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ARCHÆOLOGY AS AN AID TO ZOOLOGY.*

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INTRODUCTION.

The important bearing of palæontology on zoology has long been recognized by zoologists, but it is not so generally known that archæology also can give valuable aid to zoology. To the archæologist, however, the saving of the bones and shells of animals found in the course of his explorations of the graves, mounds, shell-heaps and village sites of prehistoric man, is important principally because it is by means of them that he learns something of the kinds of animals used for food, and what animal bones were used as material for artifacts, by prehistoric people. For a long time some archæologists did not seem to see any further use for such findings, but all now realize how important it is for them to collect all bones of animals, not only for their own purposes, but for the zoologist's also. So much of the earlier archæological exploration, too, was conducted in a profuncatory manner with a view more to secure rarities than anything else. To the mere relic seeker, especially, animal bones are useless rubbish, and it is surprising that even those from whom better work could have been expected seldom collected these bones unless they showed evidence of workmanship.

In nearly every prehistoric site explored by the archæologist animal bones and shells are more or less numerous, but they are found less frequently in graves and mounds. The Roebuck prehistoric village site, near Prescott, Ontario, explored by the writer for the Geological Survey, Canada, in 1912 and 1915, yielded a large number of shells of fresh-water clams and animal bones, of which about six barrels were collected. From the Baum village site, in Ross county, Ohio, twenty barrels full of bones were sent to the museum of the Ohio Archæological and Historical Society in Columbus. One can get an idea from this of the large accumulations of shells and bones sometimes found.

*Besides those whose help is acknowledged in the text, grateful acknowledgments are here tendered to all others who kindly supplied me with information.

The bones of nearly all the larger animals used as food are found. The presence of the smaller birds and such animals as mice, shrews, moles, and bats, which were probably not used as food at all, is most often not due to human agency, especially where the entire skeletons are present. Mere absence of the bones of a certain animal from shell or refuse heaps, however, does not necessarily mean that its flesh was excluded from the aboriginal menu. Its bones may have been so small as to disappear, or they may have been gnawed to pieces by the aboriginal dog. Some taboo prohibiting the eating of the flesh of certain species may account for the absence of the bones of other animals.

Some of the bones may owe their preservation to the fact that they were buried in refuse heaps composed mainly of wood ashes. Another factor which probably accounts for the excellent preservation of some is that most of them had been boiled with the meat on them, thus possibly eliminating nearly all the animal matter which might cause decay. A few owe their preservation to partial carbonization. The shells of fresh-water clams found in the refuse in some places are invariably fresh looking with the epidermis intact and the inside surface still retaining its pearly lustre.

One has to contend with several difficulties in determining the species of animals to which many of these bones belonged. Many of them have been reduced to indeterminate fragments, possibly in order to extract the marrow and also to make them of a size small enough to go into cooking pots. Others have been fashioned into various implements and ornaments; although as in the case of awls, enough of the original shape of the bone sometimes remains to enable one to identify the species of animal to which it belonged.

As to the probable age of the sites where these bones are found, it will perhaps be unnecessary to say that where no relics of the white man occur, they may be all the way from three hundred to five hundred and perhaps more years old. Algonkian sites in Ontario, and probably in central New York

also, may antedate the Iroquoian occupation by hundreds of years, but these do not yield many animal remains.

By identifying the animal bones collected by the archæologist the zoologist can determine the former presence of (1) animals now extinct, of which we have no historical record; (2) animals which are known to have become extinct or to have been exterminated since the arrival of Europeans on this continent; (3) animals not now living in the vicinity of the prehistoric site, but found in other and more distant parts of the country; and (4) animals still living in the area covered by the archæological explorations. It is also possible for him to greatly extend the range of some species thus filling in gaps in distribution.

As practically all the bones owe their presence in archæological sites to the fact that they are those of food animals it would probably be possible to get an approximate idea of the relative abundance of any of these animals in a certain region. The bones of those most relished for food would naturally preponderate and there would be a preponderance of the herbivores as compared with carnivores.

Given a sufficient number of specimens it is possible for the zoologist to learn whether there is any difference in the size of the bones or shells of recent and prehistoric animals of the same species. For example, there is a difference in size between recent oyster shells and those from shell-heaps. Oyster shells found by Mr. Harlan I. Smith in a shell-heap on Merigomish harbor, Nova Scotia, are much larger than those of oysters now living in the vicinity. Those from the heaps of Damariscotta, Maine, likewise are much larger than recent shells, being from eight to ten and some even fourteen inches long. Then, too, Dr. Edward S. Morse has found that shells of *Mya* from prehistoric shell-heaps of the coast of Maine and Massachusetts were higher in comparison with their length than recent specimens collected in the immediate vicinity of the same heaps. He also observed a change in the shell of the common beach cockle (*Lunatia*). The ancient shell-heap form from Marblehead, Mass., "has a much more elevated spire than the recent form living on the shore today, and this variation curiously enough was in accordance with what he had observed in a species of *Natica* in the Japanese shell-heaps."¹

There is a possibility, too, that the zoologist might discover among archæological finds some bones exhibiting unknown pathological conditions of interest

¹Changes in *Mya* and *Lunatia* since the Deposition of the New England Shell-heaps, Proc. Am. Assoc. Adv. Science, 30th meeting, Cincinnati (Salem, 1882), p. 345.

to the student of animal pathology. It is of interest to note here that the shells of *Unio complanatus* Solander, one of our common fresh-water clams, found in the refuse of the Rockbuck village site, seemed to be affected by the same species of parasitic fresh-water sponge (probably *Vioa*), causing exfoliation of the sides and umbonic region, as are those of the present day.

ZOOLOGICAL INTEREST OF SOME ARCHAEOLOGICAL DISCOVERIES.

The mention of a few examples will suffice to show that some other discoveries made by archæologists are of considerable zoological interest. One of the most recent was made by the late Dr. H. Hæberlin, of Columbia University, New York, in a cave in Porto Rico.² The bones were those of a large extinct species of rodent belonging to a new genus and species, allied to *Plagiodontia*. To this rodent Dr. J. A. Allen has given the name *Isolobodon portoricensis*.³

In shell-heaps in Maine were discovered many bones of an extinct species of large and heavily built mink (*Lutreola macrondon* Prentiss), which "may have lived to historic times." Fifty-three finds of this mink were made in one shell-heap alone, one-fifth of all the animal bones found.⁴

Dr. Henry C. Mercer in his explorations of the Durham cave in Bucks county, Pennsylvania, found two vertebræ and a fragment of the lower jaw of an extinct species of peccary (*Mylohyus pennsylvanicus*). The modern peccaries are not known to have ranged any farther north than the Red river.⁵

As examples of discoveries which have extended the range of certain species, I might mention the following: In a mound in Lee county, Virginia, were found the bones of the caribou, which, on the authority of Dr. J. A. Allen, "is farther south than bones of the caribou have hitherto been found."⁶ In a shell-heap in Maine, Dr. Wyman found the bones of the elk or wapiti. This animal

²Some Archaeological Work in Porto Rico, American Anthropologist, N.S., 1917, Vol. 19, pp. 225-226.

³An Extinct Octodont from the Island of Porto Rico, West Indies, Annals of the New York Academy of Sciences, Vol. XXVII, pp. 17-22.

⁴Loomis, F. B., and Young, D. B., On the Shell-heaps of Maine, The American Journal of Science (New Haven, Conn.), 1912, Vol. XXXIV, pp. 27-28. See also F. B. Loomis, New Mink from the Shell-heaps of Maine, *ibid.*, 1911, Vol. XXXI, pp. 227-229; D. W. Prentiss, Description of an Extinct Mink from the Shell-heaps of the Maine Coast, Proceedings of the U. S. National Museum (Washington, 1903), Vol. XXVI, pp. 887-888, and an article by M. Hardy on The Extinct Mink from the Shell-heaps, Forest and Stream, 1903, Vol. LXI, p. 125. Hardy thinks the animal became extinct about 1860.

⁵An exploration of Durham cave in 1893, Publications of the University of Pennsylvania, Vol. VI, p. 175.

⁶Carr, Lucien, Report of the Exploration of a Mound in Lee county, Virginia, etc., Report of the Peabody Museum, Vol. II, 1876-78, p. 89.

then (1868) was not known to exist east of the Alleghany mountains.⁷

The discovery of bison bones in a cave on the upper Tularosa river, New Mexico, has extended the southwestern range of this mammal over one hundred miles.⁸

One of the most recent discoveries is that of some deer bones in Nova Scotia. Mr. Smith found a distal phalanx and some teeth in shell-heaps on Merigomish harbor, and I found several astragali, distal⁹ and proximal phalanges, the distal end of a humerus and teeth in a shell-heap on Mahone bay, about seventy-five miles west of Halifax. Nicholas Denys¹⁰ (circa 1653) does not mention the deer, and the first printed record of its appearance in Nova Scotia was in 1888. Even in New Brunswick it was not seen until 1818, only becoming plentiful by 1847.¹¹

Although they were plentiful in the days of early settlement, caribou seem to have been scarce around Mahone bay in prehistoric times, only a small piece of antler, doubtfully referred to this species, being found in the shell-heap there. Only a few individuals, also, are represented among the animal remains from Merigomish harbor.

Some archaeological discoveries may help to settle uncertain or disputed points in zoology. For instance, I found in the prehistoric shell-heap on Mahone bay, the shells of the land snail *Helix hortensis* Müller,¹² and Dr. G. F. Matthew found some in a shell-heap at Bocabec, New Brunswick.¹³ They have also been found on an island in Penobscot bay, Maine,¹⁴ and on Martha's Vineyard.¹⁵ This snail is considered to be " unquestionably identical with the European species," and it was for a long time generally accepted by conchologists that it had been introduced from Europe. Morse, however, considered it "strange

that, while in the old country it is found near the habitations of men, in this country it occurs only upon the most uninhabitable islands."¹⁶ The shells found in the Mahone bay shell-heap, while they still retain traces of the rarely occurring rufous revolving bands, bear the same appearance of age as the other shells composing the heap. There is a possibility that these snails worked their way down into the shell-heap recently, perhaps by way of the burrows of small mammals, but if this were really so we would expect them to be almost as fresh looking as recent shells. Besides, if these snails crawled into the heap recently, why did we not find other species also? Dr. Matthew found the shells of no less than six native species of snails at various levels in the heap at Bocabec, and Morse reported nine from a heap on an island on the coast of Maine.¹⁷ It seems to me, therefore, just as probable that the snail shells from the Mahone bay shell-heap were deposited with the rest of the shells when the heap was formed as that they were intrusive. This and other testimony would tend to prove that the species was indigenous or else had found its way to America through other channels than commercial intercourse long before the arrival of Europeans on this continent.¹⁸ Possibly they came by way of the much discussed land-connection between the old and the new world.¹⁹

The occurrence in a shell-heap on an island in Casco bay, Maine, "of the little snail *Zua lubricoides*" Stimpson (now known as *Cochlicopa lubrica* Müller), is also, according to Morse, "inconsistent with the view that it is an introduced species."²⁰

It is still doubtful whether *Litorina litorea* (Linn.), or "Periwinkle," is an indigenous species or one introduced from Europe. No shells have yet been found in any of the prehistoric shell-heaps of the Atlantic coast, but if some were found deep in one of these heaps it would certainly be indisputable evidence that this species was here long before the advent of the white man. The possibility of finding this shell again suggests the necessity for careful and thorough methods of archaeological

⁷Wyman, Dr. Jeffries, An Account of Some Kjoekkenmoeddings, or Shell-heaps, in Maine and Massachusetts, The American Naturalist, 1868, Vol. I, p. 572.

