JACK MILLS

BIRDS OF PREY

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FALCONRY, THE SPORT OF KINGS

Once the Means of Supplying Man's Necessities, It Has Survived the Centuries as One of the Most Romantic Pastimes of History

BY LOUIS AGASSIZ FUERTES

Illustrations in Color from Paintings by the Author

IT WILL surprise many to learn that the art of falconry, or hawking, goes back to the remote and unwritten past. We have many proofs of this in the frescoes and sculptures of the early Egyptians and Persians. And in all the time that has passed since that early day there has never been a total lapse of the art; falconry has in every age been carried on in some part of the world. Reference material is found in books not only of England, Holland, France, Italy, and Spain, but of China, Japan, and Russia, while the sport has been followed from immemorial time in India and northern Africa.

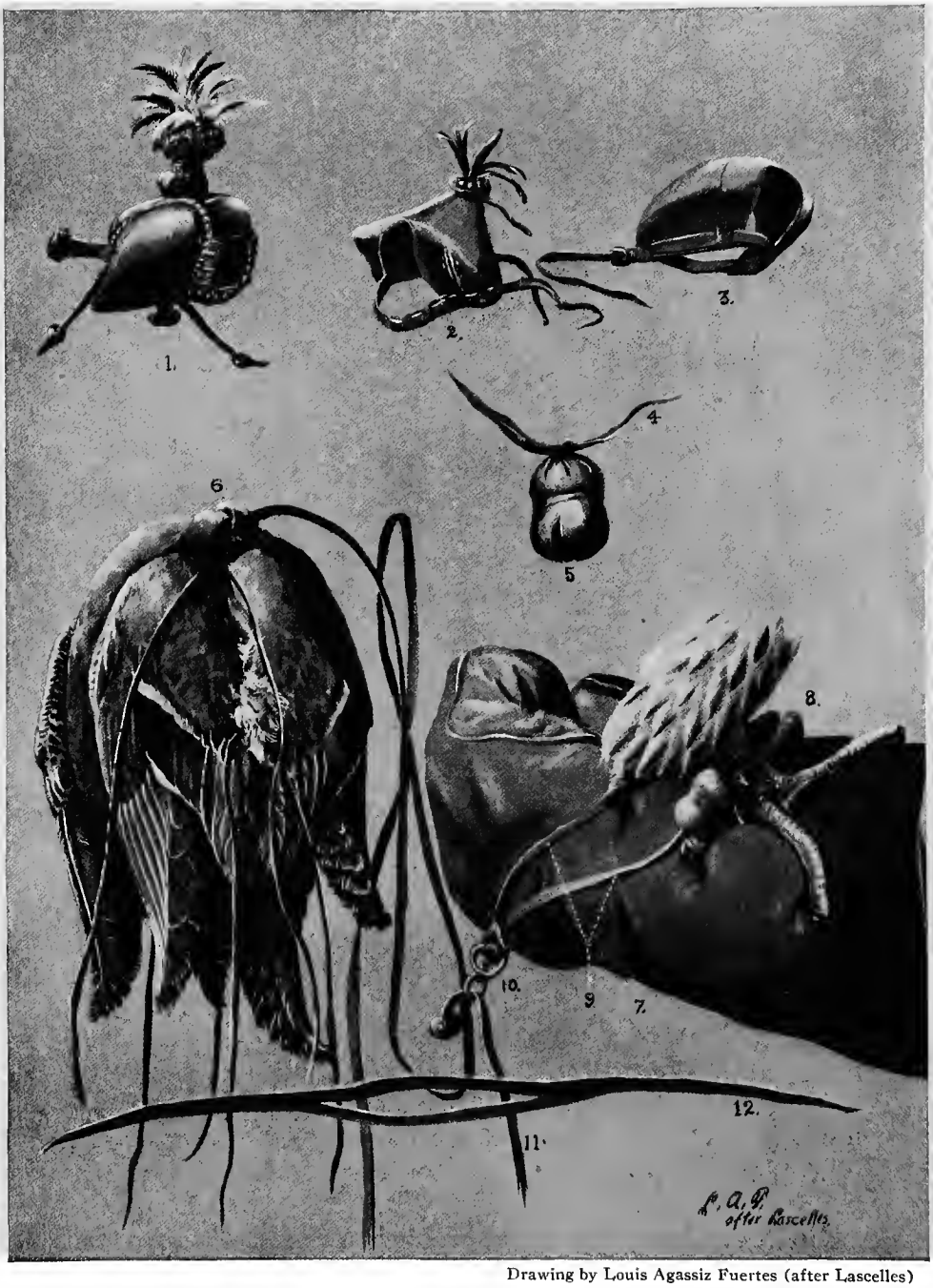
The ancient Greeks apparently knew nothing of falconry, but the Lombards, settling in north Italy about 560, knew of the art, and by 875 it had become a generally known practice throughout western Europe and Saxon England. From that time it thrived, filling an important place in the life of the times.

RETURNING CRUSADERS WERE ENTHUSIASTIC DEVOTEES OF FALCONRY

A vast impetus was given to falconry by the returning crusaders, who had become familiar with the methods of the Orient and had brought with them both falcons and trainers. War lords never left their courts without their falconers and a cadge of hawks, to be flown at anything that might be deemed worthy.

The gun, of course, delivered a serious blow to the art, as it provided a quick, sure, and inexpensive way of getting meat. Still, the real devotees were never greatly affected by this device, and through the centuries, up to the rebellion in England, and later through the French Revolution on the Continent, falconry survived the difficulties imposed by the introduction of firearms, the breaking up of the country into small holdings, the reclaiming of large areas of wild land, and other inevitable changes incident to a multiplying and advancing population.

As a general practice, however, falconry in Europe ceased after the great social upheavals mentioned. Its maintenance as a sport since then is attributable in large measure to half a dozen hawking clubs, among which are the Falconers' Club, the High Ash Club, and the Loo Club in Holland. There were probably thirty or forty private establishments in England in 1914, but no doubt the World



Drawing by Louis Agassiz Fuertes (after Lascelles)

TRAPPINGS AND GEAR USED IN FALCONRY: "HAWK FURNITURE"

(1) Dutch hood, commonly used on all but newly caught hawks; (2) Indian hood, preferred by some falconers for the same use as the Dutch hood; (3) Rufter hood, for new-caught hawks, made of soft leather and open behind, merely covering the eyes; (4) Bewit, a light strap by which to hold on the bell; (5) Indian bell, the type preferred to all others; (6) Lure; (7) Glove or gauntlet; (8) Method of attaching the bell and jess to falcon's foot; (9) Jesses, light straps permanently attached to falcon's feet; (10) Swivel, through which is passed the leash; (11) Leash, by which the hawk is held till quarry is sighted; and (12) Brail, a slit strap that goes over one wing and is tied around the other side of the hawk, to prevent it from "bating," or flying off when still wild.

War has made a heavy toll on both the personnel and the support of the sport.

Within the last twenty years there had been a great renascence of amateur falconry among the English, and some rather successful attempts have been made in America, particularly in the Genesee Valley, New York.

The great expense of maintaining the birds, due to the scarcity of experienced trainers and catchers, and the difficulties of forwarding so rangy a sport in the settled conditions of most of our eastern country have made it impossible, however, to achieve any real success in America and the growing sentiment against killing all but a few species of game-birds will probably act as a further deterrent. Still, there are several common birds which are recognized as game that would make admirable quarry for the peregrine, notably the quail of our Atlantic States and the sharp-tailed grouse of the northern prairies. The native wild goshawk is already the chief problem of all the grouse of our northern wooded section.

HAWKS ARE AMONG THE SHYEST OF CREATURES

While it is true that in training hawks to hunt, as in all other animal training, advantage is taken of the natural proclivities of the creature in hand, nevertheless, it seems at first glance that these vigorous and intrepid birds are taught to go almost directly against their instincts. First of all, being among the wildest and shyest of creatures, they must be taught that man, instead of being their worst enemy, is really their best friend. Then the rest becomes comparatively easy, if no mistakes are made. But any one of hundreds of possible errors may undo weeks of patient and successful labor.

Then, too, since different kinds of game must be hunted at different times of the year and in different kinds of cover, either the same hawk must be trained first for one type of work and later for something entirely different, or different kinds of hawks must be used.

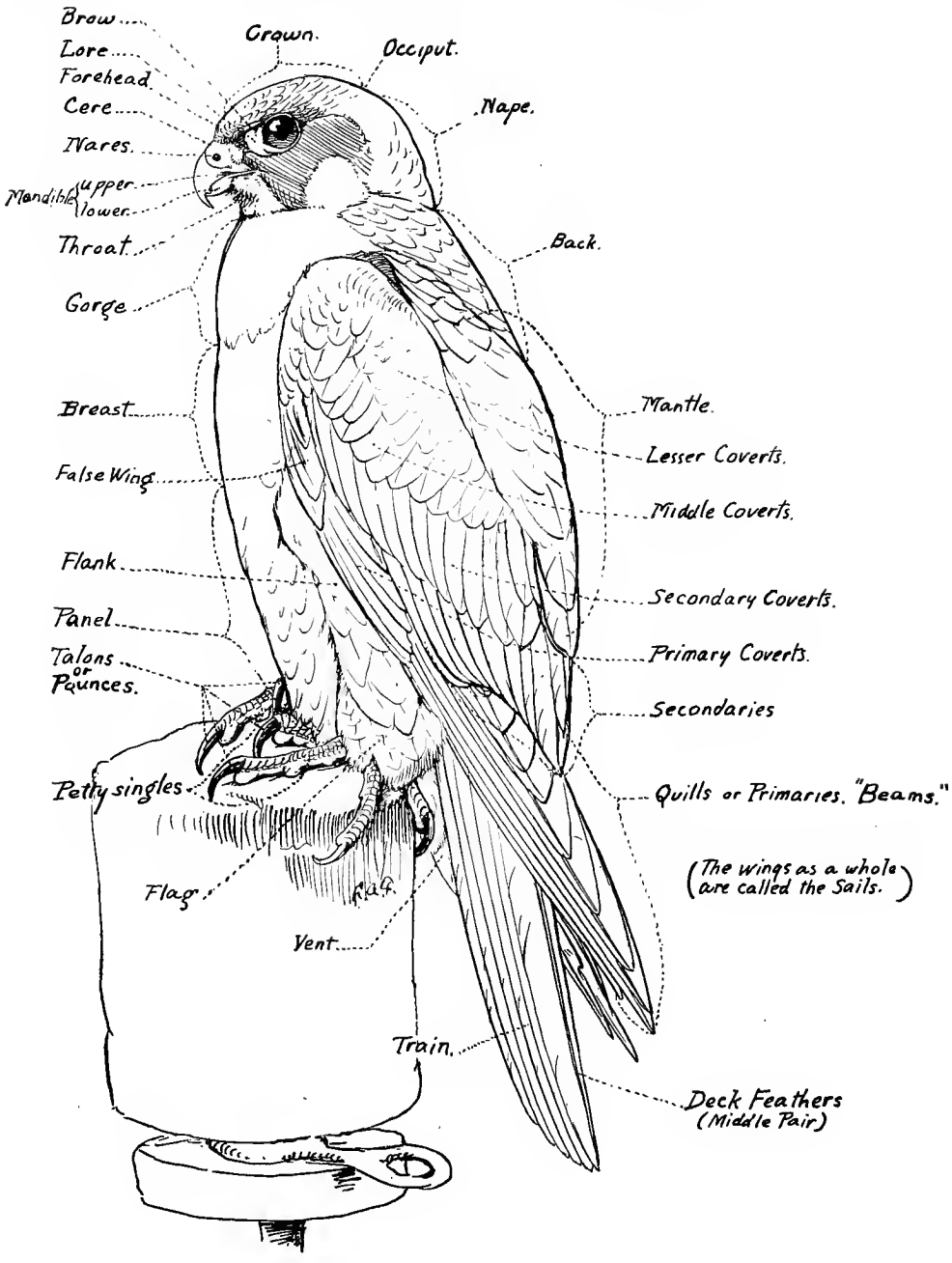
Of the hundreds of kinds of hawks, only certain ones possess the combination of qualities necessary for this beautiful and romantic sport. A hawk must be at once kind and fierce; it must be able to stand the changes of climate of its owner's country; it must be strong enough and swift enough to overtake and strike down its quarry, and intelligent enough to be able to unlearn much of its native knowledge. These qualities are possessed by only about a dozen species, belonging to two groups or genera—the true falcons, of the genus Falco, or long-winged hawks, and the short-winged group of forest-hawks known as "Accipiters." Only two of the latter are used, the goshawk and the European sparrowhawk. (The bird known in America as sparrowhawk is a small falcon which feeds principally on insects and is useless for hunting.)

THE PEREGRINE IS THE MOST COSMOPOLITAN OF BIRDS

The peregrine is the only falcon proper found all over the world. There is no other bird with such a cosmopolitan range. It is found on both sides of the Equator, throughout the entire world, nearly to the Arctic and Antarctic circles. It is natural, then, that this should be the falcon of falcons and known to all ages of man as a tractable and capable help in his search for food; for falconry was at first a very practical and even sordid pursuit, only later—much later—becoming the sport of the privileged classes.

A peculiar set of traditions and an equally picturesque language have become inseparably attached to the art of falconry; and it is only fair to the Scotch, who, in their conservatism, have been responsible for the colorful language of golf, to give them the credit for preserving the romantic terminology of falconry. It was in Scotland that the art was perpetuated after it had languished over most of Europe.

Ancient history is eloquent with the influence of the noble sport of hawking, the history of medieval Europe is richly colored with it, sixteenth and seventeenth century literature fairly abounds in passages concerning it, and the language of the day was so tinctured with the jargon of the hawkers that it is fair to conclude that, before men had knowledge of gunpowder and the fowling-piece, hawking was such a general practice as to be the principal means of obtaining wild game.



Drawing by Louis Agassiz Fuertes

A CHART GIVING THE FALCONERS' NAMES FOR THE PARTS OF A HAWK

According to the "Boke of St. Albans," published about 1486, the kinds of hawks apparently used by the various elements in English society are given as follows:

Emperor	Eagle.
King	Gerfalcon and tiercil of gerfalcon.
Prince	Falcon gentle and tiercil gentle.
Duke	Rock falcon.
Erle	Peregrine.
Baron	Bastard.
Knight	Sacre and sacret.
Squire	Lanare and lanret.
Lady	Mezlyon (Merlin).
Young Man	Hobby.
Yeoman	Goshawk.
Poorman	Tezcett.
Priest	Sparrowhawk.
Holywater Clerk	Muskayte.

THE FALCONER'S NAMES FOR HIS HAWKS

Falcons of the same kind differ so in performance and character, according to their experience before being taken in hand, that the falconer has separate names for each type, as follows:

Eyess is the name given to falcons taken from the nest;

Brancher is applied to young that have left the nest, but not the neighborhood of their infancy;

Passagers are birds of the year caught in the autumn migration;

Haggards are adult birds with two or more years of wild experience;

Falcon is strictly the female of any of the larger long-winged hawks, while the male, being nearly a third smaller and lighter in weight, is called the "tiercel" or "tarsel." In strictest usage (now generally ignored) the tiercel is the male of the goshawk, the larger of the short-winged hawks, while the male peregrine is the "light tiercel" or "tiercel-gentle" of Juliet's time. Being so much larger and stronger, the female, or falcon proper, has always received the greatest share of the falconer's regard and labor.

One who trains and hunts long-wings only is the true falconer, while the user of goshawks and sparrow-hawks is technically an Austringer or Ostringer, from the Latin *Astru* (French *Autur*), the generic name of these hawks.

The falconer has a special name for every part of his hawk and for every thing he does.

Falcons are brought into subjection to man's will either by being taken from the nest just before they are able to fly or by being caught wild after they are fully grown and self-supporting. Those taken from the nest (eyess hawks) are the ones usually trained over most of Europe. Ordinarily they are much gentler and more easily trained, but lack the dash and style of the wild-caught birds known as "haggards." In India and Africa, however, the eyess is virtually unknown, as the hawks are always trapped adult.

THE BIRD'S TRAINING BEGINS

In the training of eyesses the procedure of the present day differs only slightly from that of the Middle Ages. Modern falconers use very much the same quaint medicines and nostrums and have the same names for falconine troubles as are so picturesquely described by Bert in his "Treatise of Hawks and Hawking," published 300 years ago.

The young hawks are left until nearly all the down has been replaced by brown feathers. Their removal from the nest takes place toward evening, when they are put in a hamper and sent to the falconer. It is highly desirable that as much as possible of their journey be made at night.

Arriving at their destination, they are placed in a roughly made nest and fed on chopped beef and egg, and a little later on fresh birds, rabbit, rat, or squirrel. All food should be tied to a board in a given place, to force the young hawks, which are otherwise free except for the bell and "jess," or leg-strap, to come to the same place for food.

The birds are now "at hack" until they learn to fly, and begin to stoop at live prey on their own account. They should be left entirely alone, and for the present the wilder they become the better; for should they come now to associate food with man's presence, they would at once start clamoring and screaming every time they saw a man—a most undesirable trick.

If properly "hacked," the young birds soon learn to make long flights into the surrounding country, returning at regular intervals to be fed from the shelf or feeding-board. They may be left in this state of virtual freedom for some three weeks,

Photograph by Guy Bailey

PEREGRINE FALCON AT HER EYRIE ON THE FACE OF A 400-FOOT CLIFF NEAR ITHACA, NEW YORK

A pair of falcons has nested for many years in the same deep gorge. One July day sixteen pigeons were brought to the young hawks by the parent birds.

until they begin to catch prey for themselves. Then they are "caught up." It is time to catch them when they begin to be absent at the regular feeding time.

A bow-net is used in the trapping—a light twine net fastened along one side to a stick bent into a half circle, the free side being pegged down and the ends of the stick swiveled to pegs in the ground.

The net is folded back on the pegged side and a light cord fifty yards long tied to the middle of the bow. The trap is then baited with a tempting morsel, also pegged in place, and the bird is trapped when it comes to feed. The moment it is caught a soft leather hood, open at the back and known as a "rufter," is placed over its eyes and tied on, a swivel and leash tied to the jesses, and it is put down on soft grass with a block to sit on and left for an hour or two to settle down.

Its real "manning" (training to endure the presence of strangers) now begins. It must be carried on the gloved hand for several hours each day, spoken to, and softly stroked until it begins to lose its nervousness and becomes reconciled to the hand as a perch. It may now be fed a little, and when it eats without hesitation the hood may be removed gently, in candle-light, and the meal nearly finished unhooded. The rufter must be replaced before the end of the meal, however, or the hawk will come to associate the hood with the end of its feeding time, and resent it.

