

other root-lined nests contained no hair. One of these had a complete, thin, inner wall composed almost entirely of fine grass roots, except at the rim where old dead grass was used (19).

Three of the nests may be classed as hair lined (horse or cow hairs). One of these contained some white hair lining (5), one was lined with brown horse sheddings (4), one was so thickly lined with hair that it completely covered the other nest material (6). Yet another pair of birds had lined their nest very nicely with white rabbit's fur (prairie hare or jack rabbit) (3).

In one instance there was no fabricated nest structure, but only a mat of dead grass in the *bottom* of the excavation; the bare earth formed the only walls (9).

Notes.—(a) 12, 16. (b) 7, 21. Some long hair-like roots in lining (8). Nicely lined with fine roots (13). Lined in bottom with fine grass roots (17).

**Form and Dimensions.**—The nest is a deep, well formed cup, sometimes slightly contracted at the rim. As compared with nests of the McCown Longspur, these nests of the Chestnut-collared are somewhat smaller but of about the same proportions. Diameter (three nests) varies from 2 to  $2\frac{3}{4}$  inches; depth from  $1\frac{1}{2}$  to 2 inches; the ratio of depth to diameter from 0.75 to 0.91 (average 0.82).

*Excelsior, Minnesota, January 10, 1935.*

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## A SECOND AVIFAUNA FROM THE MCKITTRICK PLEISTOCENE

WITH THREE CHARTS

By LOYE MILLER

In 1921 Merriam and Stock announced the discovery of vertebrate remains preserved in asphalt of Pleistocene age at McKittrick, California. Birds from this deposit were made the subject of several papers by Miller (Condor, 24, 1922, pp. 122-124; 26, 1924, pp. 178-180; Univ. Calif. Publ., Bull. Dept. Geol. Sci., 15, 1925, pp. 307-326). The most extensive of these papers appeared after the excavations at the original exposure had been discontinued and the collections made available for study. The source of this material was a lens located on the north side of the Taft-McKittrick highway, its existence being made evident by the road building operations. The avifauna from this first excavation is here designated as Fauna No. 1. Later exploration in the same general locality brought to light an accumulation on the opposite side of the highway and approximately one hundred feet distant from the former exposure. The avifauna of this second excavation presents a totally different picture from that of the first, and it is here designated as Fauna No. 2. This second, and larger, collection constitutes the subject of the present paper.

**Matrix and material.**—The matrix is not appreciably different from that of locality No. 1, that is, crude asphalt with an admixture of fine grained silt. On the whole there may be slightly less silt though there appears to be more than in the matrix at Rancho La Brea. Much more interesting is the better preservation of the enclosed fossils. They retain much more of their original strength. Those from the earlier excavation have a tendency to crumble, as though impregnation with the asphalt had been retarded and perhaps a longer exposure to water had resulted. Preservation of bird remains in the second fauna is quite the equal of that at Rancho La Brea. An attempt was made by the excavator to apply customary methods and

impregnate the specimens with shellac. This effort was, however, entirely wasted as the medium did not penetrate the bone and the specimens retain a remarkable degree of their original firmness without it.

**Comparison of faunas.**—Fauna No. 1 was discussed at some length in 1925 (*op. cit.*) and details need not be repeated here. Outstanding features are as follows:

1. Aquatic species constitute the majority both in variety and in numbers.
2. Raptorial species few and, except for *Aquila*, occur in small numbers.
3. Owls very few.
4. Cathartiform vultures represented by two bones of *Teratornis* only.
5. Gallinaceous birds represented by three bones of California Quail (*Lophortyx*).
6. *Colaptes* absent.
7. Raven represented by two bones.
8. One bone represents the grebes and loons.
9. Gulls, pelicans, and cormorants absent.
10. Mud gathering swallows (*Petrochelidon*) abundant.

So strongly in contrast with this picture is that offered by Fauna No. 2 that some profound environmental factor is definitely indicated.

1. Aquatic species are far in the minority.
2. Raptors are abundant.
3. Owls are well represented.
4. *Teratornis* is represented by 178 bones. *Cathartes* and *Coragyps* are both present. Condors are wanting.
5. *Lophortyx* is represented by 92 bones but no other galliform is present.
6. *Colaptes* is well represented.
7. *Corvus* is abundant.
8. Grebes, loons, cormorants, and pelicans are entirely absent.
9. Mud swallows are present.
10. A large testudinate resembling the present desert tortoise is fairly abundant.