⁸Lyon, Marcus W., jr., Mammal Remains from Two Prehistoric Village Sites in New Mexico, Proceedings of the U. S. National Museum, 1907, Vol. XXXI, pp. 647-648.

⁹Identification confirmed by Dr. Gerrit S. Miller, of the U. S. National Museum.

¹⁰Description and Natural History of the Coasts of North America (Acadia), translated and edited by W. F. Ganong. Published by the Champlain Society (Toronto, 1908).

¹¹Chamberlain, Montagu, Mammals of New Brunswick, Bulletin Natural History Society of New Brunswick (St. John, 1884), No. III, p. 39.

¹²Identification confirmed by C. W. Johnson, Curator, Boston Society of Natural History.

¹³Discoveries at a Village of the Stone Age at Bocabec, N.B., Bulletin Nat. Hist. Soc., New Brunswick, No. III, p. 24.

¹⁴Johnson, C. W., *Helix hortensis* from a Maine Shell-heap, The Nautilus, 1914-1915, Vol. XXVIII, p. 131.

¹⁵Johnson, C. W., The Distribution of *Helix hortensis* Muller, in North America, *ibid.*, 1906, Vol. XX, p. 76.

¹⁶The Land Snails of New England, The American Naturalist, 1868, Vol. I, p. 187.

¹⁷Wyman, *op. cit.*, p. 566. Also Proceedings of the Boston Society of Natural History, 1866-1868, Vol. XI, pp. 301-302. The presence in the lower portion of this particular heap of so many species of snails which, as Morse notes, can only exist in hardwood growths, whereas the island at the time of the exploration of the shell-heap was covered with large spruce trees, would argue a considerable antiquity for the shell-heap.

¹⁸See Johnson, *op. cit.*, pp. 73-80. See also Dr. W. H. Dall's Land and Fresh-water Mollusks (Harriman Alaska Expedition, New York, 1905), Vol. XIII, p. 29, for its occurrence in the glacial Pleistocene of Maine.

¹⁹See Scharff, R. F., Distribution and Origin of Life in America (New York, 1912), p. 14.

²⁰Wyman, *op. cit.*, p. 566.

exploration. It might be of interest to note, in this connection, that shells of *Litorina irrorata* Say, which species now ranges no farther north than the coast of Florida, were found in the refuse of a prehistoric rockshelter near New Haven, Connecticut.²¹ Its place in Connecticut waters is now taken by *Litorina litorea*.

While we are on the subject, I might mention a few other archaeological discoveries of interest to the conchologist. The Mahone bay shell-heap, besides shells of *Mya arenaria* Linn., *Pecten Magellanicus* (Gmelin), *Venus mercenaria* Linn., *Spisula solidissima* (Dillwyn), *Spisula polynyma* (?) (Stimpson), *Mytilus edulis* Linn., *Ensis directus* (Conrad), *Lunatia heros* (Say), *Purpura lapillus* (Linn.), and *Buccinum undatum* Linn., also yielded two small shells of the oyster (*Ostrea virginica* Gmelin.) So far as I can learn very few oysters now occur in the bay. No oyster shells were found in the prehistoric shell-heap near French Village at the head of St. Margaret's bay.²² Only a single fragment was discovered in a shell-heap on Cole harbor, east of Halifax.²³ Dr. Matthew did not find any oyster shells in the heap at Bocabec,²⁴ nor were they reported by Professor Baird from the heaps at Oak bay, St. Croix river.²⁵ Oysters seem very scarce on the Atlantic coast of Nova Scotia, and according to Whiteaves only a few are found at Jeddore Head, and in Country and Lipscombe harbors, east of Halifax. The same authority does not mention their occurrence anywhere on the Bay of Fundy.²⁶

Our shell-heap evidence therefore is interesting as suggesting that the oyster also was scarce on the whole outer or Atlantic coast of the Maritime Provinces in prehistoric times. Mr. Smith found many oyster shells in the heaps on Merigomish harbor, which accords well with the present more common occurrence of the species in Northumberland straits.

On the coast of Maine there is a scarcity of oysters at the present day, but the prehistoric shell-heaps are almost entirely composed of oyster shells, some of the heaps, especially those on the Damariscotta river, reaching a depth of from six to twenty-five feet and covering many acres of ground.

²¹MacCurdy, G. G.: The Passing of a Connecticut Rockshelter, The American Journal of Science, 1914, Vol. XXXVIII, pp. 517-518.

²²Jones, J. M., in Smithsonian Report, 1863, p. 371, and Glossip], W., On the Occurrence of the Kjøkkenmoedding on the Shores of Nova Scotia, Proceedings and Transactions of the Nova Scotian Institute of Natural Science for 1863-1866 (Halifax, 1867), Vol. I.

²³G[lossip], op. cit., p. 98.

²⁴Op. cit.

²⁵Baird, Spencer F., Notes on Certain Aboriginal Shell Mounds of the Coast of New Brunswick and of New England, Proceedings of the U.S. National Museum, 1881, Vol. IV, p. 293.

²⁶Catalogue of the Marine Vertebrata of Eastern Canada (Geological Survey, Canada), Ottawa, 1901, p. 115.

THE PREHISTORIC FAUNA OF THE ST. LAWRENCE AND OTTAWA VALLEYS.

One can get a fairly good knowledge of the fauna of the St. Lawrence and Ottawa valleys in prehistoric times from a study of the animal bones recovered from the Roebuck village site. This is the largest collection of animal bones from a single site in any museum in Canada. The bones comprise those of mammals, birds, reptiles and fish, and there also are shells of several species of land snails and fresh-water shell-fish. My information is as yet not complete enough to reconstruct the entire fauna, so I will attempt to show how the mammalian fauna alone could be reconstructed by means of archaeological and other evidences.

The first column in the table below indicates the animals which are known to inhabit the country surrounding the Roebuck village site. The second column shows those whose former presence is vouched for by old residents.²⁷ In the third column is indicated the species formerly and still living elsewhere in the Ottawa valley within from fifty to seventy-five miles of the site. The last column gives the species represented by bones found at the Roebuck village site.

Names of Mammals	Present known Fauna.	Former known Fauna.	Elsewhere in Ottawa valley	Prehistoric Roebuck village site.
COTTON-TAIL RABBIT, <i>Sylvilagus floridanus</i> (Allen)	X			
VARYING HARE, <i>Lepus americanus</i> Erxleben ²⁸			X	X
CANADA PORCUPINE, <i>Erethizon dorsatum</i> (Linn.)		X	X	X
JUMPING MOUSE, <i>Zapus hudsonius</i> (Zimmerman)	X		X	
RED-BACKED MOUSE, <i>Evolotomys gapperi</i> (Vigors)			X	

²⁷I am indebted to Mr. George A. Drummond, of Roebuck, Ont., and Mr. F. P. Smith, of Brockville, for lists of mammals found in the vicinity of the site.

²⁸It is interesting to note that neither Mr. Drummond nor Mr. Smith mentions the White or Southern Varying Hare. It has been known for some time that the common Cotton-tail rabbit is continually pushing its way farther to the north, gradually displacing the hare. The hare goes with the destruction of the coniferous forests and the Cotton-tail comes in with the second-growth. (See The Geographical Distribution of the Eastern Races of the Cotton-tail, etc., by Outram Bangs, in Proc. Boston Society of Natural History, 1895, Vol. XXVI, p. 412).

Names of Mammals	Present known Fauna.	Former known Fauna.	Elsewhere in Ottawa valley.	Prehistoric Roebuck village site.
MEADOW MOUSE, <i>Microtus pennsylvanicus</i> (Ord) ²⁹ -----			X	X
MUSKRAT, <i>Ondatra zibethica</i> (Linn.)--	X		X	X
WHITE-FOOTED MOUSE, <i>Peromyscus leucopus</i> (Rafinesque)-----	X		X	
CANADIAN BEAVER, <i>Castor canadensis</i> Kuhl.----		X	X	X
WOODCHUCK, <i>Marmota monax</i> (Linn.)----	X		X	X
CHIPMUNK, <i>Tamias striatus</i> (Linn.)----	X		X	X
BLACK OR GRAY SQUIRREL, <i>Sciurus carolinensis</i> Gmelin.	X			
RED SQUIRREL, <i>Sciurus hudsonicus</i> (Erxleben)-----	X		X	X
FLYING SQUIRREL, <i>Glaucomys volans</i> (Linn.)--	X		X	
SHORT-TAILED SHREW, <i>Blarina brevicauda</i> (Say)--			X	
BREWER'S MOLE, <i>Parascalops breweri</i> (Bachman)-----			X	
STAR-NOSED MOLE, <i>Candylura cristata</i> (Linn.)-	X		X	
BROWN BAT, <i>Eptesicus fuscus</i> (Beauvois)	X		X	
SAY'S BAT, <i>Myotis subulatus</i> (Say)----			X	
SILVER-HAIRED BAT, <i>Lasionycteris noctivagans</i> (LeConte)-----			X	
VIRGINIA DEER, <i>Odocoileus americanus</i> (Erxleben)-----	X		X	X
WAPITI, <i>Cervus canadensis</i> (Erxleben) ³⁰ -----		X		X

²⁹The incisor teeth of this species, identified by Dr. R. A. Anderson, of the Biological Division, Geological Survey, Canada, were recovered from the faeces of some animal, probably the aboriginal dog.

³⁰Represented by a few molar teeth, a polished perforated canine, and possibly by some phalanges. Antlers were plowed up about one mile west of the site some years ago.