When the bird feeds freely by candle-light it may be tried in daylight, and after this is accomplished it should be accustomed to the presence of men, children, dogs, and other creatures ordinarily frightful to it. This does not usually take many days.

MOST OF THE HAWK'S LIFE IS SPENT IN DARKNESS

Now comes the hardest part of the manning—the breaking to the hood.

This is a delicate business, one in which many a fine hawk has been ruined, as a hood-shy hawk, whatever its other virtues, is of no use to its owner. Most of the hawk's life henceforth is spent in the darkness of the hood, which is only removed in the loft or at the moment when it is to be flown at quarry.

THE HAWK IS TAUGHT TO STRIKE AT A SWINGING LURE

Thus far our hawk has been fed always from the hack-board or from the fist; now the lure must be brought out and put into use. This is a padded weight (a horseshoe is excellent) with wings of teal or pigeon attached. It is also provided with strings for attaching food and a long string by which it can be dragged. The hawk is given a bite or two from it, when it is thrown to the ground, where the meal is finished.

For a time now the bird must be fed only from the lure.

As soon as the hawk recognizes the lure immediately and flies to it for food, it is given, hooded, to an assistant and "hooded off" to the falconer, who swings the lure some 200 yards distant. The bird probably will fly at the lure almost at once and in any case will discover and recognize it soon.

The lure is twitched out of sight just as the hawk goes to grasp it. At the second attempt the food tied to the lure should be awarded, and after a few repetitions of this the bird will seldom be far from its master when he has the lure with him.

The bird must now be taught to kill for itself, and a fledgling pigeon is a good subject for this. If properly trained to the lure, there is no danger of the hawk "carrying" (flying off with its quarry), which is a serious fault. After a few "easy" birds, a capable old pigeon may be flown.

The hawk, unless unusually good, will miss on this quarry, but on returning high in the air should be thrown an easy bird; then well fed and petted. It has probably learned from this that to succeed it must be above its quarry. After this is learned, the hawk may be flown at wild game.

This is the merest outline of the training of young hawks. It is an easy task, compared with the manning of haggard or passage hawks, which have for a season at least been accustomed to shunning man as the worst of all evils.

Hawks may be caught anywhere within their range, but by far the most famous place for this exciting (and remunerative) pursuit is in South Brabant, in Holland. Here, near the little village of Valkenswaarde, lies a great open moor, where thousands of passage birds go by in the autumn, followed by the falcons that prey upon them. From time immemorial—certainly well through the Middle Ages—falcons have been trapped and trained here for the nobility of all Europe.

In the heyday of the sport, emissaries from the courts of each little duchy and principality gathered at Valkenswaarde after the trapping and bought for their masters the product of the season's catch.

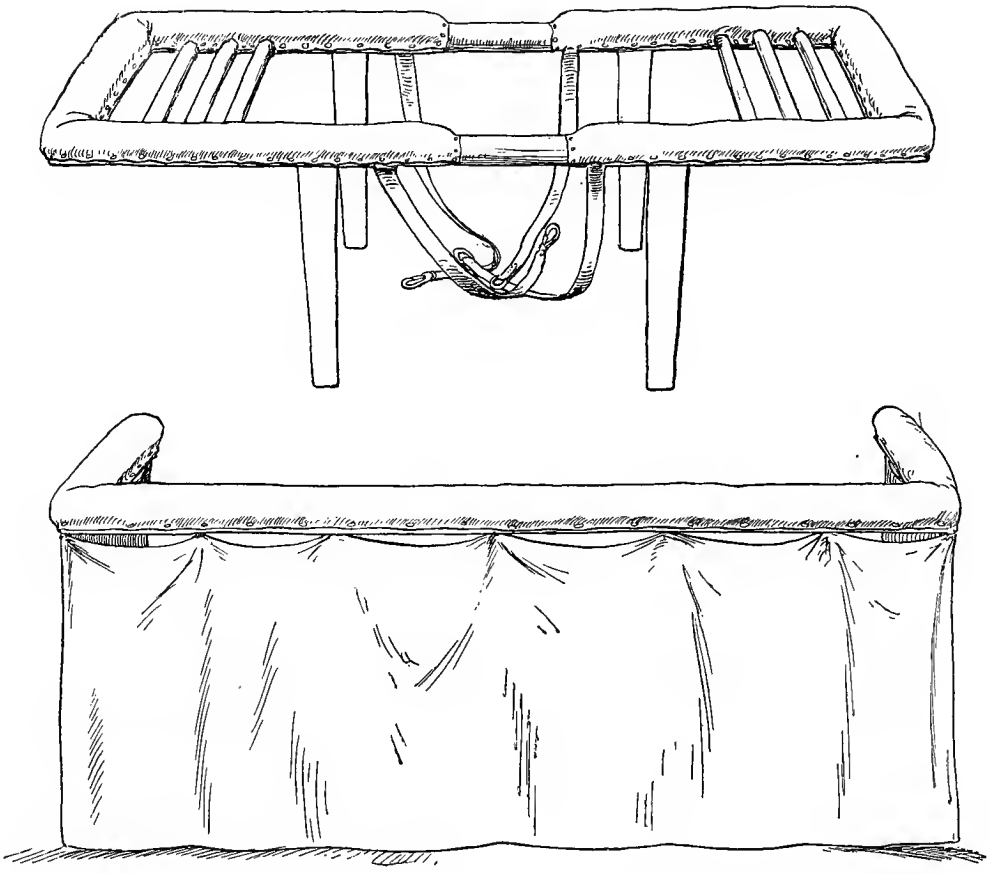
What a picturesque and lively scene these medieval auctions must have been, with knight bidding against knight for the beautiful birds that had been won out of the air and brought into the thralldom of man!

The old cult of falcon catching and training has never completely languished at Valkenswaarde, and the family of Möllens has for many generations led in the industry. Indeed, wherever falconry is practiced the Möllens are known as the most skillful and expert trappers and trainers, and many of the most famous falcons in the history of the sport have come from their able hands.

In capturing the "passage hawks," the trapper conceals himself in a sod hut, from which extend long strings to operate the net and the decoys used to lure the wild hawk within range from afar, after its approach has been heralded by the little telltale "announcer."

THE BUTCHER-BIRD IS THE TRAPPER'S SCOUT

Now, of all birds, perhaps the shrike, or butcher-bird, most cordially hates and fears its big competitor and ogre, the falcon. And the shrike can detect its enemy in the far, far distance much sooner and more infallibly than can man, even with strong glasses. Therefore, the skillful



From a drawing by Louis Agassiz Fuertes

UPPER FIGURE, FIELD CADGE; LOWER FIGURE, SCREEN CADGE, FOR HOUSING FALCONS

The carrier of the cadge was usually a country boy—a tenant of the owner of the hawks. From "cadger" came "codger," a countryman, and doubtless cad and caddie, both typical Scottish derivatives only slightly different in their present-day applications.

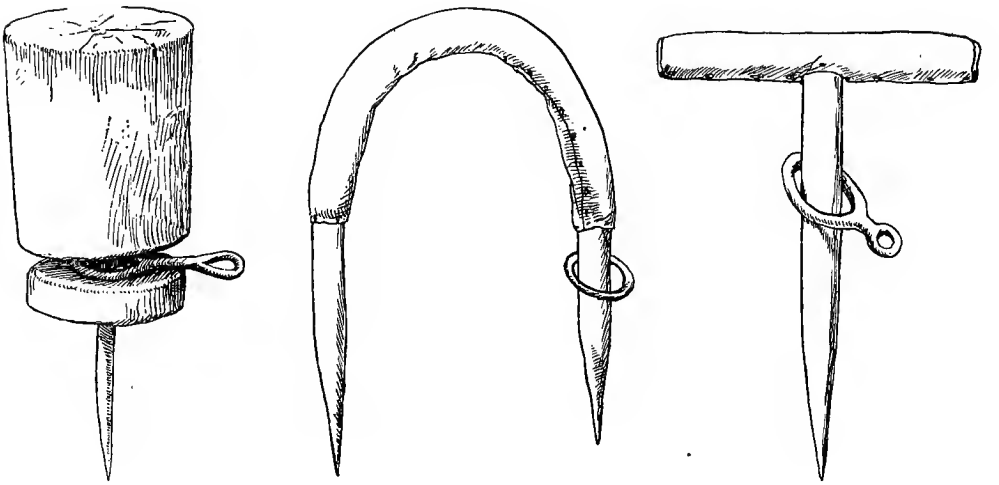
falcon-catcher first traps his shrike and attaches him to a perch on a little sod mound with a retreat into which it may dive to safety when the hawk comes near.

The shrike sits quietly on its perch until it sees a falcon in the distance, when it begins to chatter and scold, getting more and more excited as the falcon approaches, and finally actually "pointing," thus giving the trapper ample time to have everything in readiness.

At the first sign, the trapper retreats into his hut and closes everything except the little peep-window and begins working his tied pigeon and the decoy hawk up and down on the elevated line, to attract the wild falcon's eye.

The actual trap consists of a bow-net set some fifty yards from the hut. Through a ringed peg driven in the middle of the net passes the tether to the bait, a live pigeon which is in retreat in a box a few feet away. When the falcon has come within a hundred yards of the trap the "lure" pigeon is dragged out, flapping its wings. The hawk prepares to stoop. At this moment the "lure" pigeon is dropped and dives to shelter and the "bait" pigeon is drawn out of its box into view. When the hawk has struck, the victim and victor are drawn gently into the exact center of the net, which is then sprung by means of a line from the hut.

The falconer loses no time now. He runs out to the trap, fastens jesses to the



From a drawing by Louis Agassiz Fuertes

BLOCKS AND PERCHES, FOR "WEATHERING" HAWKS

The falcons are all rock-dwellers by nature and are most comfortable when perched on a flat surface; hence blocks are used, with a swivel to prevent the leash from getting tangled up. The short-winged forest hawks, like the Goshawk and Sparrowhawk, have enormous claws, which are greatly in the way on a flat surface, and are therefore weathered on slender "bow" perches. The T-perch is used for eagles.

hawk's legs, and puts a sock over his captive's head and body with as little fuss and excitement as possible—an operation calling for great skill and dexterity. The captured hawk is then hurried to the hut and laid on its back and all is made ready for another attempt.

The training of a haggard hawk is in many respects similar to that of an eyess, but with this vast difference: the eyess, taken young and with no fear or hatred of man, requires simply to be led to do the will of its master, whereas the haggard has to be redeemed by patience and kindness from a state of fierce enmity and suspicion into one of complete docility and submission, and has to unlearn all the teachings of its experience and instinct and learn the will of its new master.

The trainer takes his new hawk to the loft and there removes the sock, replacing it with a soft rufter hood.

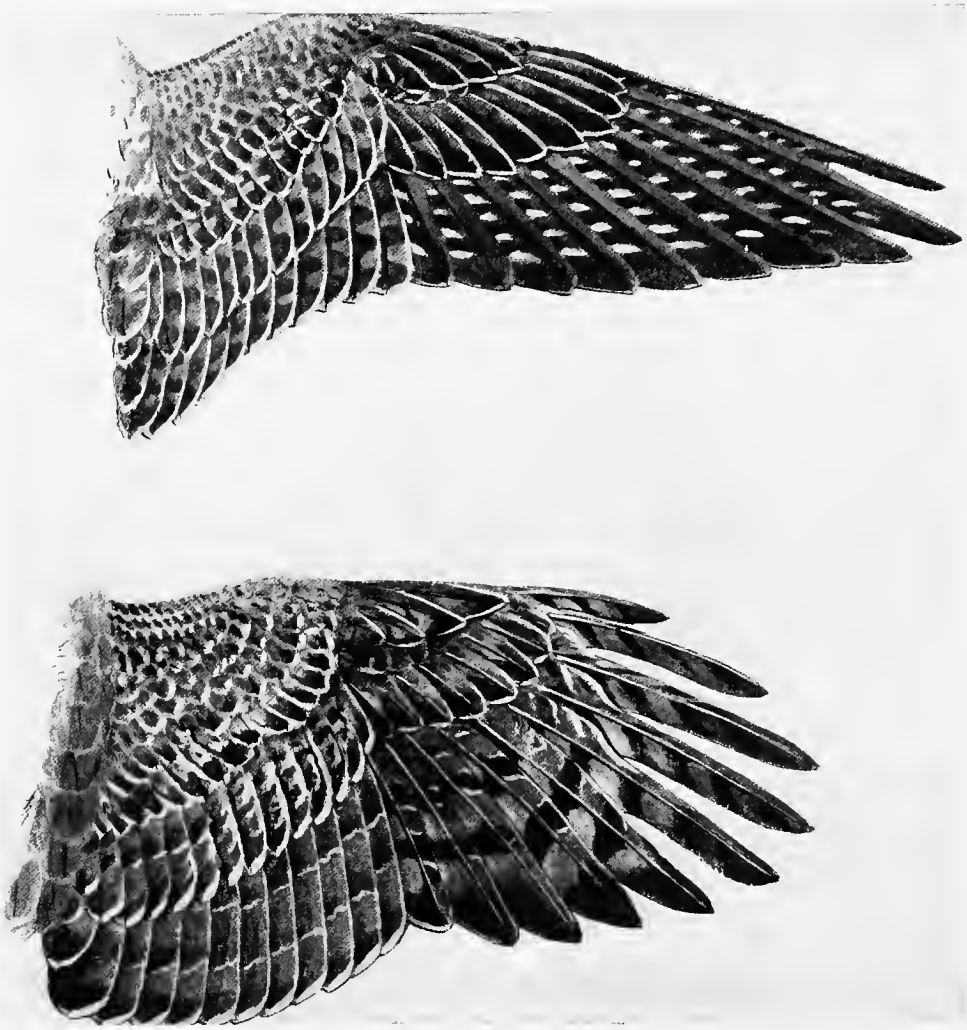
It would take too long to tell in detail all the many difficulties that lie before the falconer; but, with no accidents and much skill, patience, and understanding, a fully adult haggard peregrine may become accustomed to the presence of man and his works in a fortnight. This is accomplished by requiring the newly caught hawk to sit for hours and hours upon the hand and by depriving it of any chance to go to sleep until it is thoroughly reconciled to the new condition. It is then gradually allowed more light and more ease and rewarded with food as its docility progresses.

In some respects it is easier to train the haggard than the eyess to hunt, for the former has long killed for itself, while the food of the eyess has been furnished by its master. Eyesses are usually more tractable and run truer to "form," but the haggard almost invariably has vastly more dash and style than its house-bred loft-mate.

The style of action and methods of hunting are so different with the long-winged hawks and their short-winged cousins that they had best be considered separately.

THE "LONG-WINGS" ALWAYS ATTACK IN THE AIR

The "long-wings," or falcons proper, by nature strike their prey in the air, killing it clean by the direct blow they deliver at the end of their "stoop." They battle for position in the air, attaining their "pitch," or position above their



Painting by Louis Agassiz Fuertes

WING OF FALCON, OR LONG-WINGED HAWK (UPPER), AND WING OF GOSHAWK, OR SHORT-WINGED HAWK (LOWER)

The Long-wing is adapted to swift flight in the open, being flat, long, narrow, rigid, and unbroken to the end, only the outer feather being notched, and that only for a short distance. The Short-wing is adapted for precipitate flight in cover, being short, broad, deeply cupped, elastic, and with the "ailerons" deeply notched on at least five feathers.

quarry, by circling or "ringing," and, when sufficiently well placed, dashing down headlong, hitting their quarry a resounding blow that often can be heard a long distance, following it down and striking again if necessary, but never "binding" to it, and never striking quarry that is sitting or on the ground.

Falcons proper are always hunted in open country, where the quarry is either located and flushed with dogs or beaters and the hawk flown from the falconer's wrist, or the birds are trained to "wait on." In the latter case, upon being unhooded and flown, they ring up and up, attain their "pitch," wait for the game to be flushed, and when it is well under way make their terrific stoop.

On large game, like heron, falcons are often flown in "casts," or pairs, and take

turns stooping in rapid succession until the quarry is killed.

In the good old days many kinds of hawks were used, but those most esteemed, because of their size, style, and beauty, were the gerfalcons of the north. Centuries ago the Icelanders caught and trained both old and young birds, and the annual catch sometimes amounted to hundreds.

In general, however, the gerfalcon does not seem to thrive in England or on the Continent. It wilts in the summer and becomes listless, refusing to fly, and finally fading and falling prey to some one of the many ills that beset hawks. This seems to point to a great skill and knowledge on the part of the medieval falconers, who certainly used the gers very extensively and successfully in killing the kite, a most capable hawk, then common all over Britain and Europe.

WHEN THE DESERT FALCON HUNTS THE GAZELLE

The sacre, a "desert falcon," nearly as large and heavy as the gerfalcon, is still used in India for hunting the kite, and probably this is the most thrilling quarry that has ever been used in falconry. The kite is a magnificent flier and spends much time at an altitude of thousands of feet, so that the actual battle often takes place so high as to be almost out of sight.

Another spectacular use to which the sacre is put is in the hunting of gazelles and of bustards. The falconer and his field are mounted on swift horses, and in the gazelle hunt three, five, or more hawks are cast when the quarry is started. It is an exciting chase, full of danger for every one concerned—the riders, because of the chase over rough country; the quarry, because of the number and intrepidity of his assailants; and the hawks, because in their dashing stoops they are frequently impaled upon the horns of their quarry.

The Houbara bustard, a large plover-like bird the size of a turkey, affords a spectacular chase. He does not fly, but, with wings and neck outstretched, runs like a cloud-shadow fleeting over the plain. The hawks, three or more in a cast, pursue and worry their quarry for miles over the desert, only striking the fatal blow when the bustard has become nearly exhausted, as by that time have also such horses as have been able to keep up with the terrific chase.

THE PEREGRINE IS THE FALCON OF FALCONS

The peregrine, falcon of falcons, is not as large or as strong as either the gers or the sacre, but combines, with a hardihood unknown to the "exotics," all the qualities that go to make a good hawk—gentleness, teachability, courage, dash, willingness to "wait on" at a great height, and, most important of all, availability; for, as has been said, the peregrine has a world-wide range, and is therefore obtainable in almost any country where men want to use it. In this article, then, unless specially noted, the peregrine is the subject of the narrative.

In a wild state, were it a common bird anywhere, it would be a very undesirable neighbor, for it preys almost exclusively on birds, and is capable of taking such swift and resourceful game as plover, snipe, and wild-fowl. Its common name in America, the duck-hawk, is well given, the reference being to wild ducks and not the tame bird.