**Ecologic relations.**—Even where the species are common to both faunas their relative abundance often shows a marked diversity and the ecologic balance is therefore quite different. Aquatic species are present in both faunas, but they constitute 67% in No. 1 and 17% in No. 2. The strictly land birds make up 33% of Fauna No. 1 and 75% of No. 2.

There are 35 species in No. 1, 7 of which are unrepresented among the 50 species of No. 2. All of these are water birds. Study of the charts (figs. 17-19 herewith) which present a schematic view of the two faunas will convince one of the radical difference between the two accumulations, and it is the writer's opinion that geologic time is not a factor in the case. Rather, I would say the immediately local conditions are responsible.

Locality No. 1 was postulated as a region of very flat topography with shallow and probably intermittent ponds, extended mud bars and grassy areas. The picture still holds the imagination. Locality No. 2, though but a few yards removed on the horizontal scale, was perhaps a foot or two higher in elevation and hence on better drained ground. Sandpipers may be abundant along the shores of our "desert" ponds; but they would find only a few feet back from shore a desert environment quite foreign to their tastes and they would not be tempted to go there. Deposit No. 1 may have resulted from an oil seep in the margin of such a body of water as the present Buena Vista Lake near Taft, California. This lake may be eight miles across in wet years and only eight feet deep in the deepest part. Such an oil seep might be covered with an inch of water at one time, or might be in the center of

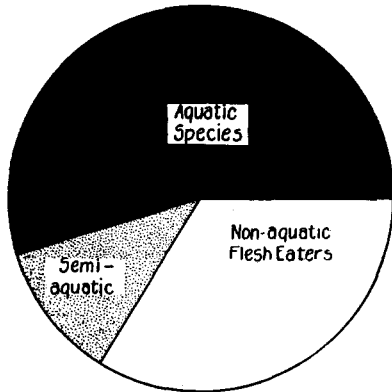


Fig. 17. Chart of Fauna No. 2 of McKittrick showing habits of the species.

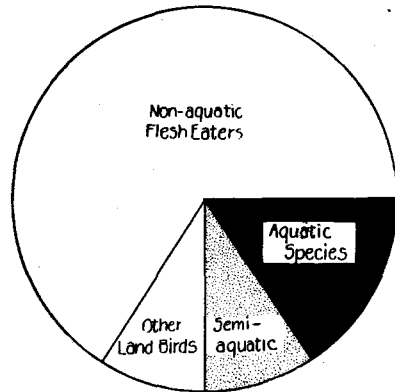


Fig. 18. Chart of Fauna No. 1 of McKittrick showing habits of the species.

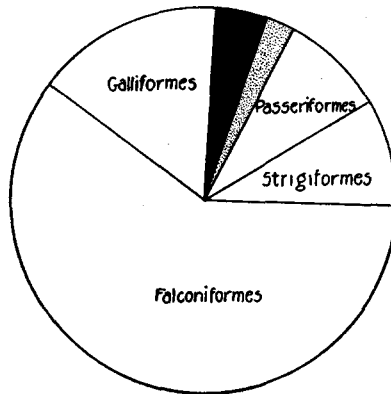


Fig. 19. Chart of Rancho La Brea fauna. Modified from Howard.

an extensive mud flat a few weeks later. A bird like the Golden Eagle would drop down onto the back of a partly submerged carcass, but would become entangled only when, in feeding or in struggling with rivals, it stepped off the carcass into the mire. Cathartiform vultures, on the other hand, habitually alight upon the ground and approach the food on foot instead of from the air. This habit might explain their practical absence from Fauna No. 1.

Fauna No. 2 suggests a quite different picture. It is more nearly a dry land fauna. Water was present at least in small quantities during dry periods when it acted as a lure to quail, doves, *Geococcyx*, and the ground foraging *Colaptes* in considerable numbers. Periods of more abundant water at the immediate locality were shorter owing to its better drainage. The percentage of strictly aquatic forms was thus reduced in comparison with Fauna No. 1. *Teratornis* could alight and amble up to its quarry. Small vertebrates and insects, captured in the oil, would be exposed to view and would tempt the smaller hawks, falcons and owls. The abundant Prairie Falcons and Sparrow Hawks might have been thus brought into the picture. Such a water supply would certainly have attracted *Parapavo* if it had been present in the locality at the time, and I am forced to believe that it was lack-

ing in the local avifauna. There may have been too little cover available for such a large and conspicuous galliform as *Parapavo* must have been. The species is especially abundant at Carpinteria (Miller, Univ. Calif. Publ., Bull. Dept. Geol. Sci., 20, 1931, pp. 361-374) which was undoubtedly provided with cover, and at Rancho La Brea where there was more cover than at McKittrick.