Names of Mammals	Present known Fauna.	Former known Fauna.	Elsewhere in Ottawa valley.	Prehistoric Roebuck village site.
MOOSE, <i>Alces americanus</i> Jardine ³¹ -		X		X
WOODLAND CARIBOU, <i>Rangifer caribou</i> (Gmelin) ³²		X	X	
RACCOON, <i>Procyon lotor</i> (Linn.)-----				
BLACK BEAR, <i>Ursus americanus</i> Pallas----	X			X
OTTER, <i>Lutra canadensis</i> (Schreber)		X	X	X
COMMON SKUNK, <i>Mephitis mephitis</i> (Schreber) ³³ -----	X		X	
WOLVERINE, <i>Gulo luscus</i> (Linn.) ³⁴ -----				
PINE MARTEN, <i>Martes americana</i> (Turton)				X
FISHER, <i>Martes pennanti</i> (Erxleben)		X		X
MINK, <i>Mustela vison</i> Schreber----	X			X
NEW YORK WEASEL, <i>Mustela noveboracensis</i> (Emmons)-----				
SMALL BROWN WEASEL, <i>Mustela cicognanii</i> Bonaparte-----	X		X	
RED FOX, <i>Vulpes fulva</i> (Desmarest)--	X		X	
GRAY WOLF, <i>Canis lycaon</i> Schreber----		X		X
WILD CAT, <i>Lynx ruffus</i> (Gueldenstaedi)		X		
CANADA LYNX, <i>Lynx canadensis</i> Kerr.----	X		X	

³¹Represented by a few molar teeth and possibly an astragalus and several phalanges. The wide antlers are said to have been plowed up in the neighborhood of the site. Moose were killed by Gallinée and his party in Lake St. Francis, about sixty miles east of the site, in 1669.

³²Mr. Drummond was informed by an old hunter that when a boy his father would bring in deer with the horns standing "straight up from the top of the head." The description at once suggests caribou. A caribou killed at L'Original about 1859 is the nearest record of its occurrence in the Ottawa valley.

³³Although the skunk was eaten by some Indians and bones have been found on sites elsewhere, no bones were found at the Roebuck site.

³⁴The wolverine may have ranged as far south as the St. Lawrence valley, but no bones were found at the Roebuck site. Dr. W. Brodie found some bones in refuse heaps in York county, Ont., which he thought were possibly those of this animal. (See Annual Archaeological Report of the Provincial Museum, Toronto, for 1901, p. 51).

Out of the thirty-eight species of mammals which possibly once constituted the mammalian fauna of the country in the neighborhood of the Roebuck site, we now know definitely that eighteen species were represented in prehistoric times. Six out of seven of the species and one doubtful species would be known only from archaeological or historical evidences.

It will at once be apparent how important our archaeological evidence would be if we had no historical evidence of the existence of these mammals, and especially after the lapse of another fifty or a hundred years, when many, if not most of the species, still found in the neighborhood, will have disappeared.

PREHISTORIC RANGE OF THE WILD TURKEY.

I will now endeavor to show by means of certain examples how archaeological evidence can be utilized to show the prehistoric distribution of certain species of animals. I have selected the wild turkey because it seems to have been one of the most important food birds wherever it was abundant. In two Ohio sites, explored by Mr. W. C. Mills,³⁵ for example, turkey bones constituted as much as eighty per cent of all the bird bones found. Almost everywhere, too, where the bird existed, the bones have been made into various implements and ornaments, the tarsometatarsus being the favorite bone for awls or bodkins. I have admitted such artifacts as evidence of its presence, although there is a slight danger here that when such artifacts are few in number they may have been brought from elsewhere.

Of the original turkey, the *Meleagris gallopavo* of Linnæus, there are now four recognized varieties, as follows:—

Meleagris gallopavo silvestris Vieillot. Wild Turkey.

Range—Eastern United States from Nebraska, Kansas, Western Oklahoma, and eastern Texas, east to central Pennsylvania; formerly north to South Dakota, southern Ontario and southern Maine.

Meleagris gallopavo merriami Nelson. Merriam's Turkey.

Range.—Transition and Upper Sonoran zones in the mountains of southern Colorado, New Mexico, Arizona, western Texas, northern Sonora, and Chihuahua.

Meleagris gallopavo osceola Scott. Florida Turkey.

Range.—Southern Florida.

Meleagris gallopavo intermedia Sennett. Rio Grande Turkey.

Range.—Middle northern Texas south to north-eastern Coahuila, Ueueo Leon and Tamaulipas.³⁶ Third ed., Revised (New York, 1910), pp. 145-146.

As may be seen from the map these varieties are found distributed over a considerable area in North America.

In Canada its habitat was limited to the southwestern part of Ontario, and it was fairly abundant in the days of pioneer settlement. Mr. C. W. Nash, Biologist of the Provincial Museum, Toronto, in a letter to the writer states that so far as he has been able to discover the range of the Wild Turkey "was confined to that part of the province south of a line drawn from the corner of Lambton county to Hamilton. It may have occasionally wandered a little north of that in some places, but not far. East of the county of Wentworth I have never heard of it." According to Macoun's Catalogue of Canadian Birds, the late Dr. Brodie said, "that many years ago (between 1840 and 1850), a well-known and reliable hunter saw a flock on the west side of Yonge street, in the township of Whitchurch, near Toronto, Ontario."³⁷ Archaeological evidence, seemingly confirmatory of the prehistoric presence of the bird in this very township, has been discovered by Dr. Brodie,³⁸ so it is altogether probable that the turkeys seen by Dr. Brodie's hunter informant were not stragglers but permanent residents of that part of York county.

It would be interesting to know just where and when the wild turkey first entered Canada, but, of course, this would necessarily be pure guess work. We know from archaeological evidence, however, that the bird was in Ontario and probably fairly abundant three, four, or perhaps even five centuries ago. Perhaps then, as when the bird was first seen by whites, adverse climatic conditions prevented the migration of the bird farther north and east. This is singular when we consider that the domesticated turkey, although mostly housed during part of our severe northern winters, seems to thrive far north of the limits reached by its wild congener.

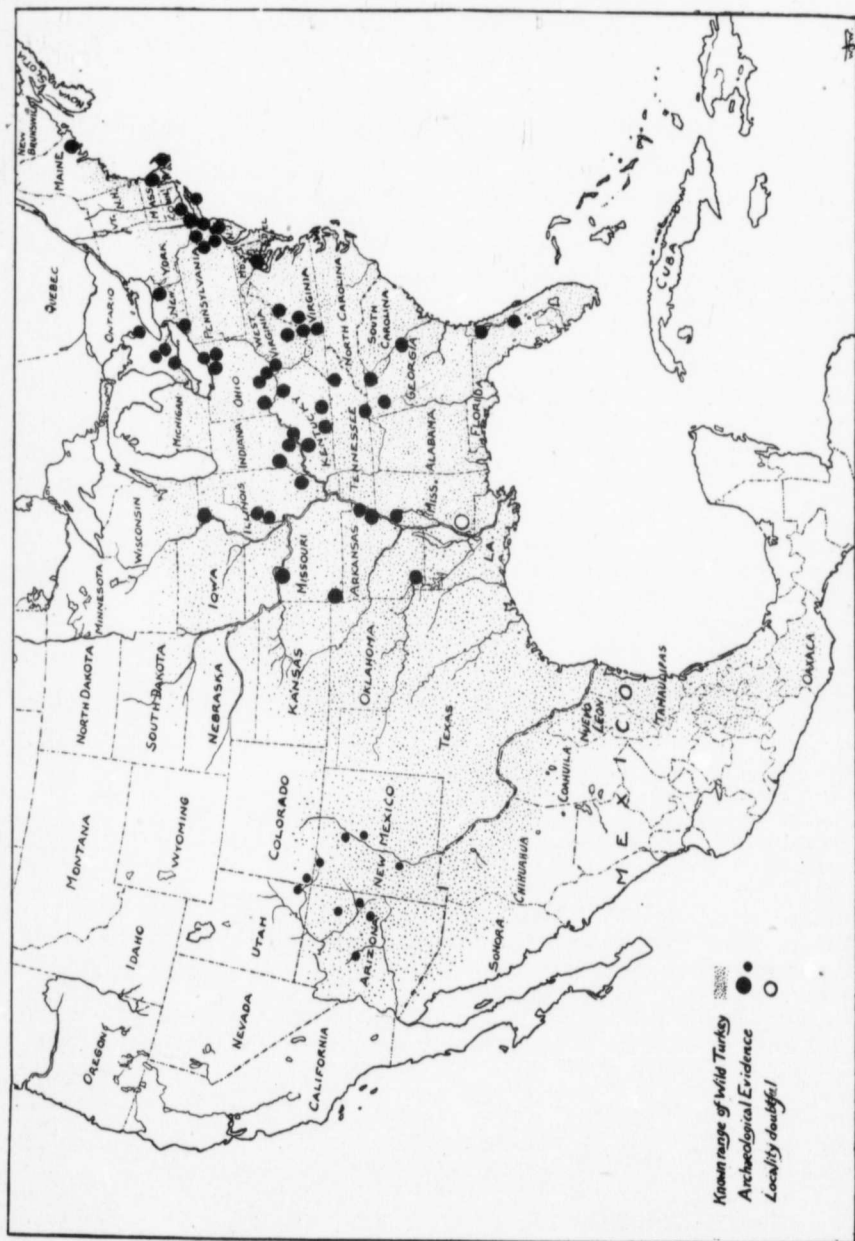
In Wisconsin the wild turkey is known to have ranged as far north as Green bay, but in all this region its bones do not appear to have been found. Perhaps the bird had spread there only a short time before the arrival of the whites. Carver (*circa* 1766-1768) saw "great plenty" of them near Lake

³⁵"Explorations of the Gartner Mound and Village Site," (Reprint from the Ohio Archaeological and Historical Quarterly, Vol. XIII, No. 2); (Columbus, 1904), p. 32; and "Explorations of the Baum Village Site (Reprint, *ibid.*, Vol. XV, No. 1), 1906, p. 31.

³⁶A. O. U. Checklist of North American Birds.

³⁷Macoun, John and James M., Catalogue of Canadian Birds (Department of Mines, Geological Survey Branch, Ottawa, 1909), p. 234.

³⁸Brodie, Dr. William, Animal Remains Found on Indian Village Sites, Annual Archaeological Report, 1901 (Ontario), p. 48



The known range of the wild turkey and the prehistoric range as far as determined from available archaeological evidence.

Pepin, in Minnesota,³⁹ and if they were seen as early as this they may have been common enough even a century earlier. The bird was once fairly plentiful in South Dakota. The Mandans knew the turkey, but no archaeological remains of the bird have so far been found on prehistoric Mandan sites.

Now, turning again to the map, it will be observed that the farthest western archaeological occurrence of what was probably *M. g. silvestris* is in southwestern Missouri,⁴⁰ the farthest southern in middle Florida and the farthest northern, in central Ontario. The occurrences in New Mexico and Arizona are most probably those of semi-domesticated *M. g. merriami*; at least the desiccated bodies with well preserved feathers, found in some ruins there, have been identified as Merriam's turkey. Our knowledge of the prehistoric range of the wild turkey, however, although slightly extended in one direction, is probably very incomplete. This is due to several reasons, one being that some regions may not have been inhabited by the turkey, the faunal areas occupied by Merriam's turkey and the Rio Grande turkey, for instance, being separated by a broad belt of desert country where the bird could not possibly exist. Then, again, other regions, inhabited by the turkey, were perhaps unsuitable for human inhabitants, and, in some areas, where there were human inhabitants, the bones of the birds for some reason may not have found their way to refuse heaps and mounds, or other archaeological remains. Another cause, and I think this is probably the principal one, is that in some regions archaeological work, if done at all, has not been done thoroughly; in short, it was not considered worth while to collect animal bones. In many instances also the identity of the bones, which may have been collected, has never been determined, and the complete results of the exploration are therefore not known.

