ancestral to modern *A. chrysaëtos*. The differences which

exist between the two populations are relatively slight, and the gradual conversion of the one into the other seems not impossible over a period of thousands of years. Contributing to this theory is the occurrence of two crania from a pit considered to be of more recent age than the typical Pleistocene deposits, namely Pit 10. Both specimens have a breadth across the postorbitals near the maximum for the Recent form, but in the zone of overlap between the Recent and fossil. In one, the relative size of the temporal scar and the relative height of the cranium fall entirely in the Recent range. In the other specimen, however, one ratio falls into the fossil range, the other into the very small zone of overlap.

It is not often that the paleontologist is afforded the opportunity of observing cases of direct ancestry. Ordinarily, fossil discoveries are discontinuous. In the later Pleistocene deposits, however, particularly in those like the Rancho La Brea beds where it is possible to study series large enough to consider species as groups rather than isolated individuals, evidence of actual transition of fossil into Recent forms begins to be revealed. Though discontinuous occurrences provide a simpler study from the point of view of the mechanics of taxonomy, these Pleistocene-Recent mergings are far more enlightening.

The case of the Golden Eagle is not an isolated occurrence. Harvey Fisher's work on the California Condor revealed a similar case, and I have noted others from Fossil Lake, Oregon (1946). Undoubtedly, now that we are awakened to the possibilities at hand, still other modern species now recorded from the Pleistocene will be found to vary in some degree from the living forms when large series are available for study.

Osteologically these ancestral groups differ from the related living forms in only one or two elements, and even in these, the distinctions, though evident, are not marked. Only in deposits yielding large series of specimens has it been possible to recognize their importance.

The question now arises as to the proper taxonomic treatment of these forms. Should they be considered as distinct species, and so named, or should the trinomial be brought into use? In reviewing the Pleistocene birds of Fossil Lake, Oregon, I encountered two instances where both an existing species and a related extinct form had been recorded. Upon careful study of a large series of bones, it became evident that in each case a single species was represented, to me obviously ancestral to the modern form. In view of the considerable overlap which occurred between these Pleistocene forms and their descendants of today, I decided upon the use of the trinomial

to designate the Pleistocene intergrading ancestors, using the trinomial here not as an expression of the geographic subspecies but of its equivalent in time. This decision was fortified by the publication of a paper by George Gaylord Simpson (1943) on species criteria in paleozoology, in which he recommends such usage for divisions of groups which are essentially continuous in time.

Whether or not this is the ultimate solution for designating this type of ancestral form remains to be seen. It has been argued that if complete records of all creatures which have ever lived were obtainable, the continuity of life forms would admit of no separation at all if time is considered comparable to space in the designation of taxonomic groups. However, no such complete record will ever be available, and, recognizing taxonomy for the artificial tool which it is, should there not be some distinction between very closely related temporal forms and clearly distinct groups?

In the usual fossil occurrence, yielding a few isolated bones, specimens of these ancestral forms would likely be assigned to living species, since it is impossible to separate the fossil from the modern in many elements. If the Pleistocene ancestors are given distinct specific names, species assignments (in many instances) may become contingent upon knowledge of the age of the deposit.

The recognition of the minor distinctions in these Pleistocene aggregations, which were once thought to be identical with modern forms, is a new concept to the avian paleontologist. As I have said before, undoubtedly such occurrences will continue to be revealed now that we are aware of the possibility. This is, therefore, a propitious time to give careful thought to the subject as a whole, rather than to consider each individual case singly as it appears. In this way we may hope to establish a line of procedure which will unify our taxonomic treatment of all such instances. At present the decision as to allocation rests with the individual worker, with the result that some forms bear the trinomial, while others of similar status are treated as distinct species.

It has been said, and with justification, that the paleontologist's species concept necessarily differs somewhat from that of the student of living birds. I have, therefore, brought the subject before this group of working ornithologists in the hope of arousing pertinent discussion.

LITERATURE CITED

FISHER, HARVEY

1944. The skulls of Cathartid vultures. Condor, 46: 272–296, 6 figs. in text. *See* pp. 289–292.

HOWARD, HILDEGARDE

1932. Eagles and eagle-like vultures of the Pleistocene of Rancho La Brea. Carnegie Inst. Wash., Pub. 429, 82 pp., 29 pls., 3 figs. in text. *See* p. 31.

1946. A review of the Pleistocene birds of Fossil Lake, Oregon. Carnegie Inst. Wash., Pub. 551, pp. 141–195, 2 pls. *See* pp. 147–151 and 182–183.

SIMPSON, GEORGE G.

1943. Criteria for genera, species, and subspecies in zoology and paleozoology. Annals N. Y. Acad. Sci., 44: 145–178. *See* pp. 170–177.

Los Angeles County Museum
Los Angeles 7
California
August, 1946

BREEDING HABITATS OF CERTAIN WOOD WARBLERS IN THE UNGLACIATED APPALACHIAN REGION

BY MAURICE BROOKS

THE unglaciated Appalachian Mountain region, from Pennsylvania southward, has long been noted, among ornithologists, for the breeding here of many species of birds generally associated with more northern regions. It has not been so well recognized that a good number of such species nest in the region in habitats which often differ radically from those usually occupied in other portions of their ranges.

Although there are other bird groups which show a tendency to occupy, locally, habitats at variance with their more common practices, this behavior is best illustrated by the wood warblers, Family Compsothlypidae. Wood warblers in the region display a great deal of plasticity in their choice of nesting sites. Most of the original timber which clothed the mountain slopes and high plateaus has been removed. From many of the mountains the spruce-fir forest of high elevations has practically disappeared. To a lesser degree, the birch-beech-maple forests, and the birch-hemlock forests have been destroyed or greatly disturbed. The oak-hickory-chestnut forest has undergone a profound transformation with the death, from the chestnut bark disease, of the chestnut, a dominant species in many areas.

Despite abrupt changes in the character of the forests, most warbler species have shown an amazing power of adaptation to new surroundings. The mountains have lost, in the time of ornithologists at least,