This same factor of cover may easily have been the deciding influence with such raptors as *Spizaetus grinnelli*, *Wetmoregyps daggetti*, and possibly of *Morphnus woodwardi*. The last named species is found in none other than the type locality, Rancho La Brea, which is farthest south of all the asphalt deposits thus far studied; hence the factor of latitude may be largely responsible.

**Time relations.**—Differences between faunas No. 1 and No. 2 are not thought to be the result of a time hiatus. There occur four extinct avian species in No. 1 and eight in No. 2, but all except one of the extinct species of No. 1 are included in the list from No. 2. The additional extinct species of No. 2 are all land birds. Their absence from Fauna No. 1 might readily be accounted for by differences postulated under the heading Ecologic relations.

Dr. Chester Stock has stated to me in conversation that there are "no radical differences in the mammalian faunas of the two localities". Any time hiatus of appreciable magnitude would be indicated by its influence upon mammalian species more than upon avian species. I am therefore strongly of the opinion that the two faunas are chronologically identical.

**Discussion of species.**—In the following list of species I have followed the dictates of the American Ornithologists' Union as announced in their "Check-list", fourth edition, 1931. Determinations are announced with a fair degree of confidence with a few exceptions where, in each case, the uncertainty is indicated. Several species of limicolines are unspecified, owing to a limited amount of comparative material. Dr. Hildegard Howard and Miss Leigh Marian Larson have passed judgment upon all the *Geococcyx* material, and their kind cooperation is gratefully acknowledged. Material at the California Institute of Technology was generously made available by Dr. Chester Stock, and was examined with some care, but the present report is restricted to the collections at the University of California where over three thousand bones were identified.

#### CICONIIFORMES

*Ardea herodias* Linnaeus, 15 bones.

*Nycticorax nycticorax* Linnaeus, 1 bone.

*Ciconia maltha* L. Miller, 107 bones.

The single specimen of *Nycticorax* appears to contrast strangely with the more abundant *Ardea* and the very abundant *Ciconia*. The last two species are, however, considered less strictly aquatic than other ciconiiform birds in America. *Ardea* habitually seeks grasshoppers, crickets, and rodents in dry stubble fields of present-day California, and the Maguari Stork of South America is said by Hudson to resort to a similar diet on the pampas of Argentina. It is not surprising, therefore, to find the Asphalt Stork present in such numbers. A review of the Pleistocene storks of California (Miller, Condor, 34, 1932, pp. 212-216) eliminates *Jabiru* from our fauna and places all the larger storks in the one variable species *Ciconia maltha*.

#### ANSERIFORMES

*Cygnus columbianus* (Ord). A single metacarpus, almost perfect, represents the Whistling Swan, a bird very little given to wandering far from water deep enough to float it freely.

*Branta canadensis* (Linnaeus)? Five bones represent a goose of the approximate size of *Branta canadensis canadensis*. Tarsus, tibia, and carpus all agree, however, in being stouter than any individual of the Recent race that has been available

for examination. Two other specimens, both left tibiae, represent a pigmy goose, smaller than *B. c. minima* or *Chen rossii*.

Comment has previously been made (Condor, 36, 1934, pp. 178-179) on the variable size of fossil geese in western America. Mr. Roland Ross was encouraged to take up the special problem of variability in the osteology of American geese with a view to the proper determination of some of our questionable fossils. His work is not yet completed, so specific designation of these limited remains is left in question.

*Branta dickeyi* Miller seems not to have any representation in the collection here considered.

*Anas platyrhynchos* Linnaeus. There are ninety-two specimens of this most versatile duck. This same versatility, however, makes it of less significance as an indicator of local conditions.

*Chaulelasmus streperus* (Linnaeus). Represented by five bones.

*Mareca americana* (Gmelin). But seven bones are assignable to this species.

*Nettion carolinense* (Gmelin).

*Querquedula cyanoptera* (Vieillot). These small teals, represented by thirty-four and eighty-one specimens respectively, occupy a large place in the census; but like the mallards, these are very adaptable species. The modern birds are repeatedly to be found in the most limited and ephemeral pond areas. Irrigation canals, out-spreading waste waters, temporarily flooded fields or weed patches in the semi-desert of the Southwest, mere puddles but a few feet across, have within my own experience in the field, attracted many of these little ducks. Their presence in the asphalt certainly indicates water, but not necessarily in large amounts.