What interesting results could be obtained had we the necessary data! Notwithstanding the incompleteness of our map, it may yet be interesting to ornithologists as showing where the turkey did exist in prehistoric times.

The very incompleteness of the map will, nevertheless, serve to emphasize how important it is for all future archaeological work to be done in a thorough, systematic manner.

PREHISTORIC RANGE OF THE GREAT AUK.

Archæological finds of bones of the Great Auk

³⁹Travels through the Interior Parts of North America, etc: Third edition, (London, 1781), p. 56.

⁴⁰C. N. Gould in his "Prehistoric Mounds in Cowley county," (Kansas), speaks of finding the bones of a gallinaceous bird, which may have been those of the turkey. (Transactions of the Kansas Academy of Science, 1895-1896 (Topeka, 1898), Vol. XV, p. 80).

(*Plautus impennis* (Linn.)), whose range on the European side of the Atlantic was from Iceland to the Bay of Biscay and on the American side from Greenland to Virginia, have helped to extend our knowledge of the former range of this bird considerably. This was interestingly shown in a map by Lucas in 1889.⁴¹ Further evidence has been discovered since this map appeared and I take the liberty of presenting one here on a larger scale giving the location of these recent additions to our knowledge. The known summer and winter ranges are as indicated on the Lucas map, but to indicate the archaeological evidence I am using a symbol which stands out more distinctly than that used by him.

In Europe the Great Auk was rarely met along the coasts of Norway and Sweden, but as is evidenced by the finding of its bones in shell-heaps, it frequented the fjords of Denmark in prehistoric times. Its remains have also been found in shell-heaps in the Orkneys, in Caithness, and on Oronsay island (Argyleshire), Scotland; in old sea caves in Durham, England, and in Donegal, Antrim, Waterford and Clare, Ireland.⁴²

In America the remains of this bird have been found in shell-heaps along the North Atlantic coast. No evidence has been found of its presence in Nova Scotia, unless some bones found in the shell-heap at the head of St. Margaret's bay, and described as "evidently belonging to a bird much larger than the Great Northern Diver (*Colymbus glacialis*)⁴³ were those of the Auk. Baird found Great Auk bones in the shell-heaps of New Brunswick.⁴⁴ In Maine the bones occurred in sufficient numbers to justify the belief that the bird was formerly very common. It was represented among the animal remains found by Wyman in the shell-heaps at Mount Desert and Crouchs cove,⁴⁵ and the shell-heap explored by Baird, especially those on some islands in Casco bay.⁴⁶ More recently, Loomis and Young found its bones the most abundant of the bird remains in one of the shell-heaps on Flagg island, Maine.⁴⁷ In Massachusetts its remains occurred in considerable numbers at Eagle Hill, in Ipswich.⁴⁸ Wyman found its bones in a

⁴¹Lucas, Frederick A.: Animals Recently Extinct or Threatened with Extermination, etc., Report of the U.S. National Museum, 1889, p. 639.

⁴²Sharpe, R. B., A Hand-book of the Birds of Great Britain (London, 1897), Vol IV, pp. 112-113; Saunders, H., An Illustrated Manual of British Birds (London, 1899), p. 698; and Hartert, E., Jourdain, F. C. R., Ticehurst, N. F., and Witherby, H. F., A Hand-list of British Birds, etc. (London, 1912), p. 206.

⁴³Jones, J. M., in Smithsonian Report for 1863, p. 371.

⁴⁴Op. cit., p. 297.

⁴⁵Wyman, op. cit., p. 574.

⁴⁶Op. cit., p. 296.

⁴⁷Op. cit., p. 29.

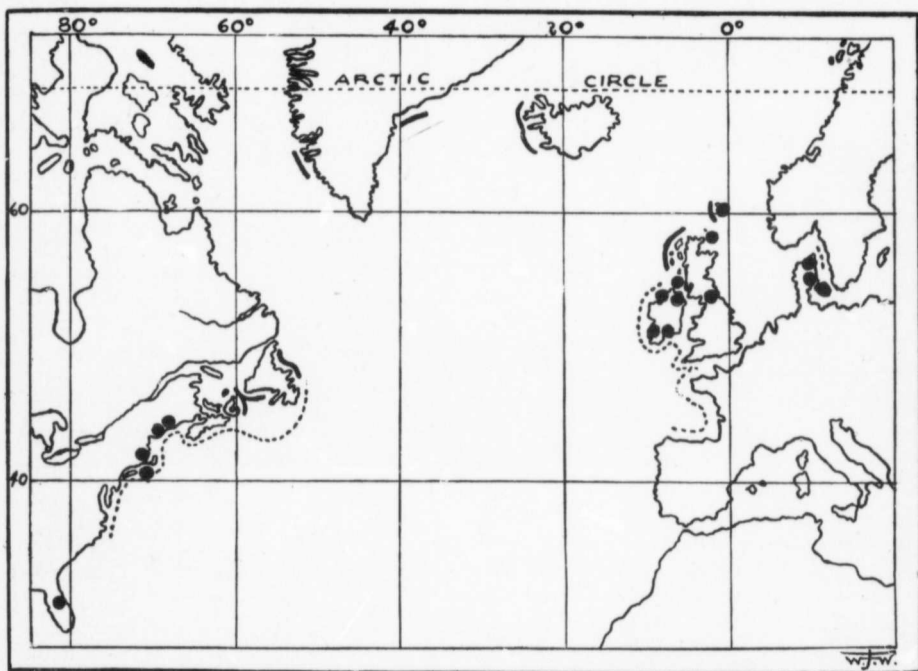
⁴⁸Baird, op. cit., p. 297.

shell-heap on Cape Cod,⁴⁹ and, according to Putnam, bones were also taken from the shell-heaps of Marblehead and Plum Island.⁵⁰

Shell-heaps on Block Island, off the coast of Rhode Island, likewise yielded evidence of its presence.⁵¹

The most interesting discovery yet recorded, however, is that of two left humeri of this bird in a shell-heap at Ormond, Florida, in 1902, by W. S. Blatchley and C. H. Hitchcock, which indicates that this bird must have gone farther south than has been generally supposed, but it is very doubtful whether it was a permanent resident of Florida.⁵²

ground that the bones are probably those of birds taken during their migration southward.⁵³ Miss Hardy, on the other hand, maintains that the bones are those of summer residents and not migrants,⁵⁴ because she thinks she "can show the best of reasons for believing that nineteen-twentieths of all the clams and oysters represented by one shell-heap were taken and shelled during the summer months." Dr. Eaton, however, speaking of the Block Island shell-heaps, says, "there is no reason for supposing that they were deposited during the summer only, or even principally. On the contrary, the remains of many birds which visit our coast in the autumn



Summer Habitat of Great Auk —. Winter Range ----. Archaeological Evidence

The discovery of the bones of the Great Auk in shell-heaps has given rise to the question whether or not the bird was a summer resident of the New England coast. This has been discussed by Lucas, Miss Hardy and others. Lucas takes the

and early spring rather indicate a permanent residence of the Indians there. Furthermore, the fact that all the auk bones found belonged to mature skeletons is opposed to the theory that these birds bred on the island.⁵⁵ Forbush, considering the archaeological and historical evidence, seems in the main to agree with Miss Hardy's conclusion and thinks "we have the best of evidence that the Great Auk was found in summer at the head of Buzzard

⁴⁹Second Annual Report of the Peabody Museum (Boston, 1869), p. 17.

⁵⁰The American Naturalist (Salem, Mass., 1870), Vol. III, p. 540; Note.

⁵¹Eaton, George F.: The Prehistoric Fauna of Block Island, as Indicated by its Ancient Shell-Heaps, The American Journal of Science (New Haven, Conn., 1898), Vol. VI, pp. 143 and 147-148.

⁵²Hay, Dr. O. P.: On the Finding of the Bones of the Great Auk (*Plautus impennis*) in Florida, The Auk, 1902, Vol. XIX, pp. 255-258.

⁵³Great Auk Notes, The Auk, 1888, Vol. V, p. 232.

⁵⁴Hardy, Fanny P., Testimony of Some Early Voyagers on the Great Auk, *ibid.*, p. 384.

⁵⁵Op. cit., p. 148.

Bay and the junction of the Cape Cod peninsula with the mainland."⁵⁰

CONCLUSION.

In these days when much stress is quite naturally laid on the economic value of scientific work, it is pleasing to know that archæology, aside from what many may consider its purely academic interest, is also, as I think I have succeeded in demonstrating above, of indirect value from an economic stand-

⁵⁰Forbush, E. W., A History of the Game Birds, Wild Fowl and Shore Birds of Massachusetts and Adjacent States. (Issued by the State Board of Agriculture, 1912), p. 496.

point. There is, of course, a reciprocal dependence of one science on another—archæology depending on zoology for the determination of animal remains and zoology on archæology for useful osteological material.

One of the main points to be remembered is that archæology in order to be truly scientific and most useful to other sciences, should be conducted in a thorough manner by trained, or at least competent, investigators and not by mere collectors of curios or other irresponsible parties, who destroy more useful material than they succeed in preserving.

TYPES OF CANADIAN CARICES.

By THEO. HOLM, CLINTON, MARYLAND, U.S.A.

For nearly thirty years the writer has enjoyed the great privilege of receiving botanical collections from the Canadian Government at Ottawa. These collections, mainly brought together by Professor John Macoun, and his son, Mr. James M. Macoun, represent an immense number of Phanerogams from the Pacific to the Atlantic slope and extending far north to the Arctic regions. Although extremely rich in species of all the natural families known from Canada, these collections, nevertheless, made it evident that one genus appeared to have interested these gentlemen more particularly than most of the others. It so happened that the genus *Carex* has been, and is yet, the favorite one of the Macouns. Naturally the collectors laid special stress on the numerous species of this genus, and it is due to the great experience and skill of these gentlemen that their collections of *Carex* have been more rich in species than similar collections brought together by botanists in general.

As a matter of fact to collect Carices is a most difficult task, at least when the aim is to have the species represented at different stages, typically and less typically developed, and to show the enormous variation exhibited by many of the species. The object of the Macouns was not merely to collect specimens, but individuals in large series of developmental stages. Many new and rare species were discovered, *Carex petricosa* Dew., and *C. Franklinii* Boott, never collected since Drummond, were brought home last year by James M. Macoun in magnificent specimens. Last but not least, the geographical range has been extended year after year and it has been shown that the genus possesses many species in Canada of extremely wide distribution, not a few being circumpolar, and many ascending from the lowlands to the alpine regions

of the Rocky Mountains. And a point of special importance is that great care was taken to consider the variation of the species, which is common to many of these, when inhabiting different localities at different altitudes, and associated with certain species. In this way a broader view has been gained, and the systematist has been guided to appreciate the power of the species to adapt itself to the environment, instead of increasing the already untold number of species supposed to be specifically new, but actually being mere forms or varieties. Many instances illustrating this fact might be mentioned, but we shall confine ourselves to a few. *Carex spectabilis* Dew., was never known before except as the typical plant, described by Dewey, but James M. Macoun gathered the species in Jasper Park, Alberta, at a number of stations, and proved the species to be one of special interest with respect to variation, influenced by the environment. Such very inconspicuous species as *C. scirpoidea* Wormskj., *C. nigricans* C. A. Mey., *C. pratensis* Drej., *C. gynocrates* Wormskj., *C. lejocarpa* C. A. Mey., and a host of others are now known and understood better than ever before through the painstaking studies in the field by John and James M. Macoun. Even the remote districts in Yukon, explored by John Macoun, have proved rich in Carices, of species closely allied to each other of the same alliance as a number of North European species, the *rigida*, *aquatilis* and *acutina* alliance, in Europe so excellently outlined and described by Elias Fries, Laestad, Blytt and others.