Like many another brigand, the peregrine prefers easy prey to difficult, is in nowise averse to poultry, and is particularly fond of domestic pigeons. A pair whose eyrie I watched on a 400-foot cliff near my home one July day had three young on the wing. During the middle of the day there was little activity and all the birds sat quietly pluming and resting; but for the first three hours in the morning and the last three in the afternoon, one old bird or the other returned about every twenty minutes with a pigeon. On that one day sixteen pigeons were brought to the young.

Of course, this was more than they could eat entirely, and much more per capita than grown birds would consume, but where an adult hawk will keep in very fine condition on half a pound of fresh game a day, a growing fledgling requires above its own weight daily of animal food in order to maintain its miraculous growth and the great physical effort of producing an entire coat of feathers.

There are many recorded instances of

the wild peregrine's adaptability to the easy life of great cities, where congenial nesting and roosting places are found in the belfries, towers, and lofts of the public buildings and pigeons in abundance are available. For many winters an old peregrine appeared in Washington, haunting the Post-Office Department building tower as a lookout, sallying forth whenever it was hungry, making a clean kill on pigeon, and returning to the post-office roof to plume and eat its prey. A member of the Biological Survey went on top of the building and collected a large number of leg-rings from carcasses that had been left by this bold and capable brigand.

A fine old female peregrine I once took from Pajaro Island, in Mexico, was living on white ibis from a convenient rookery, and her lookout tree was well surrounded by the bleached and weathered carcasses of her victims. I fancy her demise was a welcome event on the island.

Many stirring accounts are current of the courage and tenacity of purpose these hawks possess, but one of the most striking is of an eyess falcon belonging to a Major Fisher, which was flown at a woodcock near Loch Eil. Both birds mounted at once, higher and higher, until they were entirely lost to view, even with powerful glasses. After considerable time, however, a tiny speck was seen falling out of the sky, and the woodcock, closely followed by the thunderbolt in feathers that had struck him, fell toward the very patch of fern from which he had been flushed. Before hitting the ground, however, the hawk had again overtaken her victim and struck him stone dead in air. After so long a chase the falcon was well fed up, and, so far as she was concerned, her master wisely "called it a day."

The "Old Hawking Club," organized in England in 1864, always maintained a fine cadge of hawks and kept careful records of individual performances. Between August 12 and September 14 one year, the club's prize bird, "Parachute," a two-year-old eyess falcon, killed 57 grouse, 76 partridges, 5 pheasants, 3 hares, and five birds of miscellaneous species.

"General," a falcon belonging to the Duke of Leeds, killed in 1832 129 out of 132 flights, mostly at partridges. "Vesta" was flown in Scotland in nine successive years, averaging 33 grouse a season. This is an unusually long life of activity.

A glance down the records of famous clubs and of private owners reveals many interesting and romantic names, such as the falcons "Lady Jane Grey," "Empress," "Buccaneer," "Black Lady," "Comet," "Destiny," and "Will o' the Wisp"; tiercels "Druid," "Butcherboy," "Mosstrooper," "Vanquisher"; merlins "Tagrag," "She," "Ruy Lopez"; sparrow-hawks "Blanche," "Lady Macbeth," and "Faerie"; goshawks "Enid," "Isault," "Geraint," "Tostin," "Sir Tristram," and for variety "Gaiety Gal" and, grimmest and truest of all, "Shadow o' Death."

A FAMOUS FLIGHT BY "BOIS-LE-DUC"

"Bois-le-duc" was a haggard falcon of fine qualities, and the following, quoted from Lascelles, gives us a lively picture of a rook flight by this famous hawk:

"We take up our position behind a stack to wait for a rook passing on his way from the rookery in the valley to the sheepfold on the hill. Presently we see one coming, toiling slowly over the shoulder of the down.

"Shall we fly one of the young falcons lately entered and coming on so well, or shall it be the old heroine of a hundred flights, victress over more than double that number of rooks, that flies now her fourth season with all the vigor and dash she displayed in the blinding snowstorms and heavy gales of her first year?

"A hundred or two yards is far enough for a slip with a young hawk, but with a real good one a quarter of mile is not too far, while many and many a time, if the wind be right for her, the old hawk has been slipped at rooks a fair half mile away.

"It looks as if this slip would be too far for a young hawk, so the handsome old falcon is taken on hand, to the delight of the whole field, not one of whom, however large it may be, but will stay out 'just one half-hour more' when it is announced that it is the turn of old 'Bois-le-duc' to fly at the next chance that occurs.

FALCONS WEATHERING

Every pleasant day the falcons are put out on their blocks in the open air, unhooded, for an hour or two, where they preen and plume themselves, and get their fill of fresh air. It also keeps them good natured and contented in each other's presence. The birds shown here are (1) Greenland Gerfalcon, (2) Iceland Gerfalcon, (3) European Gerfalcon, (4) Goshawk, (5) Haggard Peregrine, Tiercel (6) Red or "Soar" Tiercel Peregrine, (7 and 8) Red or "Soar" Peregrine Falcon, (9) Tiercel Peregrine "rousing."

A FAIR HIT: GERFALCON STRIKING HERON

When Knighthood was in Flower the favorite game of every overlord (who alone was entitled to use the Gerfalcon) was the stately heron. Modern falconers seem unable to adapt these splendid northern hawks to present conditions, depending almost wholly upon the native peregrine. But in the fourteenth century a gerfalcon was indeed a kingly gift, and one often employed when the goodwill of a near or distant potentate was particularly desirable. In attacking, the gerfalcon climbs above the heron then "stoops" with great force at her quarry. There is no truth in the legend that the heron, as a means of defense, sometimes impales the descending enemy upon its dagger-like beak.

TIERCEL GENTLE: A HIT ON GROUSE

Scotland must receive the credit for perpetuating the "Noble Art" when it had languished over the rest of western Europe, and no quarry is better suited to the capacities of the Peregrine, or "Gentle Falcon," than the Scotch red grouse. But the "gentle" part is forgotten when the hawk makes its thunderbolt assault, diving on its victim from a height or "pitch" of hundreds of feet, usually killing it clean with a single resounding blow of the half-closed fist. A good falcon will never seize or "truss" its quarry.

The term tiercel (meaning the male of various species of falcon) is derived from the Latin *tertius*, according to some because every third bird in the nest is supposed to be a male; according to others because the male is supposed to be a third smaller than the female.

GOSHAWKS: AN ADULT TIERCEL (MALE) AND A YOUNG FEMALE

These are the fiercest and most competent killers of all, and therefore used principally by the "yeomanry" as meat getters. They are in "red" plumage for the first two years of their life, afterward becoming slaty-gray above and barred below. They require careful watching in the mews (the buildings where the hawks are kept), lest they break loose, when they will go systematically about killing every other bird in the loft. They hunt on or near the ground, and, unlike the falcon, come to earth with their quarry. Among all hawks, the female is larger and more powerful than the male.

GOSHAWK STRIKING PHEASANT

Unlike the true falcons, the short-winged Goshawk hunts ground-haunting quarry, and trusses (holds) to its victim till the latter ceases to struggle, no matter how fierce and rough the tussle may be. It kills by the vice-like squeeze of its piercing talons, instead of by the terrific blow of the half-open foot, as do the true falcons. "Red Queen," a famous goshawk of the "Old Hawking Club," had an authentic record of sixteen hares out of seventeen struck in a single morning.

HAWKING IN THE CAUCASUS

All through the Near East, particularly in Georgia and Daghestan, hawks are still used as game-getters. Goshawks are principally employed, being the most prolific killers, and the rough nature of the country making it impossible to follow the long flights of the true falcons. The quarry, mostly pheasant, partridge and hare, is located by dogs, and the goshawk flown from the hunter's wrist as the game is flushed.

A HAWKING PARTY IN ELIZABETHAN ENGLAND

When firearms came into general use the splendid sport of Falconry, as a general practice, received its death blow. But in Shakespeare's day it was at its height, and the literature of Mediæval England is full of spirited references to "the Sport of Kings." The colorful and picturesque costume of that day must have lent great charm to the scene when prince and princess, knight and lady, squire and dame rode forth, hawk on fist, to fly their favorites at rook or heron

THE START: ARABS SETTING OUT WITH FALCONS TO COURSE GAZELLES

It is difficult to tell just when hawking began. The Arabs, perhaps as early as any other people, trained certain hawks to course the swift desert game. In coursing gazelles three, five or more hawks are used, and the aid of dogs is required for the actual kill, the hawks worrying and bewildering the game until the dogs can catch up. These hawks are always fed from the eye-sockets of a calf's head, and naturally turn to this spot in their living quarry. There is great danger that the hawks may be impaled on the horns of the gazelle.

HUNTING THE BUSTARD WITH FALCONS IN NORTHERN AFRICA

This is one of the most thrilling of all uses of the falcon, for the chase often continues for many miles over the rough desert, where only the stanchest horse can follow. The size and stamina of the quarry, combined with the habit of fleet running instead of flying, make it very hard as well as dangerous for the little lanner falcon to kill, as there is so little space to turn away from the ground after the stroke.

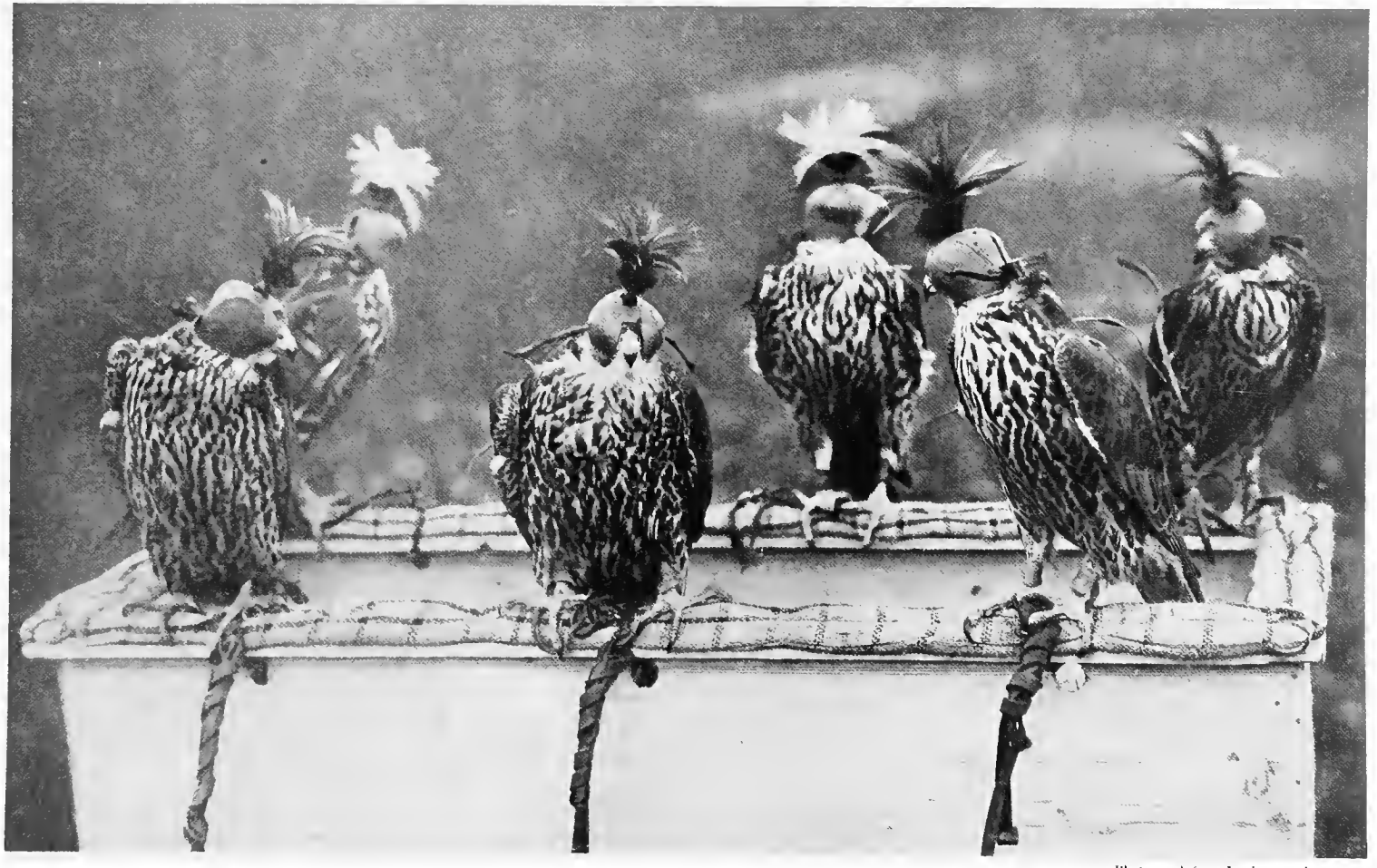
A SPARROWHAWK MAKING A TRY FOR A BLACKBIRD

Although too small and slight for "regular" game, the European Sparrowhawk, which closely resembles our Sharp-shin (see color plate XVI), is uncommonly fierce and courageous, and makes spirited dashes at such quarry as starlings and blackbirds. It is a hedgerow hunter, depending for success upon the intrepidity of its onslaught and the pertinacity with which it follows its victim. It will even run through thick cover after skulking quarry.

Photograph by L. Ollivier (Paris)

AN ALGERIAN FALCONER: BISKRA, NORTH AFRICA

Falconry had its rise in man's early necessity in man's birthplace, Central Asia, where it has thrived almost without interruption ever since. The sport has from immemorial time been followed in India and Northern Africa.



Photograph from Louis Agassiz Fuertes

THREE CAST OF FALCONS, ON THE CADGE, HOODED AND READY FOR A JOURNEY

Marco Polo describes the hunt of a ruler of Manchuria in which about 10,000 people were engaged, and over a thousand trained falcons were employed. Everything was done to insure the sumptuous ease of the great man, who was not disturbed until the quarry was overhead, when he slipped his favorite falcon and the hunt was on. Modern falconers insist on seeing all the fun, from the flushing of the game to the stoop and kill.

Photograph from Louis Agassiz Fuertes

TRAPPING FALCONS AT VALKENSWAARDE, HOLLAND

Here, since the middle ages, falcons have been caught for use all over Europe. The outfit consists of the trapper's blind, from which run four lines: one to each pole, by which a decoy hawk and a "lure" pigeon are brought out of their sod retreats into involuntary action; the third to the "bait" pigeon, bringing it from its box into the open trap-net; and the fourth to spring the net when the wild hawk has struck. On the sod retreat toward the right sits the captive shrike, which announces the advent of the hawk.

A CAST OF FALCONS ON THE WRIST: HOLLAND

The birds are carried hooded until the game is started. Then the hood is doffed, the leash slipped from the swivel and the falcons cast off, singly, unless the game is large and powerful. The rest lies with the birds.

Photograph from Louis Agassiz Fuertes

FALCONER TAKING HAGGARD PEREGRINE FROM THE BOW-NET, LURED THITHER BY THE BAIT PIGEON

Nearby is the "sock" into which the hawk will be thrust, while jesses and bell are attached to the legs. Much skill and dexterity are required, for an outraged falcon is no easy thing to handle, and can inflict severe punishment with its great needle-sharp talons. The beak, though a capable weapon, is not used, even in self-defense.

HAWKS THAT ARE THE FRIENDS OF MAN

Large, conspicuous hawks are all of great economic value, being the principal natural check on the hordes of noxious rodents that, if unmolested, would soon render agriculture unprofitable. The large soaring, circling hawks of the open country are not the ones that molest the farmer's poultry, but *are* the ones that hold in check the field-mice, gophers, ground-squirrels, mole-crickets and grasshoppers that annually cost the country many millions of dollars through their depredations on crops, orchards and forage.

ONLY FOUR MEMBERS OF THE HAWK FAMILY ARE OUR ENEMIES

The four hawks whose names are underscored are the ones that give a bad name to the whole hawk family. Of these the Cooper's Hawk is most important because commonest and most widely distributed. The Goshawk, restricted to the Northern wooded region, is terribly destructive to game birds and to poultry. The Sharp-shin, an inveterate bird-killer, is too small to molest poultry, except chicks a few days old. The Pigeon Hawk is not important, being quite rare.

"All is hushed as the rook, a single bird, presumably a strong old cock, comes slowly up. He passes us and is going nicely on when something about the party awakens his suspicions and he gives a sudden swerve that in one second takes him about 150 yards off on a side wind.

"We are not to be done this way, though, and in a moment the head of our party, with falcon on hand, dashes out at a brisk gallop down wind of the rook, which hastens up on wind. But a hundred yards or so is no matter to us with this hawk, and the moment we are fairly down wind of him the old hawk is unhooded and flung off; and the falcon is in hot pursuit of her quarry, rising with each stroke of her powerful wings till she seems to shoot upward like an arrow from the bow.

"The rook has seen her, and is making his way upward at no mean rate; but the pace of the falcon is too much for him, and ere long she is above him. Poising herself for a moment, she comes, with one terrible perpendicular stoop, straight at him.

"It would seem as though nothing could escape; but our rook is equal to the occasion, and with a clever shift he has dodged her attack by a good yard or more.

"WELL DONE, ROOK"

" 'Well done, rook!' but there is clearly now no safety for him in the air, for the falcon has shot up again, with the impetus of her stoop, to a height scarcely inferior to that from which she descended; so, turning his tail to the wind, he makes all possible haste to a small patch of thorns that promises a temporary shelter, having, however, on the way to evade two similar stoops from the hawk, almost as fine as the first.

"Alas for friend rook! On reaching the covert he finds it already occupied by the enemy, in the shape of the excited field, who soon drive him with halloo and crack of whip from his shelter, and compel him again to seek the open. The falcon has, however, strayed a little away; so he starts with might and main to ring, in spiral curves, into the very clouds.

"After him starts the hawk, but soon finds that really good rook, such as this is, can mount nearly as fast as she can.

"Up, up they go, gradually becoming smaller and smaller. Ring above ring does the falcon make, yet without getting above him, till, apparently determined to gain the victory, she starts off into the wind to make one tremendous circle that shall attain her object.

"Steadily into the wind she goes, the rook striving to follow her example, and appearing from below to be flying after the hawk. At length, as she almost completes the outer circumference of her circle, the rook, perhaps feeling his powers exhausted, turns down wind, and, at a great height, makes off as fast as he can go.

"Surely the flight is over, for the falcon is still working away, head to the wind, as hard as she can—in fact, the two birds are flying in opposite directions, half a mile apart. 'Not a bit of it,' say the initiated, who are off down wind as fast as they can ride.