*Spatula clypeata* (Linnaeus).

*Nyroca affinis* (Eyton)?

*Charitonetta albeola* (Linnaeus).

*Erismatura jamaicensis* (Gmelin)? These four species are represented by two to three specimens each, and constitute an insignificant element in the picture.

#### FALCONIFORMES

*Cathartes aura* (Linnaeus).

*Coragyps occidentalis* (L. Miller). The relative abundance of these two species of smaller vulture is directly opposite to their occurrence in Rancho La Brea. There are here, twenty-one bones of *Cathartes*, and but four of *Coragyps*. The element of latitude possibly accounts for the rarity of *Coragyps* at McKittrick, assuming that it was similar in its reactions to the living species, *C. urubu*. Its near relative, *C. shastensis*, was, however, found in the Pleistocene caverns several hundred miles to the northward. The rarity of *Cathartes aura* in the Rancho La Brea fauna has never been explained to my entire satisfaction.

Equally inexplicable is the entire absence of the California Condor, *Gymnogyps californianus*, from both McKittrick faunas. This species was incredibly abundant at Rancho La Brea. In Recent times it has been recorded from the Oregon line to northern Mexico and eastward to Nevada and New Mexico. Its apparent last stand as a declining species is in the broken ranges in sight of the McKittrick locality, and from these mountains it glides out over the lower hills and plains in search of food. Why was it not snared in the asphalt trap along with its greater and its lesser relatives?

*Teratornis merriami* L. Miller. One hundred and seventy-eight bones of this bird bring it up in point of numbers beyond any other species except the eagles. Certainly there was strong attraction at the locality for scavengers of large size and no evident factor in the immediate environment to discourage the condors had they been present. But three bones of *Teratornis* were found in the collection called Fauna No. 1. The cause of the difference is an interesting question. There are now three Pleistocene deposits in California that have produced *Teratornis* remains in fair numbers, and Wetmore (Smiths. Misc. Coll., 85, 1931, pp. 1-41) has lately discovered it in deposits of comparable age in Florida. Other occurrences of the species are not known to me.

*Accipiter cooperii* (Bonaparte). This hawk is primarily a woods or brush-land hunter, hence it is not surprising that no more than two bones are thus identified.

*Buteo borealis* (Gmelin).

*Buteo swainsoni* Bonaparte. In sharp contrast to the Cooper Hawk these buteonids are hunters of the open country. Eighty and fifty-three are the numbers of bones ascribed to them, respectively. In addition there are twenty-six bones of the same genus that are not determined as to species, but might represent either of these two. As in the Rancho La Brea fauna the hawks are less numerous than the larger raptors, a state of affairs which is ascribed either to the antagonism of larger species or to their more frequent recourse to the entrapped or decomposing food supply.

Skeletal characters of the buteonid hawks are so nearly uniform throughout the group that actual size and proportionate size of parts become the main recourse of the student who has to deal with only the skeleton. Based on such characters alone, the typical genus, *Buteo*, reaches out and submerges several of the closely related genera of the ardent systematist. Thus *Geranoaëtus* is left with nothing but its great stature to keep it from complete submergence. The remains of fossil buteos from the asphalt are hopelessly jumbled in the matrix and each bone has to be considered as an entity wholly apart from related skeletal segments; hence the unwillingness to assign certain bones to a specific category.

*Urubitinga fragilis* (L. Miller).

*Aquila chrysaëtus* (Linnaeus).

*Neogyys errans* L. Miller. There are in the collection here discussed more than a thousand bones of raptors of eagle size making up 65% of the entire census. The determinable bones fall into three categories in the following relative abundance: *Urubitinga*, 29%; *Aquila*, 65%; *Neogyys*, 5+%. These figures are strongly in contrast with those obtained from a study of the Carpinteria asphalt (Miller, L., Univ. Calif. Publ., Bull. Dept. Geol. Sci., 20, 1931, pp. 361-374). There, *Neogyys* outnumber *Aquila* by two to one, while *Urubitinga* (*Geranoaëtus*) is more abundant in one exposure and less in the other.

McKittrick comes thus to resemble Rancho La Brea in sharp contrast to Carpinteria. This resemblance serves further to support the conclusion that Carpinteria was a wooded area at the time of accumulation of its asphalt fauna.