To the writer of these pages these collections have been of the same value and interest as to the Macouns, inasmuch as he for many years, has given special attention to the same genus in Europe and

the United States. However, our knowledge of the American element of the genus we owe almost exclusively to the Macouns, through their familiarity with the genus and correct determinations. The liberal gifts of well selected material in connection with, so to speak, a most indefatigable correspondence has enabled us to draw a concise comparison of the Old World and American representations of *Carex*.

Most prevalent in the north, even beyond the Arctic Circle, and at high elevations in the mountainous districts, the genus has proved of special interest to the student of plant geography and of the migration of species during the glacial epoch, to be traced now through the circumpolar element, mingled with types of southern origin. And the vast distribution of the genus has resulted in the production of types utterly unlike each other, when comparing the supposed ancestral with those of more recent origin. The outlining of the genus in natural greges we owe to Elias Fries, Tuckerman and Salomon Drejer, who laid the foundation of demonstrating the natural affinities, instead of following the usual tendency to arrange the species in accordance with superficial characters in a mere analytical way. And, while all other Caricographers considered the "*Indicae*" distinct from "*Vigneae*" and "*Carices genuinae*" Drejer in his excellent work "*Symbolae Caricologicae*" combined these, the "*Indicae*" with the two others; thus the "*Indicae*" may be looked upon as representing evolute types of greges of both *Vigneae* and *Carices genuinae*. Furthermore Drejer demonstrated the probable affinities of the species within the greges, considering the monostachyous as "*formae hebetatae*" passing into the "*centrales*" the typical of the grex, and culminating in some more evolute with some deviating types, the so-called "*desciscentes*." By this logical arrangement the monostachyous species became transferred to various greges, instead of as formerly constituting one most unnatural section with no other feature in common than possessing a single spicate inflorescence, the pistillate, or a spike, the staminate.

Now with respect to Canadian types of the genus, it is interesting to see that of the 39 greges enumerated by the writer¹ only five are absent from Canada; these greges are as follows: *Psyllophorac* (Europe and Azores), *Chionanthac* (Europe), *Leucocephalac* (Virginia), *Echinochlaenac* (Australia), and finally *Podogynac* (Japan).

As regards the greges present the *Microrhynchac*, *Aeorastachyac*, *Echinostachyac* and *Physocarpac*

are the best represented, being rich in species and of very wide distribution.

But of special interest are a number of types represented among the various greges, types of a very characteristic structure. These we will describe briefly in the same order as the respective greges (l.c. p. 453). A tristigmatic *Vigneae*, *C. nardina* Fr., by Boott named *C. Hepburnii* has been collected on mountain summits of Alberta and British Columbia. Some of the *formae hebetatae* of the *Astrostachyac*; *C. gynocrates* Wormskj. and *C. exilis* Dew., have been known as varying from monoecious to dioecious; of these the former confined to Greenland and this continent is undoubtedly most commonly monoecious in the north, judging from the specimens we have examined which were collected in Northern Labrador, British Columbia, Alaska and Greenland; in the last place we found this species probably at its most northern limit Skarvefjaeld on the island of Disco, about 69 N. lat. where it occurred only as monoecious. A still more evolute stage is represented by *C. exilis*, which in Canada occurs as monoecious or dioecious, mono—or plio—stachyous. A gynaeandrous² spike is frequently met with in this species, besides that the female plant may possess several lateral spikes, from one to six, at the base of the terminal. Among the *centrales* of this grex we find *C. stellulata* Good., *C. interior* Bail., *C. sterilis* Willd., widely distributed and clearly demonstrating a natural alliance of true species, although of very close relationship. The very peculiar and rare *C. sychnocephala* Carey of the grex *Sychnocephalac* is also a native of Canada, and only one Old World species is known of this grex, *C. cyperoides* L.; they both are very much alike, showing exactly the same habit. Among the *Xerochlaenac*, *C. macrocephala* Willd., with its dense and remarkably large inflorescence occurs on the coast and islands of Alaska, and this *Carex* is tristigmatic, although a typical member of *Vigneae*. Very peculiar is the Canadian representative of *C. teretiuscula* Good³ with its large and frequently ramified inflorescence. Among the *Athrostachyac*, *C. festiva* is represented by a multitude of forms, and is widely distributed in the mountains; a very interesting alliance is composed of *C. pratensis* Drej., *C. pestasata* Dew.,

²The term gynaeandrous is applied to spikes with both sexes represented, the pistillate flowers being situated above the staminate; the opposite position occurs in androgynous spikes, where the staminate flowers are situated at the apex of the spike, the pistillate at the base. Formerly the term androgynous was used to signify both cases.

³It is very unjust to accept the name *C. diandra* Schrank in place of Goodenough's *C. teretiuscula*, since Schrank's material upon which he established the species was mixed, containing also *C. paradoxa* Willd. and *C. paniculata* L.

¹Greges Caricum (Studies in the Cyperaceae) American Journal of Science, Vol. XVI, 1903, p. 445.

C. adusta Boott, and *C. liddonii* Boott, besides *C. aenea* Fernald, all of which have been collected in Canada, and at a number of remote stations. Even the monotypic grex *Microcephalae* with *C. capitata* L. occurs in Yukon and Alaska, extending eastward to Alberta, Hudson Bay and Greenland.

Among the Carices genuinae the Melananthae is one of the most interesting grexes; the *formae hebetatae* with their sessile spikes, and the terminal being gynæcandrous resemble certain *Vigneae* (*C. alpina* Sw.), and a corresponding distribution of the sexes occurs in several species of the centrales; *C. atrata* L. and its allies. In Canada *C. alpina* Sw.⁴ is known from the higher mountains; *C. atrata* L., the typical plant, has been collected at several stations by James M. Macoun, notably in the mountains of Alberta, Jasper Park, but a near ally of this, *C. ovata* Rudge (*C. atratifomis* Britton) is much more frequent especially on the Atlantic coast, nevertheless it is absent from Greenland, where it is replaced by the typical *C. atrata*. The very evolute type *C. Mertensii* Presc., in which the numerous spikes are gynæcandrous, is known from the western districts, British Columbia and Alaska. A very singular type of this grex is *C. Parryana* Dew.; it may occur as dioecious, with a single spike; which, however, seems constantly to be pistillate; or the culm is terminated by a gynæcandrous seldom purely staminate or pistillate spike, while there may also be one to four lateral spikes which are purely pistillate. *Carex Parryana* was described from specimens collected by Dr. Richardson at Hudson Bay, but has since been reported as abundant in the northern part of the prairie region, extending from Portage la Prairie to near the Athabasca river. From the mountains of Alberta, Jasper Park, James M. Macoun brought home a splendid series of *C. spectabilis* Dew., illustrating the various forms under which it appears, when inhabiting different altitudes, and stations with environment of varied nature. These interesting forms together with the typical plant have, so far, only been observed in Washington, Mt. Paddo, where they were discovered by Mr. Wilhelm Suksdorf. A species of somewhat remarkable habit is *C. microchaeta* nob., which John

Macoun collected in Yukon; in this species the culm is phyllopodic, otherwise the plant resembles somewhat *C. Tolmiei* Boott, and *C. spectabilis* Dew., but is, however, of a much more robust habit.

Passing to the *Microrhynchae*, Canada is very rich in species of this grex, and several of these are of abundant occurrence; *Carex stricta* Lam., *vulgaris* Fr., *acutina* Bail., *variabilis* Bail., and *lenticularis* Michx., are perhaps the best known. Typical *C. vulgaris* Fr., is known from Alaska, British Columbia and from the eastern provinces, but the variety *lipocarpa*, nob., is much more frequent, and readily to be distinguished by the narrow leaves and the early deciduous perigynia; this variety abounds on Vancouver Island, in British Columbia and Yukon at various elevations. The variety *stolonifera* Hoppe has been collected in Labrador. Another and quite striking variety is *limnophila* nob., which resembles *C. rufina* Drej., the culm being low, curved and the spikes contiguous with the terminal occasionally gynæcandrous. It has been found on St. Paul Island, Bering Sea, and on a nunatak in Columbia glacier, Prince William's Sound; still another variety *hydrophila* nob., from Yukon is a very slender plant, with long stolons clothed with shining, purplish brown scale-like leaves, the spikes are peduncled, cylindric, dense-flowered and erect; finally the variety *strictaeformis* Bail. occurs in Nova Scotia; it is of caespitose habit, quite tall and slender with the sessile spikes remote and subtended by short bracts. In other words *C. vulgaris* shows in Canada the same ability to vary as is the case with the European plant, but, in several respects it varies in a different way. For instance the long stipitate, strongly nerved perigynium is not represented in the European plant, nor is the perigynium early deciduous as is the case with our common variety *lipocarpa*.

C. aquatilis Wahlenb., has been reported from a number of stations in Canada, and it is sometimes accompanied by some closely allied species, in Yukon by *C. sphacelata* nob., and *C. chionophila* nob.; in the Arctic regions it is replaced by *C. stans* Drej. While *Carex rigida* Good. is common in the Arctic regions, it has also been reported from some of the higher mountains in British Columbia, and the variety *Bigelovii* (Torr.) Tuckerm., is known from the Hudson Bay region. Two allies of *C. rigida*: *C. consimilis* nob., and *C. cyclocarpa* nob., are natives of Yukon; in the former the orbicular perigynium is sharply denticulate along the upper part of the margins, but the habit reminds one of *C. hyperborea* Drej.; in *C. cyclocarpa* the perigynium is turgid of a dark brownish green color

⁴The name *C. alpina* Sw. has been replaced by *C. Halleri* Gunn., in Gray's New Manual of Botany, because Schinz and Theilung have adopted this name (Bull. d'herb. Boissier, Vol. 7, 1907). However Gunner did only "pro tempore" propose this species, and without his name as author. After his death his herbarium was examined, and as stated by several Swedish authors, Gunner's material contained not only *C. alpina*, but also *C. Norvegica*, thus the name *Halleri* became invalidated. No other authors have, so far, called the species *C. Halleri*, and surely the old masters knew they had some good reason for ignoring this name.

with purplish spots above, and the caespitose habit reminds one of *C. caespitosa* L., but it lacks the aphyllipodic structure of this species.