A MAGNIFICENT STOOP, AND VICTORY!

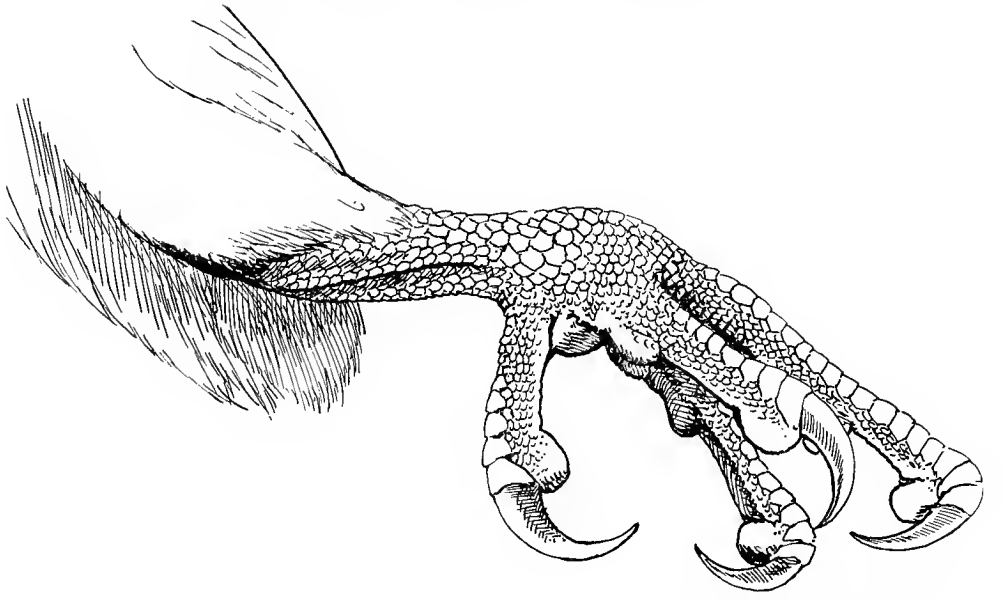
"In another moment you see the falcon come round, and though at such a height she looks no bigger than a swallow, you can see that she is far above the rook, while her pace, slightly descending as she is, is almost that of a bullet. So thinks her quarry, apparently; for, shutting his wings, he tries to drop like a stone into a clump of trees now nearly beneath him.

"Swiftly as he drops, there is a swifter behind him, and down from that terrific height comes the falcon like a thunderbolt. Lord, what a stoop!

"By the powers, she has missed! And now surely he must escape.

"But no. Shooting upward like a rocket, the old falcon puts in one more straight, swift stoop, and the rook is taken just as he enters the sanctuary which he has had his eyes on from the first. Whoo-who-op! A grand ring! a magnificent stoop! a splendid flight! Bravo, 'Bois-le-duc!' "

Among the smaller falcons the merlin, hobby, and kestrel are the only ones now used, and, indeed, the kestrel, being largely a locust and mouse feeder, seems to be rather beyond the skill of the modern trainer, though there are abundant proofs that it was used in medieval times. This is a beautiful and gentle species and



Drawing by Louis Agassiz Fuertes

THE FALCON'S FIST

Falcons kill their prey in full flight, by a terrific blow with the half-closed foot, returning after the strike to pick up the victim (see Color Plate II).

it is a pity it cannot be more profitably used.

TRAINING THE SHORT-WINGED HAWKS

Thus far nothing has been said of the training and hunting of the two short-winged hawks, the goshawk and the sparrowhawk.

Just as the falcons, with their long, narrow wings and compact bodies, are adapted to the chase in the open, with wide maneuvers and great stoops through unbroken space, so these rangy, slim-legged birds, with their short, "broad-fingered" wings and long, sweeping train, are beautifully adapted to work in the tangles and forests, where they naturally live.

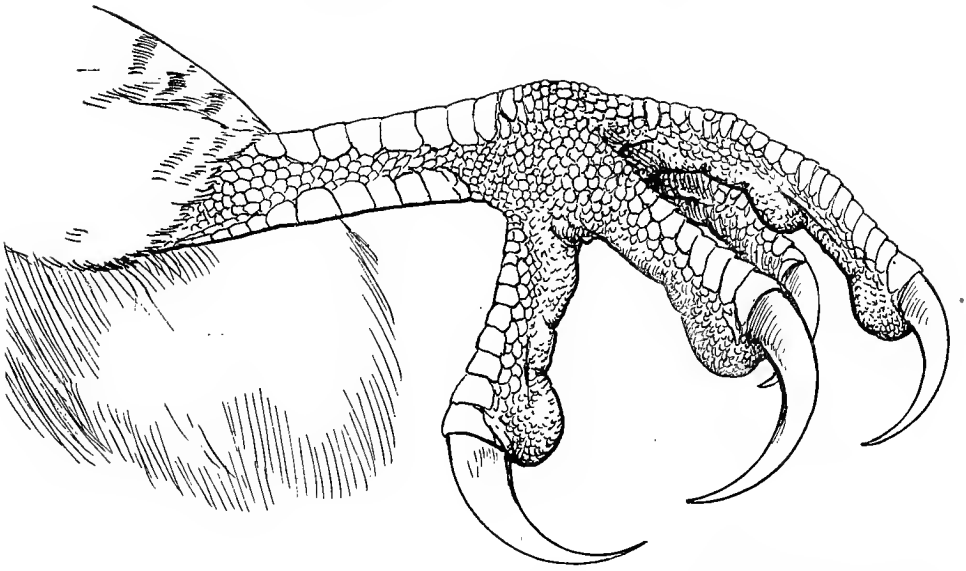
These birds seldom come out into open country unless there is some tempting poultry yard or game preserve where a quick sally is assured of its reward. When such a larder is discovered, however, little peace comes to the owner until the marauder has been brought to earth, for it will take its daily toll until the yard or cover is depleted.

Goshawks and horned owls are generally to be feared in cold winters on all extensive game covers in this country, and they make sad havoc with the work of years when once they infest such a place (see text, page 461).

The goshawk is a very different creature from the falcon, and by its nature and style of hunting is fitted for entirely different work; for the goshawk does not strike its prey in air and return to it after the turn, but pursues it and binds to it at once, whether in air or, as it prefers, on the ground. These hawks have a curious habit, too, of covering their quarry with their outstretched wings and tail until it ceases to struggle.

THE GOSHAWK'S FEET ARE ENGINES OF DEATH

The feet of the goshawk are veritable engines of death, with enormous talons and great strength. Whereas a falcon's foot is more like a fist to deliver a terrible blow, the short-wing's feet are like great ice-tongs with semicircular claws nearly an inch long, which enter the very vitals of the quarry and kill as tough a creature as a rat or a hare in a few seconds and take the life of any bird almost instantly (see drawings on this and the opposite page).



Drawing by Louis Agassiz Fuertes

DRAWING OF THE FOOT OF A GOSHAWK (NATURAL SIZE)

The Goshawk kills its prey by clutching, and driving its great talons into its victim's vitals, not releasing its hold until the quarry ceases to struggle (see Color Plate V and text, page 458).

These hawks are worked along hedgerows or in woods, only being used in open ground on hares, rabbits, or pheasants. In thick cover they perch hard by, watching for the instant the quarry may be put out by dogs or beaters.

The short-wings are very much more intent on their game than are the falcons, and even in a wild state have been known to chase fowls into the farmer's kitchen and kill there. Dr. Fisher records an amusing instance in which a goshawk dashed in and seized a fowl which had that instant been killed by a farmer, dragging it only a few rods before starting to deplume it. In another case, a hawk pursued its quarry through the kitchen of a farm-house into a bedroom and there made its kill under the bed!

While the strikes of this hawk are very hard and impetuous, they are usually short, and do not result in the exhaustion that follows a good flight by a falcon. Thus they may be flown many times in a day, and there is the record of old "Gaiety Gal," who was flown at 17 hares in one morning, trussing to all and killing clean all but the last, which, being exceptionally strong and the hawk naturally weary, got away after a struggle. Sir Henry Boynton's "Red Queen" killed 24 rabbits in one day.

There is something almost devilish about the fury of a goshawk's strike. Her yellow or orange eye, the pupil concentrated to a cold point, fairly burns with ferocity, and the clutch of her awful foot is such that virtually no amount of twisting or somersaulting on the part of the hare or rabbit can dislodge the great piercing hooks.

As an example of the goshawk's single-mindedness when in pursuit of quarry, Lascelles tells of one which drove impetuously downhill at a rabbit. As the quarry leaped four feet in the air to avoid the stroke which grazed it, the hawk turned over and caught it from underneath while in the air, "rolling afterward down a steep bank head over heels, but never leaving go her hold."

"It is not uncommon," continues this observer, "to see a rabbit captured at the mouth of a burrow, and hawk and all disappear under ground; but when she is lifted out, however much she is knocked about, the rabbit is in her foot."

THE SPARROWHAWK HAS MANY ADMIRERS

The sparrowhawk is reclaimed and trained in much the same manner as other hawks, and her tactics are almost exactly those of her big relative. No

whit less fierce and bloodthirsty is she, and the blackbird or starling that has put into a hedgerow or thicket has small chance of eluding the cold eye that is quietly watching from some near-by perch for the first stir.

The sparrowhawk has many enthusiastic supporters, and for many reasons is the best fitted for the amateur falconer, as these birds are not costly and small loss attends failure. They may be used on almost all small game and brush birds, and have been used with success on partridge. In England, however, the sparrowhawk is used chiefly on blackbirds and starlings, and while it is in a way small sport, the ingenuity of the quarry and the catlike agility of the little hawk give spice to the chase.

Here, even the tiny male or "muskett" is of use. The chase is over if the hawk makes a true strike; but the quarry is resourceful and nimble and it is frequently very difficult to make the pursued bird fly if it has once succeeded in reaching cover.

I once saw close at hand the tactics of a house-sparrow, which flew chattering within a few inches of my head, hotly pursued by a male sharp-shin, the American miniature of the sparrowhawk. The sparrow flew directly into the densest twiggery of an old lilac clump, and there continued to flutter and chatter. Almost instantly the hawk, wings and tail thrown back and lean, sharp talons extended, struck the bush with a thwack, trying to drive through to the terrified (but still resourceful) sparrow. Failing, the hawk, entirely ignoring me, turned back again on its course, flew past me to a distance of perhaps a hundred feet, wheeled, and again drove at the bush as if thrown from a catapult.

This occurred four times in rapid succession before the hawk decided it was of no use and continued on its way philosophically. After a very short time the sparrow, too, resumed its normal state of mind and joined a group of others in the road near by.

From the foregoing it will be seen that falconry had its rise through man's early necessity, in man's birthplace, central Asia, where it has thrived almost without interruption ever since; that later it became the sport of the more privileged classes, attained a high pitch of popularity in medieval times, and has since fallen, as the result of many contributing causes, to a point where it is costly and extremely difficult to maintain.

It is not too much to suppose, however, that there will always be those who have the means and the desire to keep alive one of the most beautiful and romantic sports that man has ever devised. Fortunately, there is plenty of colorful literature on the subject from the days of chivalry and there are several practical books by later-day devotees of the art.

It is, perhaps, not too much to venture the belief that now, after the war that has so completely occupied the minds and lives of the civilized world is over, we shall swing back to some of the less serious pursuits that we formerly enjoyed, and that among these falconry may undergo a real revival.

AMERICAN BIRDS OF PREY—A REVIEW OF THEIR VALUE

IT IS not always easy to cast up an exact balance to show at a glance just what value we should attach to any given bird or animal, and the difficulty becomes much greater as the element of prejudice or chance personal observation complicates the verdict which dispassionate research determines for any given species.

The prejudice against all birds of prey is so general that it is well nigh impossible to convince any one who has once seen a hawk steal a chicken that only a few kinds have this habit, and that all the rest deserve the most careful protection. This fact has been admirably set forth, however, in that now rare work, published in 1893 by the Bureau of Biological Survey, Dr. A. K. Fisher's "Hawks and Owls of the United States." Much of the specific information in the present article has been drawn from that authoritative source.

For many years the field agents of the

Biological Survey have been instructed to send to the Bureau the crops and stomachs of all the birds and animals they collect, that their food habits may be studied without favor or prejudice. As a result of this study, the balance in favor of the American birds of prey has been shown to be an overwhelming one. No similar natural check exists against the hordes of destructive and rapidly multiplying field-mice, gophers, wood-rats, ground-squirrels, and moles. Many persecuted species of birds feed their ravenous young almost exclusively on those pests of our grazing and grain regions, the grasshoppers, locusts, and mole-crickets.

It cannot be denied, nor is it my intention to palliate the charge, that certain hawks and owls are villainous destroyers of poultry, game, and beneficial birds. Let it be said here in parentheses, however, that man's own self-introduced pet, the cat, undoubtedly kills as many little chickens and vastly more beneficial and desirable birds than do all the birds of prey in America, many times over.

Virtually all the damage of which the opponents of our birds of prey complain is done by five kinds of hawk and one owl. The number of birds and fowls killed by the remaining eleven common hawks and five owls is so insignificant as to be comparatively of no importance.

The purpose of this study is not to cover in detail the whole performance of the entire list of American raptorial birds, and not more than two-thirds of the species are mentioned. Those that are so rare or that dwell in such remote or uninhabitable regions as seldom to fall under observation are omitted, as the family is, at best, a difficult one to describe or treat in a simple and lucid way. This is, of course, the reason for the present confusion in the minds of all except real students of ornithology. Still, the injustice and folly of persecuting a valuable family of birds for the misdeeds of less than a fourth of its number is so preposterous that another attempt to clear the situation is justifiable.

THE DESTRUCTIVE SPECIES (SEE COLOR PLATE XVI)

Among hawks, the guilt for poultry, game, and bird slaughter practically falls on two rather small groups, most members of both groups being among the comparatively rare hawks. The whole genus *Accipiter,* consisting of the Goshawk, Cooper's Hawk, and Sharp-shinned Hawk, are savage, bloodthirsty, and cold-hearted slaughterers, and are responsible in large measure for the anathema that is the portion of all hawks. Of these the Goshawk (*A. atricapillus*) is at once the largest and most destructive. It inhabits only the northern wooded portions of America, coming south in winter to a line extending from Virginia to central California, and farther south in the mountains.

This intrepid bird has frequently been known to chase a fowl into a farm-house and make its kill in an inner room (see page 459). It is a forest hawk and is seldom seen far from the cover of woods. It feeds on birds in preference to all other food, with rabbits as second choice. On northern game preserves it is coming to be a grave nuisance and has seriously menaced the small remaining numbers of Heath hens on Marthas Vineyard. Its rarity over most of the country is its one redeeming feature, unless we can admire its intrepid courage and its great beauty, ignoring its destructiveness.

The Cooper's Hawk (*A. cooperi*) is the most important species as a destroyer of game and poultry. It is a common species everywhere in North America, living in the woods, whence it makes short, swift sallies, returning immediately with its prey. It is seldom apprehended at work and is known chiefly by its accomplished depredations. It is a bold, cunning, and destructive hawk, and is, more than any other species, responsible for the work which has given all hawks a bad name. While most of its daily kill is among the birds of the forest, it is a serious nuisance on the farm, taking toll of young chickens, ducks, and pigeons, but being hardly powerful enough to tackle successfully the grown birds.

This hawk can usually be told by its flight, which is accomplished by three or four sharp flaps and a short sail, repeated as long as it is in sight. When it soars, its circles are small, and the long tail and rounded wings give it a totally different appearance from the "soaring hawks" of the red-tail and red-shoulder type. It is almost the exact counterpart

Photograph from Louis Agassiz Fuertes

THE SHRIKE ON HIS LOOKOUT

His business is to espy the passing falcon afar, and by his excitement and clamor to inform the trapper of the hawk's approach (see text, page 435).

of the smaller Sharpshin, whose habits are equally destructive, but the quarry is smaller, in keeping with the size of the bird.

THE BIRD-KILLING FALCONS ARE NOT COMMON

The long-winged true falcons, which include the Duck Hawk or Peregrine, Prairie Falcon, and Pigeon Hawk, as well as the powerful Gerfalcons of the far north, are all great bird-killers, and it is fortunate that they are nowhere common. These splendid birds all kill on the wing, ignoring sitting prey, and while we must admire the skill, speed, and grace with which they strike and the nobility of their courage, it is true that they do much damage on game covers and preserves, appearing in numbers when game becomes abundant.

The Gerfalcons are too rare to be economically important, but the Duck Hawk is found in small numbers all over America and must be considered an undesirable bird. It can take care of itself, however, rarely falling to the gun and avoiding traps with uncanny skill.

In the more arid portions and in the mountains of the West the pale-brown Prairie Falcon is not rare. This species is less partial to water and feeds exten-

Photograph by Howard H. Cleaves

A RED-SHOULDERED HAWK PHOTOGRAPHED AT THE MOMENT OF ITS STRIKE

Note the phenomenal reach of leg of this bird of prey, a species widely distributed and commonly known as the "Henhawk." The name does it an injustice, for it deserves to be encouraged and protected as an enemy of rodents and destructive insects.

sively on desert quail, jays, and other birds of its inhospitable habitat.

The Pigeon Hawk is really much like a tiny peregrine. It can catch the fleet and elusive sandpipers and plover along shore and is usually encountered following the migrating flocks in spring and fall. This little falcon varies its diet and improves its record by consuming large numbers of crickets, grasshoppers and beetles, but it is a willing and capable ogre when song birds abound, and one seldom comes to hand that has not plenty of evidence against it in its crop.

Among the owls, the Great Horned, or "Cat Owl," does practically all the damage for the family. Big, powerful, aggressive, and fearless, he finds no difficulty in helping himself to the farmer's poultry whenever he feels like it, when allowed to roost outside. A muskrat trap, set baited or bare on a convenient perch near the chicken yard, is a cruel but practical way of determining who has been thieving, though sometimes a Barred Owl, ratting around the barns, falls victim to this method.

These, then, are the real culprits, if placed on a profit-and-loss basis. The beneficial species outnumbers those on the "black list."

THE BENEFICIAL SPECIES (SEE COLOR PLATE XV)

By far the most important group of rodent-killing birds is the very group to which we have mistakenly given the common name of "Henhawk" and "Chicken Hawk," a most unfortunate error and one most difficult to undo.