*Neophrontops americanus* L. Miller. It is interesting to find this "Old World" vulture outnumbering two to one the two smaller American vultures, *Cathartes* and *Coragyps*. This creature must have been abundant and versatile in habit. Its remains have appeared in all three of California's asphalt deposits, though it is rare in both faunas at Carpinteria. It is also poorly represented in Fauna No. 1 at McKittrick. Forty-six bones are found in this collection.

*Circus hudsonius* (Linnaeus). Sixty-three bones represent the Marsh Hawk, making the species fit beautifully into the picture which we have reconstructed, of the McKittrick landscape.

*Polyborus cheriway* (Jacquin). This more tropical species is represented by thirty bones including all the characteristic elements of the skeleton. The species is today a most versatile bird, found in open country or in dense cover. It walks or runs readily, but has effective talons. It feeds upon fish, reptiles, birds, or mammals, fresh or otherwise. As might be expected, therefore, its remains have been retrieved from most of the Pleistocene or sub-Recent deposits of the south and west.

*Falco mexicanus* Schlegel.

*Falco peregrinus* Tunstall.

*Falco* indet. As in the Marsh Hawk, the abundant remains of these powerful falcons lend color to the Pleistocene picture. They are hunters of the great open spaces, particularly in the case of *mexicanus* which is by far the most abundant. Sixty-five bones are assigned to that species and fifteen to *peregrinus*. Certain segments of the skeleton of these falcons are readily distinguished, but others are uncertain, just as in the case of *Buteo* discussed above.

*Falco columbarius* Linnaeus. The ten specimens of this small falcon include perfect tarsus, humeri and metacarpus, with parts of tibia and femur, making identification quite certain. The species is one of our rarest falcons in southern California today, and it seems to have been equally so in the past. It was rare at Rancho La Brea and was not found at all at Carpinteria.

*Falco sparverius* Linnaeus. One hundred and two specimens of this species show its great abundance and suggest an adaptability comparable to that of today. Its remains have been found also in: Potter Creek Cave; McKittrick Fauna No. 1; Rancho La Brea; Carpinteria; Saber Tooth Cave, Florida (Wetmore, *op cit.*); and Conkling and

Shelter caves, New Mexico (Howard and Miller, Condor, 35, 1933, pp. 15-18).

*Falco swarthy* L. Miller. Four fragments of a giant falcon are placed in the same category as the type specimen of *Falco swarthy* purely on the basis of gigantism, and they are truly gigantic. Nothing approaching them in size has ever come into my hands before, except a large specimen of *Falco rusticolus* from Greenland. The fossil bird is slightly greater than the Recent specimen from Greenland.

#### GALLIFORMES

*Lophortyx californica* (Shaw). Ninety-three bones of the California Quail bring the Galliformes quite prominently into the faunal picture. It is, however, the only representative of the entire order in the two McKittrick faunas. In Fauna No. 1, there were but three bones. The species aids us quite materially in reconstructing the Pleistocene landscape and throws into sharp contrast the two McKittrick faunas. The absence of the splendid *Parapavo*, so abundant in the Rancho La Brea and Carpinteria faunas, is further emphasized by this evidence. McKittrick Fauna No. 1 was entrapped under conditions that were possibly too humid; but here in the locality of Fauna No. 2 the conditions must have been quite favorable, hence the total lack of *Parapavo* remains is necessarily ascribed to other causes. The bird was apparently absent from the locality and perhaps the most plausible explanation of that fact is that the mountain barrier restrained its northward dispersal from the coastal district.

#### GRUIFORMES

*Grus canadensis* (Linnaeus). The State Game authorities of California have within the last few years made some most interesting moving pictures of this crane at a point only a few miles north of McKittrick. Great numbers of the birds were photographed upon their wintering grounds in flat plains country quite apart from open water. The Pleistocene landscape may quite properly be reconstructed along similar lines and the eighty-six bones of this crane would appear quite in keeping.

#### CHARADRIIFORMES

Slightly more than eight per cent of the determinable bones have been ascribed to the shore birds. Among them are recognized *Eupoda montana* (Townsend), *Numenius americanus* Bechstein, *Totanus melanoleucus* (Gmelin), and *Recurvirostra americana* Gmelin.

Of these, *Numenius* is represented by two bones only, *Eupoda* by seventy-four, and each of the others by half that number. A still larger number of bones remain unassigned to specific category. There are many species of the smaller waders that follow the migratory urge, shifting back and forth over a given locality with the seasons. They are so markedly similar when the entire specimens are at hand, and size is so variable with age and sex, that a mass of unassociated bones representing all the limb and girdle elements is almost impossible of taxonomic analysis. My inability to make satisfactory determinations is freely admitted, but to publish a number of uncertain records is considered a most unfortunate procedure. There are ninety-seven bones of small sandpiper-like birds that are relegated to this indeterminate group.