Allied to *C. acutina* Bail. is *C. limnocharis* nob. from Yukon, a species with long, slender, pistillate spikes of reddish brown color, in habit much like the European *C. proluxa* Fr. Furthermore there are two very characteristic species bearing a strong resemblance to the European *C. acuta* L., *C. Sitchensis* Presc., known from Alaska, and *C. dives* nob., from the Chilliwack Valley and Vancouver Island, British Columbia. And, if we compare the European representations of these alliances, the *aquatilis*, *rigida* and *acuta*, we meet with analogous types corresponding with those of this continent.

The large grex *Aeorastachya* is also well exemplified in Canada, and several of the species are also well known from the northern parts of Europe, viz, *Carex subspathacea* Wormskj., *C. salina* Wahlenb., *C. cryptocarpa* C. A. Mey., *C. maritima* L., *C. Magellanica* Lam.⁵ *C. limosa* L., *C. rariflora* Sm., and *C. stygia* Fr. Of these *C. subspathacea*, *rariflora* and *stygia* extend to the Arctic regions.

But especially characteristic of this continent are *C. macrochaeta* C. A. Mey., *C. nesophila* nob., *C. aperta* Boott, *C. crinita* Lam., and *C. magnifica* Dew. A somewhat peculiar habit is exhibited by *C. nesophila*; the culm is phyllopodic and the spikes resemble those of *C. salina*, while the structure of perigynium corresponds with that of *C. macrochaeta*. This interesting species was detected by James M. Macoun on St. Paul Island, Bering Sea, and since then it has also been collected on Popoff Island by Mr. Trevor Kincaid.

Although exceedingly frequent on the Alaskan coast and the islands, *C. macrochaeta* shows but

⁵With respect to *C. Magellanica* Lam., this species has been excluded from the North American flora, and in the recently published Gray's New Manual of Botany it has been replaced by *C. paupercula* Michx. on the strength of the diagnosis of Lamarek calling for a species with androgynous spikes, as pointed out by M. L. Fernald (Rhodora, Vol. 8, 1906, p. 73). And Mr. Fernald having examined 623 inflorescences and finding that in 600 of these the terminal spike was purely staminate, and only more or less androgynous in the remaining 23, this author reaches the remarkable conclusion that the North American species is distinct from Lamarek's, which was collected on the shores of the Straits of Magellan. The fact is, however, that Lamarek (Encyclop. 3, p. 385, n. 25) described his species "spicis androgynis," meaning that all the spikes, the terminal as well as the lateral, had staminate flowers at the base thus beneath the pistillate flowers. In *C. Magellanica* the spikes are, thus, gynaeandrous, i.e., pistillate at the top, staminate at the base and exactly this disposition of the sexes occurs in the North American and European representations of *C. Magellanica*. The main point, that the lateral spikes are constantly gynaeandrous has escaped the attention of Mr. Fernald, although Boott, Schkuhr and nearly all other caricographers have described and figured the species correctly. The fact, that the terminal spike is frequently purely staminate is of no importance.

slight variation. The terminal spike is usually wholly staminate, but we found, however, a few specimens from Unalaska in which this was either androgynous or gynaeandrous or even entirely pistillate. In the variety *emarginata* nob., the scales are prominently emarginate with a seta four times as long as the body of the scale.

In another variety *macrochaeta*, nob., the plant is very robust with four short and heavy pistillate spikes, the perigynium is very large and longer than the simply mucronate scale; it was collected on St. Paul Island, Bering Sea, by James M. Macoun. These varieties agree, however with the typical plant with respect to the culms being constantly aphyllipodic.

Among the *Cenchracarpae* we meet with the interesting little species *C. bicolor* All., reported from Alaska, Yukon and British Columbia, besides from Labrador; it occurs also in Greenland, and on the Alps in South Europe. Much more frequent is *C. aurea* Nutt., and among the desciscentes we meet with *C. granularis* Muhl., *C. pallescens* L. and the very local *C. Torreyi*, Tuckerm.

From a morphological viewpoint the *Lejochlaenae* constitute one of the most interesting grexes with their monopodial shoots and aphyllipodic culms. They are mostly sylvan types of light green color, and the more or less drooping spikes give them a very graceful aspect. Nearly all the American members are represented in Canada, and while *C. Hendersonii* Bail. is a western type the others are mainly eastern. We meet here with the *laxiflora* alliance, as well as with some desciscentes: *C. grisea* Wahlenb., *C. oligocarpa* Schk., *C. conoidea* Schk., and *C. glaucodea* Tuckerm.

The *Dactylostachya* are much less common, and altogether poorly represented on this continent; Canada, however, is the home of the beautiful little species *C. concinna* R. Br., *C. pedunculata* Muehl. and *C. Richardsonii*, R. Br.

Some few species of the small grex *Microcarpae* are represented in Canada, viz: *C. gracillima* Schw., and *C. formosa* Dew. Characteristic of the *Athrochlaenae* is the scales being deciduous of the perigynia being prominently stipitate and reflexed at maturity. It is a very small grex containing only two species, *C. pyrenaica* Wahlenb., and *C. nigricans* C. A. Mey. Both are found in Canada and the geographical name of the former certainly proves very unfortunate, inasmuch as the species occurs also in New Zealand. A grex closely allied to the *Athrochlaenae* is that of the *Stenocarpae* so far as concerns the structure of the perigynium, being attenuated at both ends, relatively narrow, and the generally dark colored spikes. It is a grex

of very peculiar geographic distribution since two of the *formae hebetatae*: *C. lejocarpa* C. A. Mey., and *C. circinata* C. A. Mey., are known only from Alaska and Oregon, besides some few stations on the coast of British Columbia. The *formae centrales* on the other hand, are mostly natives of the European Alps and the Himalayas, some very few occurring in Canada, viz: *C. petricosa* Dew., and *C. Franklinii* Boott., furthermore *C. Lemmonii* Boott (*C. ablata* Bail.) occurs at several stations in Canada, Washington, Montana and California. Among the *formae desciscentes* is the circumpolar *C. misandra* R. Br., which occurs in the Rocky Mountains of Colorado extending northward through the Canadian provinces.

Nearly all the American members of the *Sphaeridiophorae* have been collected in Canada, and among the *hebetatae* *C. scirpoidea* Michx., with the variety *stenochnaena* nob., is quite extensively distributed. The Greenland *C. deflexa* Hornem., occurs in Canada, but is generally confounded with *C. Rossii* Boott.; however, these two species are easily distinguished, since the culms of *C. Rossii* are aphyllopodic, those of *C. deflexa*, on the other hand, phyllopodic.

The rather large and coarse species of the *Trichocarpae* are in Canada represented by *C. riparia* Curt., var *lacustris* Willd., *C. trichocarpa* Muhl., with the var. *aristata* (R. Br.) Bail., *C. filiformis* L., *C. lanuginosa* Michx., and the very characteristic *C. Houghtonii* Torr. These species are, however, of a very ordinary structure, but readily distinguished by the perigynium being of a brownish or dark green color, more or less turgid, pubescent and attenuated into a bidentate beak with the sharp teeth spreading.

Of greater interest is the grex *Hymenochlaenae*. Here we meet with some *formae hebetatae*: *C. Steudellii* Kunth, *C. Willdenowii* Schk., and *C. Bachii* Boott, of which the flowerbearing culms are ramified in exactly the same manner as in the *Indicae*, the *Vigneastrae* of Tuckerman.⁶ The more evolute types resemble, on the other hand, *Carices genuinae* in general, but they are mostly light green, with the spikes long-peduncled and drooping. The best known are, for instance, *C. arcata* Boott, *C. debilis* Michx., *C. longirostris* Torr., *C. flexilis* Rudge, *C. capillaris* L., *C. assiniboensis* W. Boott, and the singular, very conspicuous, *C. amplifolia* Boott. The presence of these species in Canada thus illustrate the fact of the morphological structure of the flower bearing stem being identical with that of certain members of the highly developed

Indicae, as pointed out above, in *C. Willdenowii* for instance. In passing to the *Spirostachyae*, only a few are known from this continent, and some few of these from Canada, viz: *C. Oederi* Retz., *C. flava* L., *C. scuarrosa* L., and the very rare *C. fulva* Good., the last of which being less rare in Europe.

As representing the most evolute of the greges we have the *Echinostachyae*, *Physocarpae* and *Rhynchophorae*. In these the perigynium is thin, membranaceous and inflated. In the *Echinostachyae* the pistillate spikes are peduncled, drooping and squarrose at maturity, the beak of the perigynium is quite distinct bidentate.

Two small monostachyous species: *C. microlochin* Wahlenb., and *C. pauciflora* Lightf., represent *formae hebetatae*, and both occur in Canada. Among the *formae centrales* we meet with the very slender *C. subulata* Michx., and the much more conspicuous *C. pseudocyperus* L., *C. Schweinitzii* Dew., *C. hystrix* Muehl., and *C. rotorsza* Schweinitz, all well known in Canada, with the exception of *C. Schweinitzii*, which is very rare.

Characteristic of the *Physocarpae* is the perigynium having a very short, mostly emarginate beak, and the pistillate spikes not being squarrose, moreover the scale of the pistillate flower is lanceolate, acuminate, but lacks the mucro or arista of the two other greges. It is an interesting grex, and widely distributed in Canada, but several of the species are, sometimes, difficult to identify, especially those with the dark colored perigynia, for instance: *C. pulla* Good., *C. physocarpa* Presl., *C. compacta* R. Br., and *C. rotundata* Wahlenb. They are very graceful species with the shining, dark brown spikes frequently peduncled and drooping. Of a more robust habit and with the spikes of a lighter color are *C. utriculata* Boott., occurring in numberless forms throughout Canada, furthermore *C. vesicaria* L., *C. oligosperma* Michx., and a few others.

Finally the grex *Rhynchophorae* characterized by the large, erect or ascending perigynia, much inflated, strongly nerved and terminated by a prominent, bidentate beak. The species are tall, and of the same habit as those of the two former greges and like these they are inhabitants of borders of ponds, creeks and wet swamps. The grex begins with some *formae hebetatae*, *C. Michauxiana* Bœckl., and *C. folliculata* L., passing from these into *C. intumescens* Rudge, and *C. Grayii* Carey, of a similar but much more robust habit, while the more ordinary forms, such as *C. lupulina* Muehl., *C. lurida* Wahlenb., *C. Tuckermanni* Boott, and *C. monile* Tuckm., may be considered as the most

⁶Holm, Theo., Studies in the Cyperaceae, XIII Carex Willdenowii and its allies (Am. Jour. of Sc., Vol. X, July, 1900, p. 33).

evolute of this grex. In Canada the grex is thus well represented, and only a very few American species are absent.

Considered altogether the genus *Carex* in Canada is rich in types, some being confined to this continent, others being known also from Eurasia. The arctic element Canada shares mostly with Europe, and as stated above several species are circumpolar, and it deserves attention that many of these Canadian *Carices* represent alliances analogous to those of the old world, exemplified by types of a corresponding habit and general aspect.