It may be stated broadly that the big, conspicuous hawks we see sitting, eagle-like, on tall snags above the green of the woods, or in exposed positions from which to view a large area, or sailing in broad, majestic circles high in the summer sky, are not the ones we may blame for our losses, but *are* the ones we have to thank for holding in check the vast and all-but-overwhelming army of field-mice and other destructive mammals which keep agriculture near to the unprofitable point. These pests are difficult and very expensive to fight by artificial means, and the soaring hawks are their one great and efficient enemy.

Next come all the owls except the Great Horned, which, indeed, must have

From a painting by Louis Agassiz Fuertes

OF THE SEVEN OWLS ORDINARILY ENCOUNTERED IN THE UNITED STATES, THE ONLY ONE THAT DOES MORE HARM THAN GOOD IS THE GREAT HORNED

While most of the others occasionally kill a bird, they are, as a family, decidedly helpful to man, killing vast quantities of mice, rats, gophers, and squirrels. They see by day just as well as other birds.

some credit, as he, too, kills his full share, but in addition to a diet of valuable prey.

Of the *Buteos,* or "Soaring Hawks," the big Red-tail is the commonest and most widely diffused, and consequently the most important. Almost universally dubbed "Henhawk," this valuable species is universally persecuted and shot on sight.

Let us take the summary of Dr. Fisher's examinations of 562 stomaches of Red-tails from all over the United States. Of these, 89 were empty, leaving 473 which carried evidence. Of these, 54 contained poultry or game, 278 contained mice, 131 other mammals (28 species of destructive mammals), 37 batrachians or reptiles, 47 insects, 8 crabs, and 13 offal.

If a Red-tail is *caught in the act* of killing poultry it should be shot, as it "has the habit." The above record shows plainly, however, that the preponderance of evidence is vastly in favor of the species, whose size and appetite make it a most effective and valuable ally of the farmer in his fight against the mice and rats that menace his labors.

All over the West another large and conspicuous hawk is found, which is a great killer of vermin, particularly of small rodents. This is Swainson's Hawk, whose record is absolutely clean, its whole food being divided about equally between small mammals and insects.

THE RED-SHOULDER SHOULD BE ENCOURAGED

Another very common and widely distributed "Henhawk" is the Red-shoulder. This bird has an even better record than the Red-tails. Some 200 examined revealed only 3 which had eaten poultry, 12 small birds, *142 mice and other mammals,* 92 insects, and a number with miscellaneous food.

Mr. Alden Loring, who watched a pair of this species that nested near a poultry farm, says: "The pair reared their young for two years about 50 rods from a poultry farm containing 800 young chickens and 400 ducks, and the keeper told me he had never seen the hawks attempt to catch one." This hawk deserves to be encouraged to the utmost, and both it and the Red-tail should be relieved of the false title by which they are so generally known and designated, either by their proper names or as "Mousehawk," and accordingly treated.

The Broad-wing, the small member of this group, does not often fall into the hands of farmers and gunners, as it is a forest hawk that seldom leaves the shade and shelter of the woods. Its particular claim to man's protection lies in its partiality to the large, fat caterpillars of the big *Cecropia, Polyphemus,* and similar large moths that defoliate the forest trees. It also, of course, consumes quantities of field-mice, voles, and shrews, and small snakes are favorite food.

The two Rough-legs feed almost exclusively on mice. The eastern Rough-leg comes to the northern States only in winter, and is not common enough to be of much economic importance. Of 45 stomachs of this species containing food, 40 contained field-mice and 5 other small mammals.

Over all western America the Ferruginous Rough-leg, or "Squirrel Hawk," is a fairly common and very important species.

With the utilization of large areas through irrigation, the ground-squirrels of the *Citellus* group have multiplied enormously, and not only cost the region millions of dollars in the grain and produce consumed, but do untold damage by burrowing in the irrigation dikes, causing floods to pour over the land at times when they are fatal to crops. By far the most effective enemy of these pestiferous rodents is the Red Rough-leg, or "Squirrel Hawk," and, as with the less desirable species, it has responded to the abundance of food, and has within comparatively few years become the principal check upon the greatly increased numbers of destructive ground-squirrels.

THE OSPREY, OUR LARGEST HAWK

The Osprey, or Fishhawk, as its name implies, feeds exclusively upon fish. It is our largest hawk, being almost as impressive on the wing as the Eagle himself. Its food consists almost wholly of the sluggish fish, such as carp and suckers, and it is in no sense a competitor of the angler or the commercial fisherman. It is our most picturesque bird of prey and should by all means enjoy perfect immunity and protection.

England, now almost without Ospreys,

AN OSPREY, OUR LARGEST HAWK, RISING FROM A STRIKE

This is America's most picturesque bird of prey, and on the wing is almost as impressive in appearance as the eagle. Feeding exclusively on fish, the bird checks itself directly over its quarry when sighted. With wings folded and talons wide open, it descends, sometimes burying itself in the water with the force of its impact. In the above photograph the hawk is seen rising from the water after striking a decoy fish anchored to a stone.

would give much to rehabilitate this beautiful creature if it could do so. But let us realize that it is virtually impossible to reëstablish any species when it has once become locally extinct.

And here let us take heed in the case of another fine species, one with every patriotic and sentimental reason for its most sedulous protection—the White-headed, or "American," Eagle. For the past year this noble species has been placed upon the black list in Alaska and, far from being protected, a bounty of 50 cents a head has been placed upon it. This had resulted, up to January, 1920, in the killing of some 5,000 eagles in Alaska.

It is charged that eagles interfere with the salmon fisheries and kill large numbers of young deer, sheep, and goats, and on this plea one of our most beautiful and interesting species is threatened with early extermination in the one region where it is, or was until recently, sufficiently common to give a thrill to the visitor. It would seem that the mere fact that it is the universally recognized emblem of our nation should give this fine species protection wherever it is found in America, and that no local interest, until thoroughly substantiated by expert Federal investigation, should withdraw it from the safety of complete Federal protection.

The Marsh Hawk has not quite so clean a record of achievement as have most of the foregoing, as out of 115 stomachs 41 contained bird remains, of which 7 were game or poultry; 79 contained small mammals, the preponderance of which were meadow-mice. Thus, while it is mainly beneficial, it does kill quite a proportion of feathered food.

Last, but very important, comes the common little Sparrowhawk. As small as the smallest, his abundance and wide distribution make it necessary to reckon with him. The American Sparrowhawk

is a little falcon, related to the Kestrel of Europe, but, unlike the European Sparrowhawk, an inveterate bird-killer, related to our Sharpshin. Our little falcon, the most ornate and beautiful of American hawks, is of invaluable service to agriculture by virtue of his fondness for grasshoppers. Occasionally he catches a bird; about a third of his diet is mice, but far the largest part is insects. During June, July, and August, when the young are being raised, they are fed over their weight daily on grasshoppers.

The service rendered by owls is even less appreciated than that of hawks, because they are mostly nocturnal, and hence are seldom heard and almost never seen. Owls are quite as expert mousers and ratters as the diurnal birds of prey, and the Great Horned is the only one which deserves a consistently bad reputation.

The Barred Owl lives almost exclusively on field and white-footed mice, with chipmunks, squirrels, rabbits, crawfish, and insects to vary the menu.

The Barn Owl, common all over the warmer parts of America, is exclusively a rodent feeder, and is 100 per cent beneficial, while both the long-eared and short-eared species are in virtually the same category, the Long-ear foraging in and around the margins of wooded areas and the Short-ear frequenting the wet meadows and marshes for voles, shrews, and mice.

Everywhere the commonest of all, the little Screech Owl, is the bird that most people hear and recognize. His soft, quavering call and velvety tooting are familiar and welcome sounds to those who know him, for he is the one owl that can and does survive with the taming of the land. Indeed, he seems to thrive best in the more thickly settled farming regions, nesting in the "woodlot" or orchard, in the village parks, or in the more wooded estates in the suburbs of large cities.

No bird of prey has a more varied list of food than this smallest of our common owls, as the following summary will show: Of 212 stomachs examined, 39 contained feathers, 112 small mammals, 100 insects, 2 lizards, 4 batrachians, 1 fish, 5 spiders, 9 crawfish, 2 scorpions, 2 earthworms, and 7 "miscellaneous."

The beautiful Snowy Owl, which comes in winter to the northern portions of the United States, has in some curious manner had protection specifically withdrawn from it and stands on the list of unprotected "vermin" on the game laws of the land. Out of 26 evidence-bearing examinations, 20 revealed injurious mammals and 11 had feathers among their contents. This is surely in favor of the Snowy Owl, which in winter is frequently seen along the seashore or on the ice-edge on the Great Lakes.

A PLEA FOR THE FARMER'S AIR SCOUTS

Is there not some direct way to bring before the agricultural and economic forces of our land their true relation to our birds of prey?

It is surely short-sighted voluntarily to destroy the greatest natural check on the greatest natural enemies of our greatest natural resource, and it would seem that merely proving the point that the birds of prey do even a little more good than harm would be sufficient to insure them complete protection. But it is easy to show that they are, all in all, of very vast value to our rural interests, and that their beneficial offices would be multiplied exactly in proportion to their increase under adequate protection.

It is largely our conservatism, the unwillingness to give up an idea that has long had lodgment in our minds, combined with the apparently complicated problem of "which is which," that has made the valuable species suffer from the misdeeds of the noxious ones, until now the situation is in many places really critical.

The time is not far away when one of two things must happen: Either proper and adequate protection must be granted and *enforced,* covering all birds of prey except the Goshawk, Cooper's Hawk, Sharp-shinned Hawk, Pigeon Hawk, Duck Hawk, and Great Horned Owl, the whole country over, or we shall soon find it too late to avail ourselves of their inestimable services, and must find new, costly, and far less efficient means of protecting our rural interests from the hordes of rapidly multiplying enemies that will continue, in ever-increasing numbers, to wage war upon agriculture.

THE MAIN ENTRANCE TO CHRISTOPHE'S CITADEL: HAITI

There are only two entrances to the citadel. One was used to bring in cannon balls from the reserve supplies stored on the terraces, and the second admitted to the prow of the fort. Massive, loopholed wooden doors guarded both entrances. Note the height of the towering walls compared with the men standing on the terrace.

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE POLICEMEN OF THE AIR

An Account of the Biological Survey of the Department of Agriculture

BY HENRY WETHERBEE HENSHAW

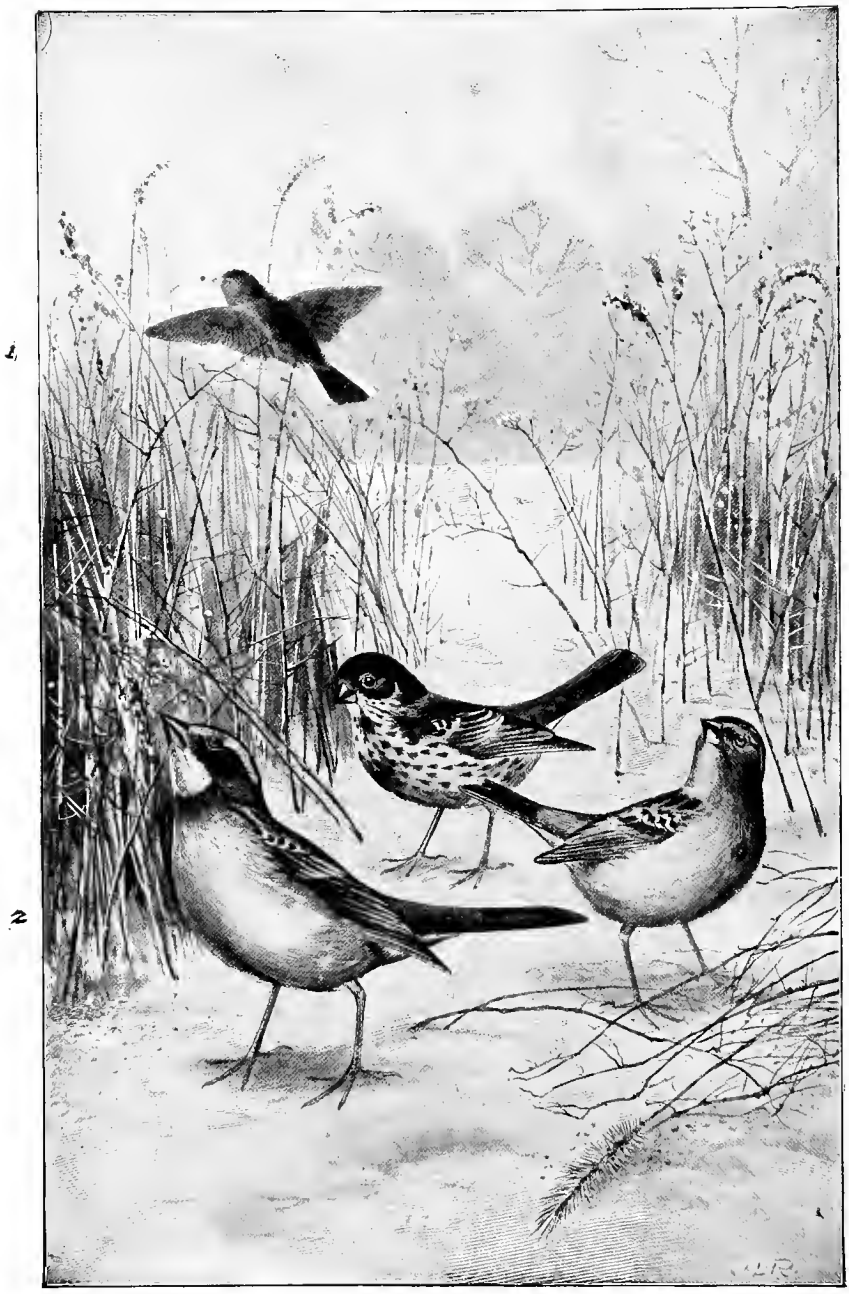
THE pursuit of science solely for its own sake, however commendable it may be, is not the spirit that animates our government in its support of scientific research. In its aims and ambitions this is a practical age. Thousands of men are experimenting, inventing, and prying into the secrets of nature for the avowed purpose of utilizing their discoveries for the practical benefit of mankind. Applied science has come to occupy a very important place in our government institutions, and in none is it more important than in the Department of Agriculture.

From small beginnings, the department in little less than half a century has expanded in every direction, and in the last decade, under the able management of Secretary Wilson, has grown to huge proportions. Its work is divided among numerous bureaus, each with a distinct line of research, and a small army of assistants is employed, many of whom are engaged in various fields of scientific investigation for the benefit of the American farmer.

It is the work of one of its bureaus, the Biological Survey, that concerns us here. The Survey had its beginning in 1885, when its present head, Doctor C. Hart Merriam, with one assistant, began to investigate the economic relations of birds to agriculture. The scope of the field was soon enlarged to include the kindred subject of economic mammalogy. In addition to these important subjects, its duties now include the study of the geographic distribution of animals and plants with special reference to the determination of life and crop zones, and the supervision of matters relating to game protection and the importation of foreign birds and animals.

RELATION OF BIRDS TO AGRICULTURE

When the Survey began its work very few accurate observations on the food of birds had been recorded. Most of the published information bearing on the subject rested on field observation only, and, besides the liability to error from faulty or insufficient observations, the data gathered in this way were entirely inadequate. It is not enough to be told that birds feed on insects; we must know the particular kinds they eat. The fact that the crow sometimes eats corn is not sufficient evidence upon which to condemn

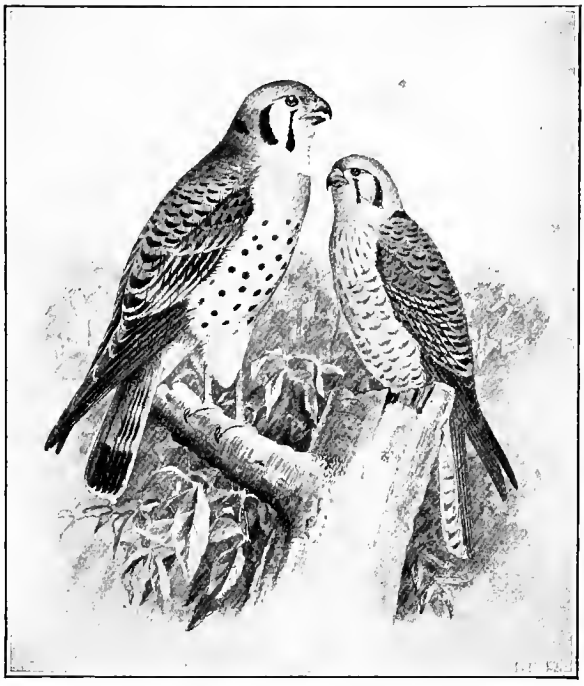


From the Biological Survey

FOUR COMMON SEED-EATING BIRDS

1, Junco; 2, White-throated Sparrow; 3, Fox Sparrow; 4, Tree Sparrow

the bird. We must learn the nature of its food at all times of year, and then strike a fair balance between its good and its bad deeds; hence the absolute necessity for the examination of the contents of birds' stomachs, by which means may be accurately determined not only the kinds of food eaten but their relative quantities. This method is exceedingly slow and laborious, requires a high order of expert ability, and moreover is open to the very serious objection that it necessitates the taking of useful lives. So far as possible, the latter objection has been minimized by utilizing the stomachs of birds killed by naturalists for scientific purposes. This material, which otherwise would be lost to economic science, renders it unnecessary, except in special cases to destroy birds for the purpose of food examinations.



From the Biological Survey

SPARROW HAWK

Which helps the farmer by eating grasshoppers, crickets, and beetles (see page 85)

In the above connection it must not be forgotten that when a thorough examination of the food of a given species is once made and the results published, the work is done for all time. The food habits of a species having been once determined by this method, no possible excuse exists, so far as food investigations go, for further destruction of bird life; and the more so because the contents of all stomachs examined are preserved as vouchers for further verification, should that be deemed necessary.

Passing to a consideration of some of the practical problems presented, it might seem that the relation of birds to agriculture were simple, since the question is chiefly one of food. Do birds destroy crops? then of course they are injurious. Do they eat insects? then of a certainty they must be beneficial. But the problems are not to be settled in this off-hand fashion. In reality they are extremely complex and are to be understood only after much painstaking study. It has been found, for instance, that a bird may be injurious at one time and not another. In one region it may be a pest and in another an unmixed blessing. Some birds—unfortunately not many—are always beneficial. Others—fortunately not many—are always and everywhere injurious. But the great bulk of birds are both harmful and beneficial by turns, according to age, season of the year, the presence or absence of their natural food, and a variety of circumstances.