#### COLUMBIFORMES

*Zenaidura macroura* (Linnaeus). This dove, extremely rare in Fauna No. 1, has a goodly representation in No. 2. There are sixteen limb and coracoid bones. The species is sparingly represented at Rancho La Brea, and it is entirely absent from the Carpinteria faunas. Except at roosting time, these are open-country birds, which probably accounts for their absence from Carpinteria. They were doubtless attracted to the McKittrick locality by an exposure of small pools of drinking water.

#### CUCULIFORMES

*Geococcyx californianus* (Lesson). This adaptable species is well represented in the present connection as compared with a single fragment from Fauna No. 1. Its presence would supplement the quail as indicator of a certain amount of low, though perhaps sparse, cover in the near vicinity. Like quail and doves, the road-runner comes to a source of drinking water when it is available, but decidedly marshy ground is not generally to its liking. One specimen of the femur of maximum size was

examined by Dr. Hildegard Howard for comparison with her lately described species from Conkling Cavern, *Geococcyx conklingi* Howard. The McKittrick bird is, however, quite noticeably slender in comparison with the sub-fossil from New Mexico.

#### STRIGIFORMES

Seven specimens about equally divided between *Bubo* and *Speotyto* constitute the entire strigiform representation in Fauna No. 1. There are fifty-nine in Fauna No. 2, and a third species is added.

*Bubo virginianus* (Gmelin). Twelve bones of this most versatile bird add little in the way of interpretative evidence.

*Speotyto cunicularia* (Molina) (twenty-six bones) is just such a bird as the picture demands. It lives in terrestrial burrows in a terrain entirely devoid of perennial growth. The birds seem to be independent of a free, natural water supply, but those represented in the fossil record were doubtless attracted to the locality by their insect prey.

*Asio wilsonianus* (Lesson) (twenty-one bones) is a species which, when not nesting, ranges from woodland to desert; but some sort of scrub not too far distant is needed as a refuge by day.

#### PICIFORMES

*Colaptes cafer* (Gmelin), with eight bones, is the only woodpecker in the collection. It feeds very commonly on the ground in mountain, hill, or desert country, from timber line to sea shore. I am surprised to find so few of its bones in the collection.

#### PASSERIFORMES

Two hundred and thirty bones are assigned to this order, and one hundred and ten of them are of the genus *Corvus*. The entire collection of passerine material is being studied by Dr. Alden H. Miller, and will be the subject of a separate report.

*University of California at Los Angeles, November 16, 1934.*

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## FROM FIELD AND STUDY

**Ring-billed Gull Killed by a Canada Goose.**—At about two o'clock on the afternoon of December 2 we sat on the stone coping above the narrow beach at Lake Merritt, Oakland, near the feeding enclosure, watching a little group of Canada Geese, Pintail, Baldpate, and Ring-billed Gulls at the water's edge, fifteen feet away. Three of the gulls were squabbling over some floating morsel, and one repeatedly raised its long wings so as to brush the head of the largest "honker," which flinched and backed awkwardly a step or two away. The squabble soon ended, and most of the birds moved off, but the gull rested quietly in the shallows, facing the lake. Then the big goose, too, began to waddle heavily into the water. When still a surprising distance away, its long neck shot down and out and the bill seized the gull by the back, near the base of the right wing. The smaller bird, quite helpless in the grip, was drawn in and the goose began deliberately to beat it to death with blows of the heavy bends of the wings. It was no case of wild flapping and striking, but of controlled blows, for the most part alternate, downward and forward, with the hard wing-bends directed as a man's fists might be. In perhaps thirty seconds the gull was a broken and unconscious mass. One wing was certainly, and one leg almost certainly, broken. After perhaps five minutes it showed some signs of life, raised its head to utter a scream, and turned weakly on the water with feeble movements of one foot, but floated off and could hardly have survived.

The goose, whose movements even during the fight had been lethargic and relatively slow, now gave itself up to transports of excitement. Out on the beach again, it stood with body and neck vertical and wings nearly full-spread, and honked loud and long at the sky. The first call blew out a small cloud of gull feathers. As long as we could make out its progress down the shore it repeated this, at intervals of a minute or two.