So far as concerns the greges we have seen that Canada is the home of certain ancestral types, *formae hebetatae*, which are absent from Europe,

in other words several of the greges are more amply represented here by possessing these types in connection with the *centrales*, and passing gradually into some more or less deviating: *desciscentes*.

The presence in Canada of such characteristic species as those of the *Lejochlaenae*, mostly sylvan types of rare morphological structure, and of southern origin, indicates the enormously wide distribution of the genus on this continent, and its ability to adapt itself to the environment, far north and far south. And the alpine flora with its arctic species intermingled with endemic or more southern types is a tangible proof of the foundation of the theory relating to the history of the arctic flora during the glacial epoch.

HUNTING THE BARREN GROUND GRIZZLY ON THE SHORES OF THE ARCTIC.

By H. F. J. LAMBART, OTTAWA.

One specimen of the Alaska Boundary Grizzly, *Ursus internationalis* Merriam,* a new bear of the Barren Grizzly group, was secured in July, 1912, when engaged on the survey of the 141st meridian. This was the year in which the meridian was completed through to the shores of the Arctic Ocean. Not more than two other specimens were seen by the Canadian and American parties during the summer although signs of the bear were constantly met with.

This one specimen was secured by mere chance. One of our camps was situated in a sheltered valley which later was found to be a favorite haunt as evidenced by the quantity of hair found in the gum of the small spruce against which he was accustomed to rub. This sheltered ravine was at the head of a small stream in which there was a luxuriant shrub growth, consisting of "buck brush" with some small scattered spruce, and was hemmed in by rolling high barren ridges. The elevation of the floor of the valley was about 2,000 feet above sea level and was situated just a little on the

Canadian side of the boundary and inland from the Arctic Ocean 45 miles.

The immediate district may be described as being under the lee of the British mountains, which parallel the coast at a distance of about 25 miles and reach an altitude of 6000 feet at the boundary; the mountains are deeply furrowed, the ridges being bare and open with little vegetation.

The burrows of the Arctic Ground Squirrel, *Citellus parryi* (Richardson), are sadly rooted out throughout the district casting suspicion on our friend the bear.

The floor of the river valleys are, generally speaking, heavily brushed as also the sheltered sides of the valley, and small patches of the small Arctic spruce in these localities are frequent.

I have definitely proved to my own satisfaction that the Brown and Grizzly bears prey upon the sheep (*Ovis dalli*) at the southern end of the boundary where they are found in large numbers, but here at the northern end where the sheep are very

*Alaska Boundary Grizzly. *Ursus internationalis* Merriam, Proc. Biol. Soc. Washington, xxvii, pp. 177-178, August 13, 1914.

Type locality—Alaska—Yukon Boundary, about 50 miles south of Arctic coast (lat. 69° 00' 30").

Type Specimen—No. 1763 ad., Ottawa Museum. Killed July 3, 1912, by Frederick Lambart, of Canadian Boundary Survey.

Range—Region bordering Arctic coast along international boundary, and doubtless adjacent mountains, between the coast and the Yukon—Porcupine; limits unknown.

Characters—Size medium or rather large; affinities doubtful. Color a peculiar pale yellowish brown. Head strongly arched; muzzle and frontal region broad. Large lower premolar strictly conical, without heel, as in the brown bears.

Cranial characters—Skull of medium size, massive, strongly arched and dished, highest over

anterior part of braincase; frontal shield broad, very short pointed posteriorly sulcate medially and swollen over orbits; postorbitals bluntly rounded, strongly decurved, not widely projecting; fronto-nasal region strongly dished; rostrum large and broad; sagittal crest long but feebly developed; zygomata subtriangular, not widely outstanding, and not much expanded vertically; palate and post-palatals rather broad; notch moderate. Teeth rather small for size of skull; heel of last upper molar small and obliquely truncate on outer side; large lower premolar strictly of brown-bear type—a single cone without heel, sulcus, or posterior cusplets; first lower molar broad and somewhat sinuous; middle lower molar narrow and short posteriorly.

Skull measurements.—Adult male (type): Basal length, 309; occipito-nasal length, 293, palatal length, 169, zygomatic breadth, 203.5, interorbital breadth, 82.

scarce, no signs of their having been attacked or preyed upon were seen.

Around the camp at the time there were a number of cayuses from the pack trains apparently entirely ignored, although one report came in of a case where one whole train was stampeded.

The specimen referred to above was shot early in the morning in the brush of the southern slopes of the valley very near the camp, mistaken by one

at the time and the skull cleaned. The pelt was naturally not in prime condition but, however, now forms a valuable specimen in the bear collection of the Victoria Memorial Museum at Ottawa.

The color of the hair is a very light brown, darker on the back and shoulders. The head is very wide and the nose long.

The large brown bear frequenting the margins of the glaciers on the southern end of the bound-



ALASKA BOUNDARY GRIZZLY, *Ursus internationalis* Merriam.

member of the party for one of the cream colored cayuses. He was quietly strolling along unconscious of the presence of any danger and killed instantly with a .303 military cartridge at close range. The bullet having mushroomed to nearly an inch in diameter was found lodged in the outer skin, which had acted like a rubber sheet absorbing the remaining spent energy of the bullet.

I am glad to say the skin was carefully preserved

ary, as well as the little black variety, was encountered.

Some interesting experiences could be sketched of these latter, their unbounded curiosity often getting the better of their natural instincts to danger, with the result that they have been known to walk into camp during the day as well as at night and ransack everything if the camp was found to have no occupant at the time.



BIRD STUDY FROM A DUCK-BLIND.

BY J. A. MUNRO, OKANAGAN LANDING, B.C.

A day's tramp in the hills usually has for an objective, a lake or slough, or a mountain-top to reach before turning homeward and after a few hours' travel, this becomes the dominant idea. One cannot sit down to watch a bird for any length of time, as the lake or slough of one's destination urges haste. One obeys the impulse and passes on, losing, it may be, a chance of learning some secret of avian psychology.

But when hidden behind a screen of brush or rushes on some pleasant lake shore, the mental attitude is that of expectancy and curiosity only. To become an inconspicuous part of the blind, that screens us from the sharp eyes of passing waterfowl, is now the object. One's predatory instincts counsel immobility and silence, so there is no impulse to move and one has the maximum of opportunity for observation. While following the flight of a bird until it is lost to view or watching with close attention, the numerous waterfowl that swim past the blind or feed within the range of binoculars, the gun is frequently forgotten. The band of scaups that swim past the blind, leaning against the breezes at an angle that reveals their white underparts and then fly straight out over the lake, until, a row of vanishing dots, they melt into the horizon, have appealed to other than the sportsman's eye. The impulse is to watch rather than shoot; the carefully built blind and the decoys swinging at their anchors to leeward have served the bird lover rather than the sportsman.

October in the Okanagan is a month of golden cloudless days and starlit nights. To-day, the 7th (1918) the lake is unruffled by the slightest breeze and on the glassy surface, there is a perfect unblurred replica of the surrounding hills. There is no frost, but the early morning air is keen and one's fingers grow numb grasping the canoe-paddle. This intimation of the cold days to come is forgotten when the first shafts of sunlight cut through the belt of firs on the mountain-top. As the sun rises higher, bathing the western hills in a flood of golden light, that creeps lower and lower until every tree stands out in relief, and as the mist-wraiths over the water are drawn up and dissipated, one can see little evidence of autumn, save the bold splashes of yellow along the shore-line where the cottonwoods are turning.

The blind is built on the edge of a narrow sandy beach, close to the mouth of a small creek that pursues its indolent course through a wide valley of farm land and brush to the north. One hun-

dred yards from the water, where the beach merges into the meadow, there is a thicket of deciduous trees, poplar, birch, alder and willow. From this shelter come the voices of a few late migrants; the faintly heard "chirp" from the last of the Audubon's Warblers and the stronger, more metallic calls from a band of Gamble Sparrows.

The lake is dotted with grebes, Western, Holboell, Horned and Pied-bills. The Horned Grebes are quite fearless; seven swim in among the decoys and alternately dive for food or preen their already immaculate plumage. Alarmed by a gun-shot, they fly, splashing along the surface for thirty or forty yards, when they alight again and huddle in a compact flock, as if for protection. In a few minutes they paddle back to rest among the decoys. Their plumage seems to be in need of constant attention; when not feeding, they are usually oiling and combing their feathers, sometimes lying on the side, one foot above the surface and bill buried in the glistening breast.

The other small species, the Pied-bill, which is much less common here, does not visit the decoys. They are more easily alarmed than the Horned Grebe, and at a sudden movement sink below the surface until only head and neck are visible, then with a rapid look to either side disappear, leaving scarcely a ripple.

The two larger species are much more wary and keep some distance out from the shore. The Western Grebe with its long slender neck and hair-like plumage, suggest reptilian ancestry more than do the other species. Paddling towards one is an interesting experience. Before being alarmed they float high on the water, conspicuously black and white; as the canoe draws near, they turn and swim straight away, showing only the black upper parts which blend with the dark water. The head is carried stiffly erect on the long straight neck and there are frequent quick glances backward. A few yards nearer and they dive with a quick clean flip. Many of these birds are suffering from a wasting disease, probably due to the presence of intestinal parasites in large numbers. The actions of the sick birds identify them at once. They swim slowly close to the shore as a rule and dive only when actively pursued, to arise exhausted within a few yards.

In the presence of their handsomer cousins the less conspicuous Holboell receive only a cursory inspection. Those that pass the blind to-day are all juveniles, with dark greyish back, spotted breast

and lacking the characteristic red neck of the adults.

The lake at noon is like a polished steel disc and a faint heat haze shimmers on the surface. Through this medium the grebe are seen as distorted shapes, suspended a foot above the water, or so it appears. Presently a faint breeze comes; the surface breaks into millions of scintillating points of light; the decoys bob up and down and make short journeys to the length of their anchor lines. The steamer ties up at the dock two miles away and the small flock of Herring Gulls that attend its daily voyage take this opportunity for a prowl along the shore, on the lookout for dead kokanees or squaw-fish. This is their daily habit. When the mid-day voyage is over they rest on the water opposite the dock until the steamer leaves in the morning then rise slowly one by one and follow with their leisurely tireless flight, keen eyes ever on the alert for the scraps that are thrown overboard from the cook's galley.

For several hours, a flock of twelve Green-winged Teal have been feeding in the shallow water, behind the thin line of rushes twenty yards out from the shore. They are very nervous, rising every few minutes and swinging out over the lake several times before pitching in again. With what marvellous speed can they check their headlong flight and drop twisting and turning down to the water! After one of their periodic flights they settle in the shallow water and from there waddle on to the beach and feed along the windrows of *Potamogeton* that drifted in during yesterday's storm. This mass of water weeds is full of the small crustaceans and insects so eagerly sought for by surface-feeding ducks and the Teal glean the abundant harvest until a passing wagon puts them to flight.