THE TREE SPARROWS VERY BENEFICIAL

For present purposes we may roughly group the bulk of our small birds into two classes — seed-eaters and insect-eaters. The seed-eaters, mostly of the sparrow family, have stout bodies and strong conical bills, expressly designed for crushing seeds. Their name is legion and the

From the Biological Survey

A USEFUL BIRD OF PREY

Swainson hawk. This bird saves the western farmer $100,000 a year (see page 85)

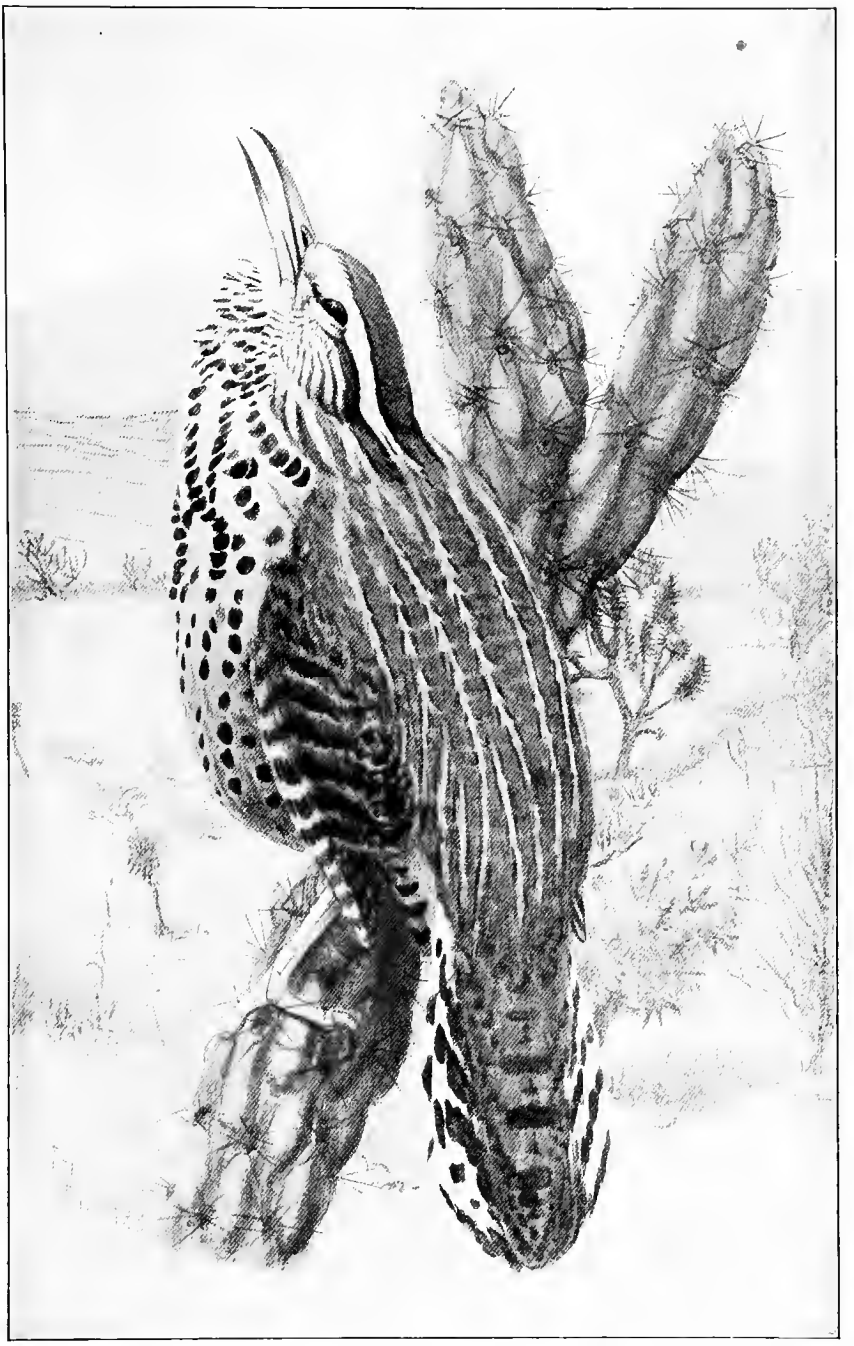
family contains more species than any other group of birds. It is well that this is so, for the destruction of weed seed is of tremendous importance to the farmer, whose trouble to keep ahead of the weeds, great as it is now, would be vastly increased were it not for the soberly clad and unobstrusive little sparrows. We may get an idea of the value of the service these birds render by noting what is done for the farmer by the tree-sparrow, one of the most confirmed seed-eaters of the group. A quarter of an ounce of seed per day is a safe estimate of the food of an adult tree-sparrow. On this reckoning, in a state like Iowa, where agriculture is relatively very important, tree-sparrows annually eat about 875 tons of weed seed:

The total value of the principal field crops of the United States for the year 1906 was about $3,500,000,000. If we estimate that the combined consumption of weed seed by the sparrow family results in an annual saving of only 1 per cent of the value of the crops, the sum total saved to the farmer in 1906 was $35,000,000.

Though seeds form the chief part of the subsistence of sparrows, the destruction of seeds is by no means all we have to thank these birds for. They eat many insects also, and seem to know instinctively that while seeds are excellent food for adult birds, they are not necessarily good for nestlings, and hence feed the latter almost exclusively on insects.

Sparrows, however, are not the only birds that consume the seeds of weeds. The eastern quail or bobwhite is a confirmed eater of weed seeds. Highly exteemed as bobwhite is by the epicure for food and by the sportsman as an object of pursuit, he is probably worth so much more as a weed-destroyer that the farmer can ill afford to have him shot, even though the privilege is roundly paid for. A bevy or two of quail on a farm is an asset the value of which no thrifty farmer should overlook. Doves also are seed eaters, especially the turtle-dove, whose crop often is so packed with the seeds of weeds that it can hold no more.

The farmer has no quarrel with birds that confine their attention to grass and weed seeds, and welcomes their presence always and everywhere. There are birds, however, which eat such seeds as corn, wheat, and barley, and whose place in the farmer's esteem is by no means so well assured—the crow and the blackbirds for instance. There are several kinds of blackbirds which at times attack crops as also does the crow. The destruction by the crow of meadow mice, and of cutworms and other insect pests and the destruction of many kinds of insects by the blackbirds, however, are considered in most localities to offset all damage done in other ways and even to leave a balance in favor of the birds.



From the Biological Survey

CACTUS WREN

A common desert bird of the southwestern United States

From the Biological Survey

GOLDEN EAGLE

The most widely distributed of the eagles. It ranges over most of North America and a large part of the old world. In sections of California the Golden Eagle feeds on ground squirrels and is wholly beneficial, while in some other parts of its range it feeds on lambs and wild game and is a noxious species.

BIRDS THAT EAT INSECTS

Many birds, as flycatchers, warblers, swallows, and chimney-swifts, live exclusively, or almost so, on insects, and very many more, as blackbirds, orioles, and some hawks, depend on them for a considerable part of their livelihood. The little sparrow-hawk lives very largely upon grasshoppers, crickets, and beetles, and even one of the larger hawks—the Swainson hawk of the western plains—at certain seasons destroys enough of these injurious insects, together with small rodents, to save the western farmer upwards of a hundred thousand dollars a year.

From the Biological Survey

A BARRED OWL

If all insects preyed upon vegetation, our inquiry into the value of insect-eating birds need go no further, since all of them might be set down as beneficial; but by no means all insects are destructive of vegetation, and their relations to each other and to birds are very complex and puzzling. The insects that feed on vegetation at some stage or other of their existence probably outnumber all others, both in number of species and of individuals; but there are two other classes of insects which deserve attention here, the predaceous and the parasitic. The predaceous insects, either in the adult or larval state, feed upon other insects and hence in the main are beneficial. It would seem, therefore, that in so far as birds destroy predaceous insects they do harm. That birds do destroy a greater or less number cannot be denied, but as many species of this group secrete nauseous fluids, which serve, in a measure at least, to protect them, and as many are of retiring habits and not readily found, the number destroyed by birds is relatively not large. Moreover, some of the predaceous insects, when insect food is not available, become vegetarians, and hence assume the role of enemies of the farmer; so that when birds destroy predaceous insects they may be doing the farmer either a good turn or an ill turn, according to circumstances.

The relation of birds to the so-called parasitic insects is still more intricate and puzzling. Parasitic insects fill a very important place in the economy of nature; it is even claimed by entomologists that they do more effective service in aiding to keep true the balance in the insect world than any other agency. They attack insects in every stage of existence and insure their destruction by depositing eggs on, or in, the bodies of adults, their larvæ (the worm or caterpillar stage), their pupæ, or their eggs. Now, birds recognize no fine distinctions in the insect world. All is grist that comes to the avian mill, and parasitic insects are snapped up by birds without the slightest regard to the fact that they are useful to man. Hence we have a complicated problem to unravel in respect to the interrelation of insect pests, of insect parasites that destroy them, and of birds that destroy both pests and their parasites. As Swift phrases it:

Photo from the Biological Survey

A MONUMENT TO THE INDUSTRY OF BARN OWLS

Field Mouse skulls found under owl roost in Smithsonian tower, Washington (see page 87)

So, naturalists observe, a flea
Has smaller fleas that on him prey;
And these have smaller still to bite 'em,
And so proceed *ad infinitum.*

After due recognition of the part insect parasites play in the economy of nature, it is evident that, unassisted, they are unequal to the task of keeping insect life in a proper state of equilibrium. In this work birds play an important, though it may be relatively a somewhat subordinate part. Had parasitic and predaceous insects been equal to the task of holding in check insect pests, there would be no place in the world for insect-eating birds. In the progress of evolution, however, long after insects and insect parasites appeared, birds found a place vacant, which even their reptilian ancestors had not been able to occupy, and proceeded to fill it. Having once gained a place in the world, birds entered into a competitive struggle with each other and with other insect-eaters. In the course of time they developed into a great number of families, each distinguished by peculiarities of form, plumage, and habits, and each endowed with methods of its own in the pursuit of food. That so many birds are insect-eaters is an index alike of the enormous reproductive capacity of insects and the inadequacy of the forces that warred on insects before the advent of birds.

HAWKS AND OWLS ARE NOT MARAUDERS BUT MOST BENEFICIAL

The popular idea regarding hawks and owls is that they are nothing but robbers and bold marauders. Their real character and the nature of their services to man are generally overlooked. The fact is that the great majority of our hawks and owls are beneficial, and spend the greater part of their lives in killing small rodents, most of which are always and everywhere noxious. Hawks and owls are long-lived birds, as birds go, and this fact gives a hint of their importance in the eyes of nature and of their value as servants of man.

The work of hawks and owls is complementary. All hawks are diurnal, and hunt their prey between the hours of daylight and dark. Owls, on the contrary, are chiefly nocturnal, but do much of their hunting in the early evening and morning hours, or by moonlight, and when pressed by hunger or when feeding young, they sometimes hunt by day. Hence, between them, hawks and owls

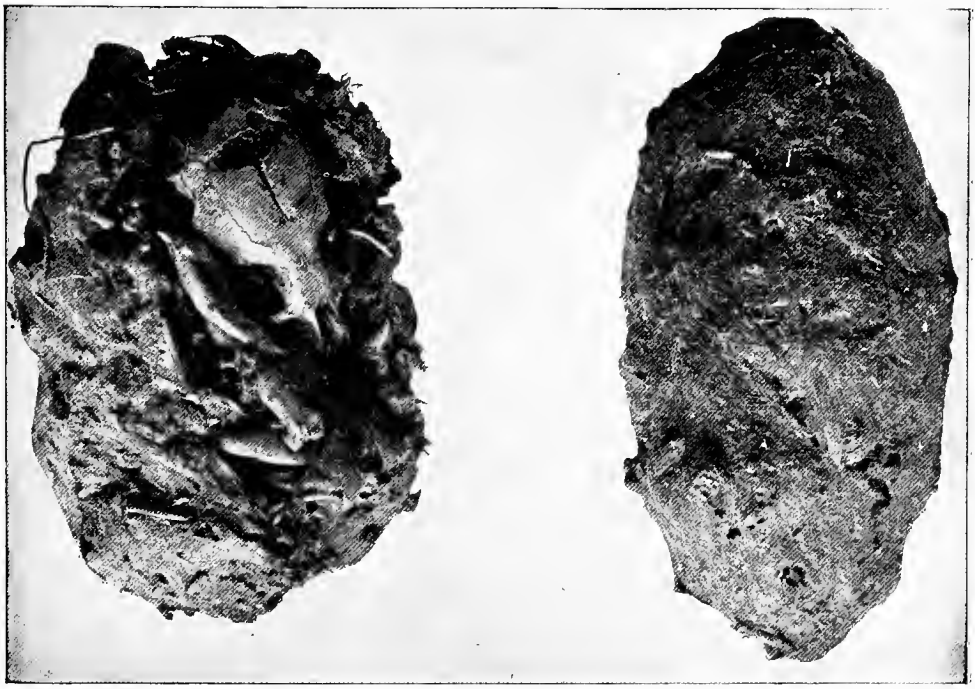


Photo from the Biological Survey

PELLETS THROWN UP BY OWLS, CONTAINING BONES AND HAIR OF MICE, NATURAL SIZE

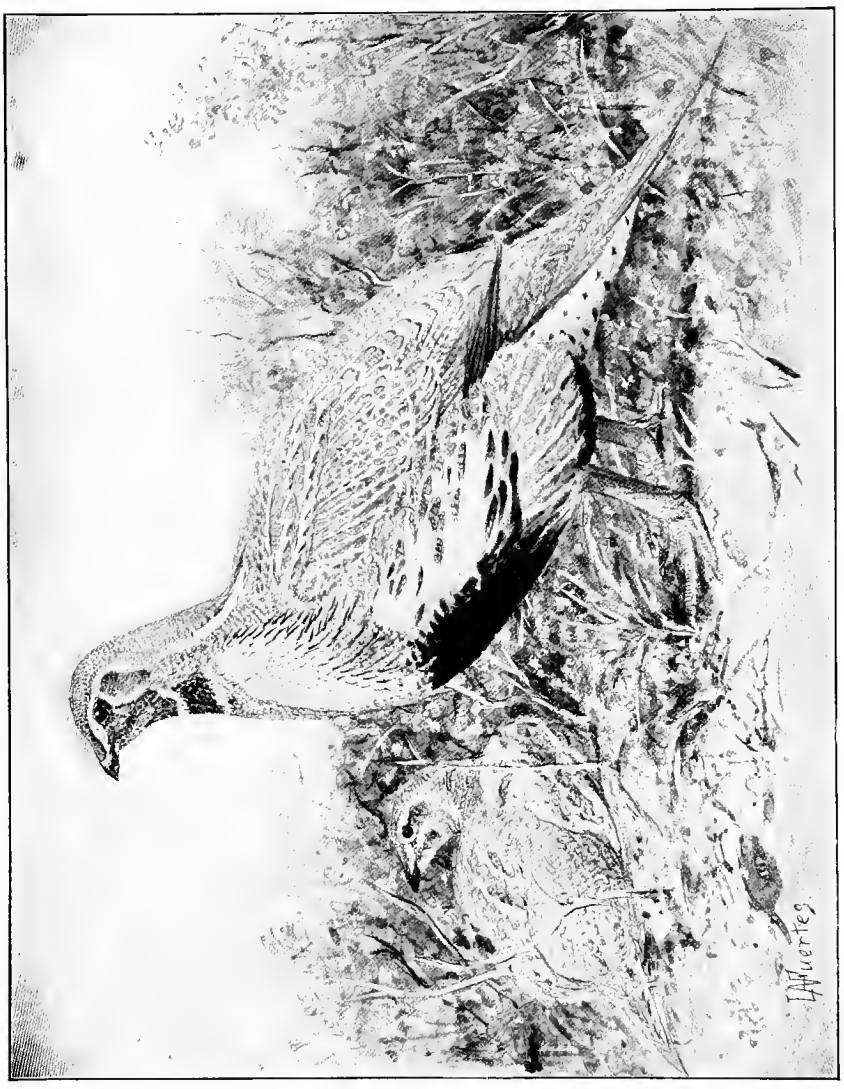
are on duty throughout the 24 hours, and thus are enabled to prey on all kinds of rodents, large and small, those which are abroad by night as well as those active by day.

The bulk of the depredations on birds and chickens due to hawks is committed by three species—the Cooper and sharp-shinned hawks and the goshawk; and the sportsman and farmer's boy should learn to know these daring robbers by sight, so as to kill them whenever possible. The so-called "hen-hawks," usually either the red-shouldered or red-tail hawk, are too often made victims of a bad name; for while both species occasionally snatch a chicken, the habit is far too uncommon to justify the name "hen-hawk." The good these two big hawks do in the long run by destroying rats and mice far more than compensates the farmer for the insignificant damage he suffers at their talons.

CURIOUS METHODS OF DIGESTION

Both hawks and owls often swallow their prey entire or in large fragments, together with the bones, hair, and even some of the feathers. Avian digestion is both good and rapid, but it is unequal to the task of assimilating such substances, and accordingly both hawks and owls throw up these rejecta in the form of neatly rolled pellets. In studying the food habits of birds of prey much use is made of these pellets, and the vicinity of a nest of a pair of horned owls, for instance, often contains an unmistakable record of the birds' food, and perhaps that of the young, for months or even years.

From the foregoing it will at once appear that the practice of offering bounties indiscriminately for the heads of hawks and owls, as has been done by some states, is a mistake, and results not only



From the Biological Survey

SAGE HEN

Our largest grouse; resident on the sage brush plains of the western United States

no purpose in their ears but to indicate the whereabouts of their victims. Hunting small birds with them is a passion. Unless speedy cognizance is taken of the tendencies of this rapidly increasing class of immigrants, some of our most valuable song and insect-eating birds will be in danger of extermination.

It should arouse a feeling of pride in Americans that our Republic has taken a foremost place among the nations that care for and protect birds. Much has already been accomplished in this country in the cause of bird protection, but much still remains to be done. So long as dead birds for hat gear are valued at a higher rate than living birds, and so long as game birds count for more in the way of sport and food than as active working friends of the farmer, so long will there be missionary work to do for such organizations as the Biological Survey and Andubon Societies.