A brown Marsh Hawk, a bird of the year, flies along the beach with business-like flight, alternately flapping, or sailing on set wings. He is overtaken and routed by several hostile crows and departs in a panic, twisting and dodging across the beach until he reaches the sheltering brush where he loses his pursuers. Crows are arriving in small bands and settle on the beach close to the water's edge, some two hundred yards from the blind. These are only the forerunners of a great noisy stream, that pass in a long straggling line, some high in the air, others close to the ground. Soon the beach is black with a cawing multitude. This is the great pre-migratory caucus; only a few of these will winter in this part of the valley. Four birds arriving by themselves are attracted to a muddy stretch of beach near the blind: they swerve from the main flight and alight in the oozy mud near the water's edge where some dead kokanees have washed in. As they feast on these a passing merlin sees them and

unnoticed, stoops like an arrow. He misses or perhaps decides that the quarry is too formidable so swings in a wide circle and settles on the top of a dead poplar in the brush, while the crows fly off with squawks of alarm and join their fellows farther down the shore.

Apparently crows do not expect enemies to appear from the water as one can approach in a canoe within a few yards while the appearance of a man on foot is the signal for their hasty departure.

The lake is still again and woolly cumulus clouds gather in the south, several sweet-voiced Mountain Bluebirds alight on the beach, their backs vividly blue against the dim-colored sand. For several minutes they quietly hunt for spiders among the debris of the beach and then continue on their way, calling as they fly.

The Osprey that yearly raises a brood in the vicinity and whose fishing grounds lie off this beach is lingering at this favored spot although the two young of her brood departed a week ago. Her clear whistle is heard at a distance, but the bird is not seen. In the shallow water fifty yards from the blind stand a number of upright fir logs, once used as mooring-posts by a long-since defunct saw-mill. One of these has been used for several summers by the Osprey as a resting place and a convenient perch on which to tear up the fish that were for her own consumption.

From far out in the lake comes the single note of a Loon, mellowed and subdued by the distance. An American Merganser swims past, neck curved and head below the surface watching for the little kokanees that are running up the creek to spawn.

A straggling flock of soft-voiced Pallid Shore Larks come drifting down the beach, like a cloud of autumn leaves blown by the wind. They flutter in a circle around the blind, alight for a moment and run to the water's edge, but without bathing or drinking they are away again like a flash, for no apparent reason. On all sides they pass, with slow undulating flight, so close, that the breath of air from their wings is felt on the cheeks. Again and again they return, always rising again before the binoculars can be levelled in the hope of picking out a Longspur among them. A short half-mile to the west, rising abruptly for a thousand feet above the lake is the bare hillside where they feed; they come to the beach only for gravel and water. It is curious how all the alpine or northern breeding birds that travel in large flocks, Rosy Finches, Shore Larks, Snow Buntings and Pipits, have this restless habit of circling and wheeling before alighting, and of flying off suddenly again in nervous haste.

A month later there is a decided change in the

aspect of the surrounding hills. Much of the color has gone; the narrow wooded coulees, that were like tongues of flame against the brown grassy slopes, are now subdued in color and merge with their surroundings. The leaves have fallen, only the delicate tracery of naked branches is seen. Along the shore line, the cottonwoods are still a blaze of orange, but many of their leaves have fallen too and cover the ground with a rustling golden carpet. The higher mountains, Terrace, Goat and Silver Star, are crowned with glittering snow-caps and the close ranks of fir for some distance below the bald summits are frosted with the silver of the first snow. As yet, there is no frost in the valley, so sitting motionless in the blind entails no discomfort and bird-life is still plentiful enough to absorb all one's attention. In the brush to the north, a Western Meadowlark is whistling, his clear flute-like notes as vivid as if it were April instead of November. A flock of brown backed Juncos are flitting through the trees or alighting on the sand and in the alders a sweet-voiced crowd of Pallid Goldfinches have gathered.

From far down the beach comes the unmistakable sonorous call of a Sandhill Crane, decidedly a belated migrant. He flies slowly along the shore with splendid slow wingbeats, head carried well forward, the neck slightly curved and legs held stiffly behind. He is attended by two softly-flying Short-eared Owls, that follow a few yards to the rear. As the crane nears the blind, he becomes suspicious and bears off to the north, the owls still following. He reaches the beach again in a wide circle and once more flies towards the blind, hesitates again and after rising higher in the air flies off, first to the north and then to the west where he is lost to view against the neutral-colored background of the hills. The owls do not follow but fly back towards the grassy meadows from whence they came and as they pass the blind, the sunlight burnishes their tawny wings until they shine like gold.

Along the eastern shore line, about two hundred yards out from the beach, a great flock of Redheads have congregated over a bed of *Potamogeton* and their feeding call, a cat-like *meow* comes softly across the water. Into this large raft, small flocks are continually flying, one sees a succession of splashes on the still water as the birds hurl themselves in and are carried by the momentum of their flight for several yards along the surface. Many of the new arrivals are Scaups and these feed among the flock of Redheads, but the Canvas Backs as a rule feed only with others of their kind. A big flight of these occurred during the past few

days. It is rarely one sees more than a dozen at one time, but during this migration flocks of twenty or thirty were common and probably two or three hundred were present at one time. As they readily fly toward the half-dozen canvass-back decoys, it is plain they are new-comers.

Close to the fringe of rushes on the shallow water near shore, a band of fifteen Ring-neck Ducks alight and immediately begin to feed. They are new arrivals and hungry; frequently all are below the surface together. More than half of them are drakes and as they rise to the surface, the white barred bill and the white triangle on the chin serve as diagnostic field-marks. The strings of weed brought to the surface trailing from their bills are hurriedly gulped and they dive for another mouthful. After feeding for forty minutes, their appetites are satisfied, so they rest on the surface for ten minutes longer, dressing their feathers and then paddle in regular alignment to the deep water and safety.

A single female Scaup swims towards the decoys, calling at regular intervals with a singular un-duck-like voice, *kuh-coo, kuh-coo*. The first syllable too short and explosive, the second exactly the coo of a pigeon.

Small bands of Buffle Head fly past, seldom more than two or three feet above the water. They swerve down to the Redhead flock but usually carry on a little beyond them, to the shallow water. The strikingly black and white adult drakes are in the minority. The young drake can be told from the ducks by their greater size, otherwise they are identical. When diving for food they are amazingly quick in their actions, coming to the surface with more buoyancy than other diving ducks. They are equally quick in the air, rising with a spring and without the preliminary splashing one associates with diving ducks.

Four Killdeer are heard down the beach and presently they fly past the blind conspicuous and noisy, to alight again a few yards away where they seem to disappear into the sand, so well do the neutral colored backs harmonize with the beach.

The half-dozen Herring Gulls that make a daily pilgrimage in the wake of the steamer have been joined by an equal number of the smaller California Gulls. These are fully adult birds with immaculate breasts that are visible from a long distance as the birds rest on the water. Red-shafted Flickers, Magpies, a Northern Shrike and a Kingfisher visit the beach during the day and in the evening outlined against a pastel tinted sky appears a triangle of Canada Geese, southward bound—a fitting climax to a perfect day.

BOOK NOTICES AND REVIEWS

THE GAME BIRDS OF CALIFORNIA. Contributions from the University of California, Museum of Vertebrate Zoology. By Jos. Grinnell, Harold Child Bryant and Tracy Irwin Storer. Univ. of Cal. Press, Berkeley, 1918, large 8 vo. pp. i-x plus 1-642, 16 colored plates and 94 text figures. Price, cloth, \$6.00 net.

This is one of the most notable bird books and one of the handsomest examples of popular book-making that has been published under the auspices of a public institution in some time. It is a credit to the University and Museum in whose name it appears, as well as to the printer who executed it and the artists and authors who illustrated and wrote it. It contains a greater mass of game bird life histories both original and compiled probably than any other work generally accessible. The colored illustrations consist of some of the best work from the brushes of Louis Agassiz Fuertes and our talented countryman, Major Allan Brooks. The many line drawings scattered throughout the text to illustrate critical points are exceptionally accurate, clean and clear. The introduction states that the work was undertaken to meet the varied requirements of the sportsman, the legislator and the naturalist and was made possible through the financial munificence of a patron who refuses to make his (or her) name known. California is to be congratulated on having such public-spirited citizens.

In an opening chapter dealing with the Decrease of Game and Its Causes it is definitely proved that game has decreased and an analysis is made of the contributing factors. Tables of game that have passed through the hands of dealers have been obtained directly from their own books and are presented in evidence. These numbers are ample evidence of the drain on wild life that market hunting entails. Other agencies of decrease are logically and calmly discussed giving due weight to their effects pro and con with convincing restraint.

The next chapter, on the Natural Enemies of Game Birds, discusses the effects of vermin and other enemies and incidentally corrects a number of common preconceptions of their relative values.

The Gun Club of California is a chapter all conservationists should read. Arguments are given on both sides to show that the subject is not a simple one to be answered offhand. Parallel columns giving detrimental and favorable effects are contrasted and the result summed up in the final paragraph, saying:

"It would appear that the institution of well re-

gulated gun clubs, occurring as it has, at a critical stage in the adjustment of natural to artificial conditions, is to be looked upon as a propitious rather than an adverse factor in the conservation of our duck supply. Whether or not, as further changes result from the increased human population, this valuation of the preserve will persist, remains to be seen"

The History of the Attempts to Introduce Non-native Game Birds in California, is an illuminating chapter, and deserves study by all who contemplate such introductions elsewhere.

The Propagation of Game Birds is an equally important chapter and includes a valuable bibliography on the subject.

The last chapter of the introductory part gives the history and present status of legislation relating to game birds in California.

The Key to the Game Birds of California seems an admirable instrument. It is clear and concise and notable for the absence of obscure or technical terms and is such that any one of ordinary intelligence should be able to get results with it.

The main part of the book is, of course, occupied with the detailed treatment of the various species in their systematic order. The descriptions of plumages are unusually complete and clear, paragraphs on Marks for Field Identification, Voice, Nest, Eggs, General Distribution and Distribution in California of each one are given, and all are admirably arranged, paragraphed and picked out by distinctive type for ready reference.

The discussions of the species include much original material, but also the most complete series of excerpts from other authors dealing with the life histories and other pertinent matter of the various species that can anywhere be found under one cover.

The method of such a tripartite authorship wherein each does that for which he is specially fitted is the ideal one in dealing with a broad subject wherein no one man can be an equal authority in all directions and the course is here amply justified by the results

This book should appeal especially to bird students, sportsmen and conservationists of western Canada as whilst it deals most particularly with California, the bulk of it is equally applicable to British Columbia and it forms the work that most nearly fulfills far western needs that has so far been published.

P. A. TAVERNER.

ERRATA

Page 51, Vol. XXXIII, Sept., 1919, delete word "late" in bottom line of right column.

Page 57, Vol. XXXIII, Sept., 1919, 11th line, left column, for "crescentic spot of purple," read "crescentic spot on purple."