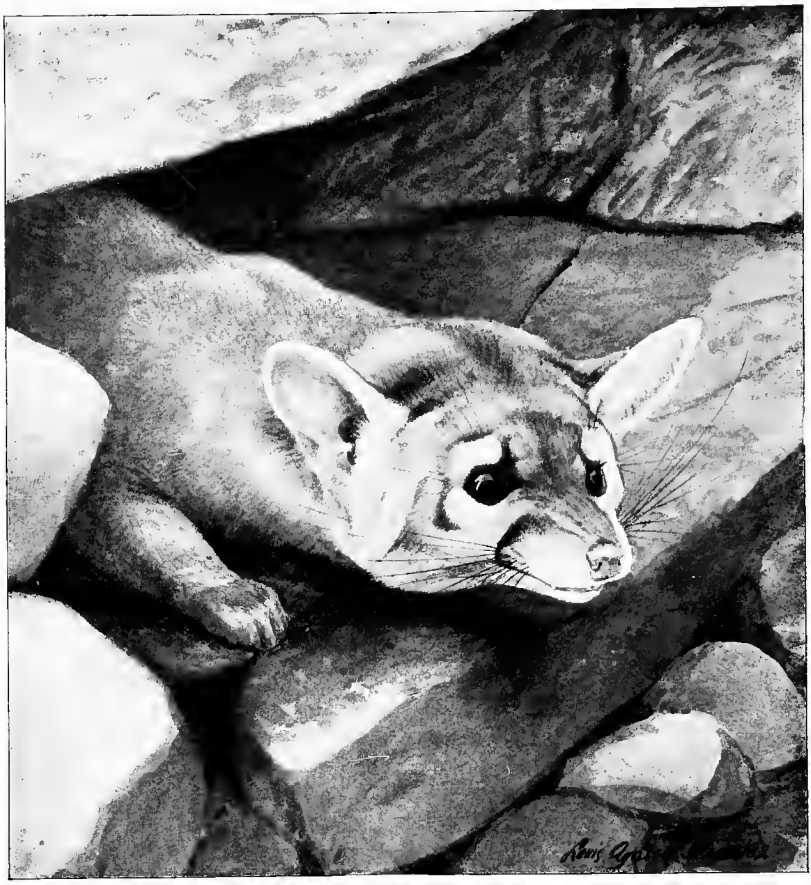
MANY OF THE SMALL MAMMALS BECOME PESTS

The relations of mammals to agriculture are very different from those of birds. Most birds, as has been shown, are beneficial, even those with injurious habits, as a rule, compensating in whole or in part for the damage they do. Such is by no means the case with mammals. As a result of the investigations of the Biological Survey, some of our common mammals indeed have been found to perform valuable service to man. To this class belong the bats, moles, and shrews, which are insectivorous; the badger, which is an indefatigable mouser when it cannot find larger game in the shape of prairie dogs and similar rodents; and the skunks and weasels, which destroy vast numbers of insects as well as mice. The fox, wild-cat, ring-tailed civet, and opossum also are believed to be useful in the main, as they eat many insects and small rodents and by no means destroy as much game as is popularly supposed. Reynard's raids on the poultry yard are not common, and they are so easily guarded against that they should count but little in the scale against him. Even coyotes when they follow their natural bent perform an important service—they keep down the number of rabbits, which constitute their natural prey. Unfortunately, however, the coyote early contracted a taste for mutton, and in some regions successful sheep-raising is practically impossible because of its destructive raids. Experiments are being made by the Biological Survey and Forest Service to discover a cheap method of fencing by means of which depredations on sheep may be prevented. Effective fencing of sheep against coyotes will compel these animals once more to rely for food chiefly on rabbits, prairie dogs, and other destructive rodents.

When all has been said, however, the list of our wild mammals that are of essential service to man is comparatively small, even if we include in it a number which are harmful and beneficial by turns, like minks, coyotes, foxes, and others, compared to the army that are always and everywhere injurious.

WOLVES CAUSE MILLIONS OF DOLLARS OF LOSS YEARLY

It was predicted that the extermination of the buffalo would be followed by that of the big wolf, so intimately associated were the two in the days when the wolf used to prey on the young, the aged, and the crippled buffalo; and for a time after our largest native mammal succumbed to the robe-hunter it seemed as if the prediction was likely to be fulfilled, so scarce did wolves become. But the old buffalo ranges soon filled with cattle, and the wolf took on a new lease of life, and in some localities now threatens to become as numerous as in former times. The value of the cattle destroyed annually by wolves amounts to millions of dollars, and this despite the payment of large sums as bounty for wolf scalps. After investigation the Biological Survey has recommended measures which it is believed will prevent the greater part of the damage. The most important of these are the systematic use of poison and the destruction of the wolf pups in the breeding



From the Biological Survey

THE RING-TAILED CIVET CAT OF THE SOUTHWESTERN UNITED STATES

A first-class mouser

dens. Wolves breed early in the year, and when snow is on the ground may be tracked to their dens with absolute certainty. Even when the ground is bare, a skillful tracker, familiar with the country and with the habits of the animal, can usually locate the dens. By destroying the increase and by the judicious use of poison to insure the death of the old ones, several millions of dollars may be saved to the stockmen annually even now, while the measures recommended, if energetically and persistently followed up, are likely to result in the practical extermination of these savage pests.

RATS AND MICE ARE OUR MOST DREADED ENEMIES

But the damage by wolves, panthers, coyotes, and all the carnivores put together does not begin to equal the destruction wrought by the army of small rodents, individually insignificant but collectively a mighty pest. Rats alone do an almost incalculable amount of harm in the United States, and everywhere they are deservedly dreaded, all the more since by long contact and constant conflict with man they have become extremely sagacious and wary, and thus far have been able to defy his utmost efforts

From the Biological Survey

TEXAS WILD CAT
An active foe of noxious rodents

to exterminate them, or even to seriously reduce their numbers, and as if the measure of their iniquity were not filled by the wholesale destruction of merchandise, household goods and foodstuffs, they are now known to serve as carriers and disseminators of that dread disease, the plague; so that measures to exterminate them, wherever that is possible, are doubly important.

When is added to the total damage done by rats the results of depredations by meadow and house mice, by prairie dogs, rabbits, gophers, ground squirrels, and other small gnawing animals, the resulting total, could it be ascertained, would stagger belief. Unfortunately accurate statistics of such damages are for the most part wanting, but a single item is suggestive. One of the small ground

Photo by Viola McColm

NOT DEAD, BUT PLAYING POSSUM

squirrels of Washington injures the wheat crop in a single county of that State to the extent of half a million dollars annually. While the loss to this country by rodents by no means equals that caused by insects, the total reaches far into the millions and is a serious drain on the national resources.

To devise methods of combating these pests, of reducing their numbers, and, if possible, of accomplishing their extermination is one of the important problems dealt with by the Biological Survey. By the use of traps, of poisoned foods, and of gases to kill the animals in their burrows, much has been accomplished. Failure to secure the utmost results aimed at by these methods is due chiefly to the difficulty of securing the coöperation of all the farmers in an infested region. It is evident that if a number of landholders withhold their aid, their farms become nurseries from which to repopulate adjoining districts. Moreover, in most regions there are sterile and unproductive areas which receive no attention, and these again are harbors of refuge for the pests which later emerge to restock farming lands. Hence the contest appears to be a never-ending one, and is a constant source of loss and annoyance to the farmer.

The difficulties of warfare against rodents are in inverse proportion to the settlement of the country. Where farms are large and there is much waste land, the difficulties are very great; but when farms are comparatively small and there is little unoccupied land, coöperation between landholders is easier to secure and results are more encouraging. In parts of Kansas, for instance, where formerly farming population was scarce and prairie dogs numerous and destructive, the animals have been practically exterminated as the result of the continued effort of numerous ranchers working together for a common end and aided by the state.

In attempting to devise more effective means of abating rodent pests the attention of the Survey has been turned to a

Photo by Viola McColm

COMMON SKUNK WADING THROUGH SLUSH—KANSAS

Photo by Bailey, Biological Survey

GRAY FOX—NEW MEXICO

study of the use of epidemic diseases—nature's own method of destroying surplus population. It has long been known that at irregular intervals, when mammals, especially rodents, that live in crowded communities increase till they are very numerous, they are suddenly smitten with an epidemic which almost wipes out the species over a considerable area. In the case of such epidemics a certain number of individuals either are immune to the disease or recover from it; for while nature is prodigal with the lives of individuals and wastes them with apparent recklessness, she cherishes the species and is chary of exposing one to the risk of elimination. After a few years the animal that has paid the price of too great prosperity again multiplies beyond limits, to be again reduced.

Efforts are now being made to obtain cultures of the diseases which prevail among the more destructive of our rodents, so that they may be employed in other regions where the animals are pests. Since the cultures may be renewed from time to time, they can be kept indefinitely and be ready for use as required. If they prove as effective as when employed by nature, the problem of a cheap and reliable method of dealing with destructive rodents will have been solved.

FOX FARMING

Time was when it might almost have been said that America furnished furs for the world, and even now no inconsiderable part of the fur harvest comes from America. Year by year, however, the harvest is diminishing, while the price of furs is steadily advancing, till the finer and rarer kinds are within the reach of only the very wealthy. Foxes of the more valuable kinds, for instance, once so numerous in this country, are now comparatively scarce. Their fur is so valuable and so much sought for that, instead of trying to discover means to compass their destruction, the Survey is now studying the best methods of fox farming, with a view to making the breeding of the

TYPICAL BREEDING GROUNDS OF COYOTES IN WESTERN WYOMING

Photos by Bailey, Biological Survey

COYOTE PUPS AT MOUTH OF BREEDING DEN IN WYOMING

A family of coyote pups was found in the hole near cross on extreme right

Photo by Bailey, Biological Survey

A MUTE WITNESS TO THE DESTRUCTIVENESS OF MICHIGAN WOLVES—BODY OF DEER LYING ON THE SNOW

animal in confinement not only possible but remunerative. When silver fox skins are worth from $300 to $600 a skin it does not need a Colonel Sellers to see golden possibilities in the business.

The raising of mink and beaver, and perhaps otter, for their fur is also thought to be entirely feasible. The beaver is being protected in Canada and in some of our own states. It should be protected in all, for apparently protection is all that is required to enable the animal to reëstablish itself in many of its old haunts. After being safeguarded for a term of years, judicious trapping might then be allowed, and thus this remarkable and valuable fur-bearer be preserved indefinitely, to be a source of both interest and profit to future generations. Even the despised skunk, which is easily cared for and is wonderfully prolific, can, it is believed, be raised in confinement with profit.

The idea of raising furs for the market is by no means new. Many attempts have been made to breed foxes for profit, especially in certain islands of Alaska, where the conditions would seem to be ideal. Some of the ventures appear to have proved remunerative, but many failures have resulted, chiefly as the result of inexperience and lack of knowledge, especially of the proper feeding and care of the animals. It is thought that the difficulties are by no means insuperable and that they can be overcome by study and carefully conducted experiments.

Thus the ends sought by the Biological Survey in its investigations of mammals differ considerably from those aimed at in its study of birds. The more carefully birds' habits are studied and their food investigated, the more apparent is it that man cannot do without them. Such is by no means true of many of our indigenous mammals. Some are valuable because they destroy noxious insects and noxious mammals; others because they furnish skins for use and comfort; but many are wholly noxious, or so nearly so that they can be safely classed as such, and their destruction compassed in every possible way, though always with the entailment of as little suffering as possible.

APPLE TREE KILLED BY RABBITS

Photos from the Biological Survey

APPLE TREE KILLED BY FIELD MICE

Photo from the Biological Survey

PRAIRIE DOGS AT MOUTH OF BURROW

LIFE AND CROP ZONES

It has long been recognized that plants and animals are not distributed fortuitously over the earth, but in their distribution are governed by well-defined laws. Certain species and groups of species are restricted to certain regions because of peculiarities of climate, temperature, and soil, summed up under the word environment, essential to their well being.

Cultivated plants are wild plants tamed—wild plants modified to some extent by care and cultivation—but in their nature and all essentials akin to their uncultivated ancestors. To a great extent, then, the laws of distribution that apply to wild plants and animals apply equally well to cultivated varieties. The ready application of these facts will appear from an example. If on a certain mountain side a particular crop is found to thrive, and the observer happens to know the particular plants, birds, and mammals natural to the locality, when he visits a different region where the same plants and animals find a congenial home he may be sure that the crop in question will thrive there also.

Such being the case, it was early perceived that a study of the distribution of wild plants and animals and the mapping of the natural areas of distribution could be made to serve a practical use, whereby the farmer would be saved enormous expense in experiments to ascertain the particular crops adapted to new localities. Accordingly, in the summer of 1889 Merriam selected the San Francisco mountain region of Arizona for an experimental survey, and it is not too much to say that the results of the work there revolutionized prevailing conceptions of the principles of geographic distribution.

In ascending the mountain a succession of climatic belts were traversed, similar to the ones to be noted in traveling from our southern boundaries to the Arctic, each zone or belt being characterized by a distinct set of animals and plants.

Photo by Viola McColm

VERY YOUNG COTTONTAIL RABBITS IN NEST

Among other results it was demonstrated that the laws governing the distribution of mammals, birds, reptiles, insects, and plants are essentially the same. Hence a map showing the boundaries of an area inhabited by an association of species of one group serves equally well for the other groups. Comparison of the facts of distribution as noted on this mountain with corresponding facts over the country at large disclosed three important truths: (*a*) That the several life zones of the mountain could be correlated with corresponding zones long recognized in the eastern United States; (*b*) that these same zones are really of transcontinental extent, though never before recognized in the West; and (*c*) that the faunas and floras of North America as a whole, and, for that matter, of the Northern Hemisphere north of the tropical region, are properly divisible into but two primary life regions—a northern, or Boreal, and a southern, or Austral (then termed Sonoran), both stretching across the continent from ocean to ocean.

Subsequently a careful study of the geographic distribution of plants and animals was undertaken, to include the whole of the United States and, where necessary, the region contiguous.*

The practical use of zone maps is easily understood. If, for instance, it is ascertained that a certain crop thrives in one part of a particular zone, it is to be expected that elsewhere within the zone, where similar local conditions prevail, the same or a closely allied crop will do well. As each zone includes thousands of square miles, the value of such information is obvious.

The final step toward making such

* The first announcement of the laws of temperature control of the geographical distribution of terrestrial animals and plants was made in this Magazine, vol. VI, 1894.

Photo by E. R. Warren

FIELD MOUSE

When numerous field mice do enormous damage to crops (see page 92)

zone maps of the utmost practical use—and a very important one—is to accompany the maps with a list of the fruits, grains, and vegetables best suited to each zone. Thus the necessary experimentation on the part of the farmer is reduced to a minimum. The farmer who wishes to find land where a certain crop may be planted with success, or the emigrant in search of conditions similar to those he is familiar with at home, has only to refer to the zone maps and to the lists connected therewith.

A small scale zone map of the United States has been completed, with lists of the farm products most likely to thrive in the several belts. While for general purposes this map is very useful, it is by no means detailed enough to give all the information the farmer or emigrant in search of a new location desires. It is the present purpose to survey each important agricultural state with sufficient detail to enable life and crop zone maps to be published, with lists of the crops specially adapted to the several parts of the respective states.

Such crop and zone maps are useful in still another field. At the present time the whole world is being searched by specialists for fruits and plants, suited to the conditions that prevail in our own country. The usefulness of such maps as a guide to the most favorable localities in which to test the value of these foreign importations can hardly be overestimated.

Noxious insects also in their dispersal over the country follow the same faunal belts, as do also many of the diseases of domestic stock and even of man. Yellow fever, the germs of which are now known to be distributed by a mosquito, has been shown to be limited to a transcontinental belt the boundaries of which were laid down by the Survey nearly twenty years ago.

Curiously enough the regions formerly occupied by particular tribes of Indians correspond in a general way with these same life zones, as was pointed out by

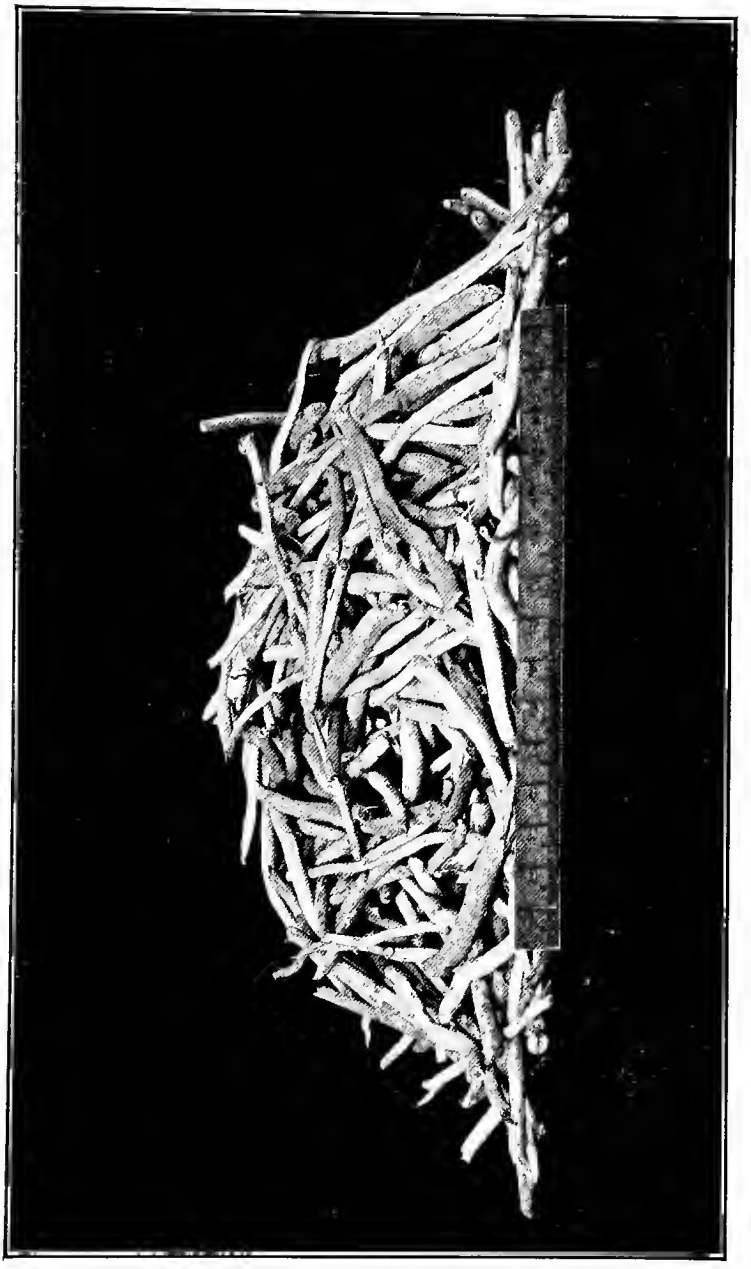


Photo from the Biological Survey

SECTIONS OF MORNING GLORY ROOTS STORED BY FIELD MOUSE FOR WINTER FOOD SUPPLY

From burrow on Potomac Flats

Photo by Osgood, Biological Survey

SHELTER-HOUSE ON FOX FARM IN MAINE

Merriam. The Indian was largely dependent for his livelihood upon the natural fruits of the earth and upon game, in the same way, though not to the same extent, as were wild animals. Thus the distribution of acorns, camas, pine seeds, wild oats, and the thousand other wild crops, as well as that of the birds and animals which furnished them food and raiment, to a great extent determined the favorite haunts of the aborigines of this continent.

GAME PROTECTION AND KINDRED SUBJECTS

What a glorious heritage of game, both bird and beast, was bequeathed by the Indians to our forebears, and with what prodigality has it been wasted by them and by ourselves! Neither motives of humanity nor far-sighted prescience deterred the Indian from wanton slaughter of game. He killed animals and birds, however, not for sport, but for food, shelter, and raiment, and the very abundance of game and his imperfect weapons made game laws restrictive measures in his time as unnecessary as they were undreamed of.

Very different are present-day conditions. Of the almost infinite number of game birds and animals that once filled our mountains and valleys only a small remnant is left. The buffalo, that ranged from the Atlantic to beyond the Rocky Mountains and blackened the plains with its countless numbers, is practically extinct in its wild state; the antelope, bands of which everywhere dotted the plains, is rapidly approaching the same fate; moose and caribou, though still occurring over much of their former range, are being greatly reduced in numbers; while elk, deer, and mountain sheep are quite unknown over much of the territory they formerly inhabited. Our game birds are facing the same fate. The present generation knows not the wild pigeon, flocks of which used to darken the sun as they swept across country. The various

Photo by Bailey, Biological Survey

ASPEN BEING FELLED BY BEAVER—NOTE SIZE OF CHIPS

Photo by Bailey, Biological Survey

BEAVER DAM FROM BELOW—NOTE STORAGE POND ABOVE DAM

The beaver is a natural ally of the reclamation engineer

Photo from Mrs Charles Shaffer

HUDSON BAY SABLE

One of the most valuable American fur bearers

species of grouse and quail have been decimated in many regions till only a beggarly remnant remains, and even ducks and geese, that with the changing seasons once thronged our tidal waters and waterways, have been so mercilessly slaughtered that the future prospects of more than one species looks dark. All of our waders have been reduced in numbers and many are almost unknown where formerly they used to cover the sand and mud flats. Such facts sufficiently empasize the need of game protection, and the study of ways and means of preserving such of our game birds and animals as still survive is regarded as one of the pressing duties of the Biological Survey.

We Americans did not at first welcome the idea of close seasons, license systems, game refuges, game wardens, and the other measures necessary for the protection of wild life. To our forefathers of not long ago the privilege of killing game when needed was an absolute necessity, and we have been so long accustomed to the idea that game is public property, to be appropriated by the first comer, that we do not take kindly to restrictions of any sort. Nevertheless both the theory and practice of game and bird protection are now firmly rooted in this country,

By courtesy of the *Pacific Monthly*

ORANGE GROVES OF SOUTHERN CALIFORNIA

In climbing the mountains in the background one traverses in succession all the life zones from the orange belt (Lower Sonoran zone) to the frigid treeless summit (Alpine zone)

simply because of the self-evident fact that without at least a measure of protection there will soon be no game left. No duty can be plainer than to so care for our game animals that the species may be perpetuated for the pleasure and use of future generations. We cannot indeed pass on in full measure the heirloom we received, but many of our finest game birds and animals still survive, to insure a future supply, provided we refrain from wanton slaughter and protect both wisely and well. The theory that wild game is not and cannot be made the property of the individual, but that it belongs to the state, which has the power to regulate its use and preservation, is now recognized almost everywhere, and the recognition of this principle has greatly aided the cause of game protection.

As the supply of native game birds diminishes, there appears to be a growing tendency among sportsmen to import birds from foreign countries for restocking covers, and the Survey is constantly in receipt of requests for information on this subject. European partridges, capercailzie, black game, willow and hazel grouse, and several kinds of pheasants have already been experimented with. It is yet too soon to decide as to the ultimate outcome of most of these efforts, but in the West, especially in Oregon and Washington, the introduction of pheasants has been successful, and in certain localities two species of these superb game birds are very numerous. In parts of the Atlantic States also they have been successfully acclimatized.

Should it prove, as now appears probable, that along with pheasants and other

foreign game birds diseases have been introduced which threaten the safety of our own native game birds, sportsmen may conclude that by the importation of foreign species they have lost more than they have gained.

As most birds, including ducks and geese, are migratory and do not breed in the states through which they pass in spring and fall, many now advocate measures placing all migratory birds under federal control. The present diversity of state laws and the wide differences in the dates of their open and close seasons are the chief arguments for delegating the care of migrants to central authority. That the effect of such a measure would be to improve existing conditions and extend the lease of life to many species of ducks and shore birds now fast approaching extinction can hardly be doubted.

BIG-GAME REFUGES

The use of government reservations for the preservation of wild animals in danger of extinction is a practical form of protection which cannot be too highly commended. The experiment on a large scale was first tried in Yellowstone Park, and the results there have been most encouraging. Despite some poaching, elk, antelope, and mountain sheep have steadily increased in numbers, while buffalo also have thriven wonderfully.

The high price paid for elks' teeth is a constant temptation to lawless hunters to kill these superb animals. It is to be hoped that the organization chiefly responsible for this demand will by official action repudiate elks' teeth as a necessary emblem of the order, and thus lend material assistance in the effort to preserve this, the noblest of our game animals.

It is a pleasure to note that the cooperation of private parties with the government authorities in efforts to perpetuate our game animals are not wanting. An instance in point is Miller and Lux's generous offer to the government of their herd of elk on the Button Willow Ranch, California. In 1905, under the direction of the Biological Survey, some 20 of these animals were successfully transferred to the Sequoia National Park, in Tulare County, where they promise to form the nucleus of a large herd of this fine species.

The New York Zoölogical Society is also actively interested in the preservation of our big game. Through its generous coöperation, the Wichita Game Preserve in Oklahoma has become the permanent home of a herd of buffalo. The animals are confined to a suitable area by means of a strong fence, and, as the preserve is in the midst of their former range, the success of the experiment would seem to be assured. Under what appear to be ideal conditions, the herd is likely to increase notably, so that in time it will be possible, if desired, to stock other reserves from the surplus.

13 BIRD RESERVATIONS

The theory of the bird reservation is nearly akin to that of the game refuge. Formerly our coast teemed with bird life, which consisted not only of migrants from the far north, but of summer residents, which found the rocky and sandy islets of our shores a very birds' paradise. The rage for hat birds changed all this and converted most of the former bird resorts into solitudes, so far as bird life is concerned. By setting aside here and there an island of no particular use for other purposes, the government has established nurseries and winter resorts where sea birds undisturbed may rear their young and find shelter. The plan has the energetic coöperation of the National Audubon Society, which has established island reserves of its own, and whose good work in this and other fields cannot be too highly extolled. The results attained are exceedingly satisfactory, and thousands of gulls, terns, pelicans, and other sea birds are reared each year in these bird resorts. Pelican Island is likely to become one of the sights of Florida, and already many tourists have sought permission to visit

ELK IN DEEP SNOW, YELLOWSTONE PARK

Photo by F. J. Haynes

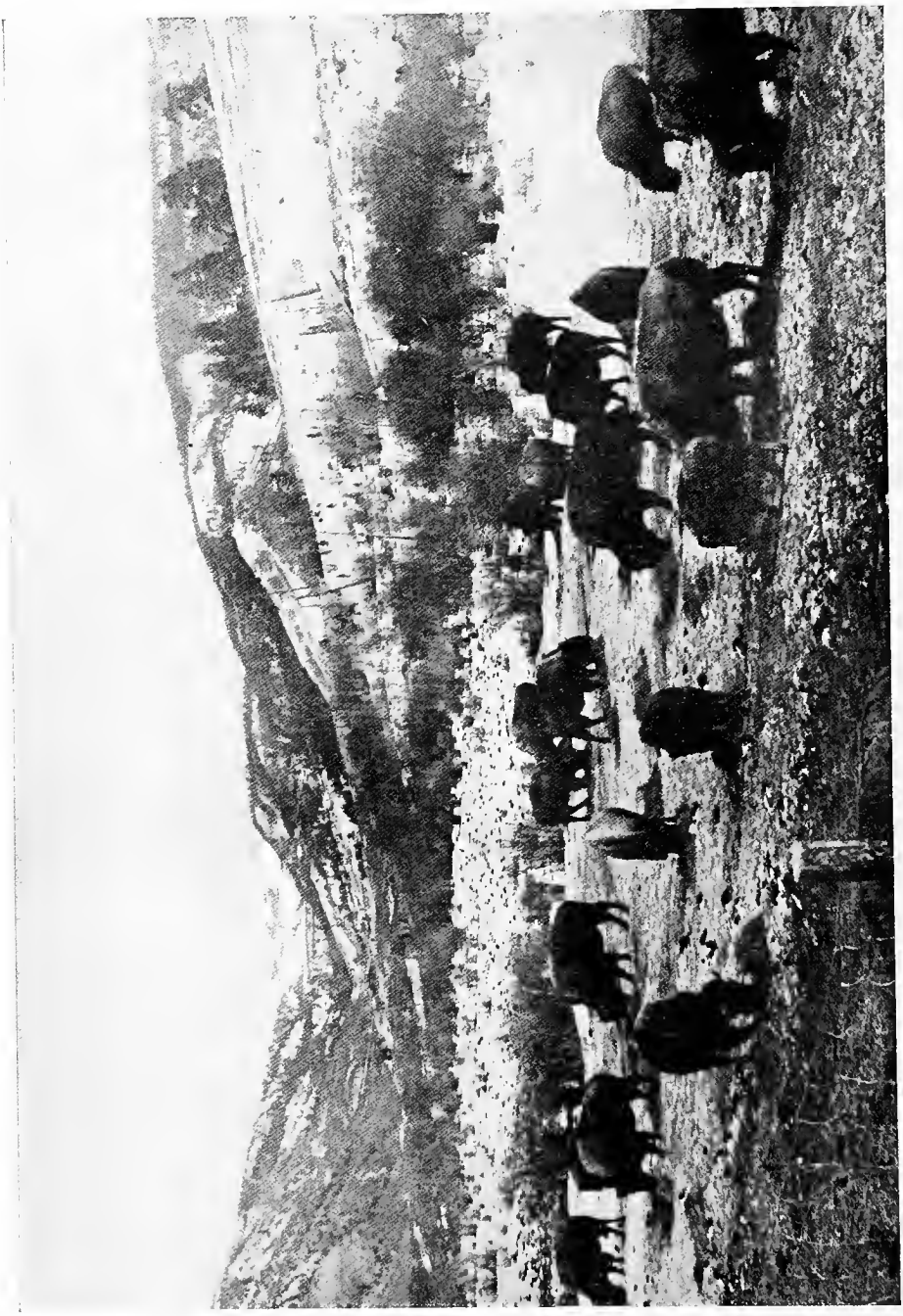


Photo by F. J. Haynes

BUFFALO IN YELLOWSTONE PARK

TWIN BLACK BEAR CUBS—YELLOWSTONE PARK

Photo by F. J. Haynes

ROYAL TERNS BREEDING ON BATTLEDORE ISLAND, COAST OF LOUISIANA—AUDUBON RESERVATION

Photo by Frank Miller, July, 1907

Photo by F. M. Chapman

A BROWN PELICAN COLONY, PELICAN ISLAND RESERVATION, FLORIDA

Photo by Finley and Bohlman

CALIFORNIA MURRES ON THREE ARCH ROCKS, OFF THE OREGON COAST

One of the reservations recently made by order of the President to protect the breeding grounds of sea fowls

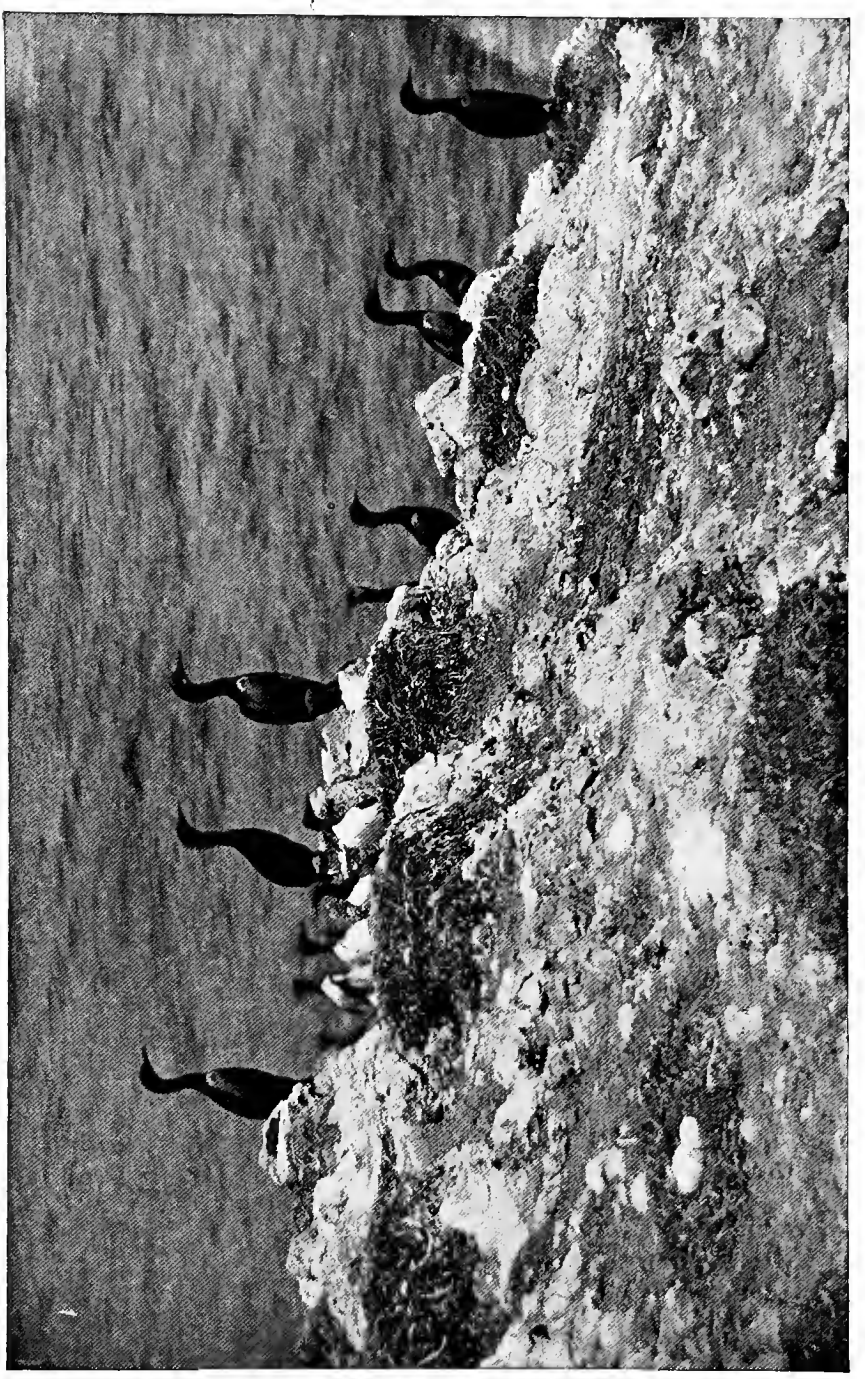


Photo by Finley and Bohlman

CORMORANTS NESTING ON THREE ARCH ROCKS BIRD RESERVATION, COAST OF OREGON

Photo by D. Lange

YOUNG CORMORANTS, DEVIL'S LAKE, NORTH DAKOTA

it to view the ungainly but interesting birds attending to their domestic duties.

As a final result of the establishment of bird refuges, there is every reason to believe not only that these island bird colonies will be maintained intact, but that in time the birds will so multiply as to restock other islands not under the control of specially appointed wardens. Thus far 13 reservations have been set apart by the Government: Breton Island, Louisiana; Pelican Island, Passage Key, and Indian Key, Florida; Stump Lake, North Dakota; Huron Islands, off the south shore of Lake Superior, Michigan; Siskiwit Islands, south of Isle Royale, Lake Superior; and a series of islands off the coast of Oregon and Washington.

PROTECTION OF GAME IN ALASKA

The big game of the world is fast being killed off. Nowadays no region is too wild or remote to attract the sportsman and the trophy hunter. Those who read the accounts of the African explorers of scarcely more than a generation ago never dreamed that in a short time the vast herds of wild game over the greater part of that continent would be a thing of the past. Alaska has now become the Mecca toward which the eyes of sportsmen are longingly turned, and were all restrictions on the export of trophies from that territory removed, a very short period would suffice to see the end of several notable game animals. The Kenai Peninsula contains the largest of the deer tribe in the world, the big Kenai moose, and horns of one of these animals, which sometimes spread 74 inches or more, command fabulous prices. Other Alaska game animals are greatly prized by sportsmen for trophies.

In a territory so remote from supplies as Alaska, game possesses more than ordinary value to its inhabitants, and the primary purpose of the Alaska game law was to preserve the game for the use of the people, both natives and white. To provide for emergencies, a special clause in the present law allows Indians, Eskimos, miners, and explorers, when in need of food or clothing, to kill game for their immediate use. Prior to the passage of the law, so many deer were killed for their hides as to threaten the extinction of these animals within accessible territory.

The law has been thought by many too drastic, and has caused much dissatisfaction.

A bill was introduced in the 59th Congress, and passed the House, which materially modifies the present law and is very liberal with regard to the shipment of trophies. It provides, among other things, for the issuing of licenses to hunt and to export a limited number of trophies and for the employment of game wardens and guides. Should this bill become a law, many of the present causes of complaint on the part of sportsmen and residents of Alaska will be removed.

THE LACEY ACT

The so-called Lacey act, approved May 25, 1900, marked a long and important step forward in the cause of bird and game protection. Prior to its passage the several states attempted in vain to prohibit the shipment of game beyond their boundaries. Game was forwarded to other states and sold in distant markets, without respect to season, under the plea that by such shipment it had become an article of interstate commerce and hence was beyond the jurisdiction of the state where offered for sale. All this was changed by the Lacey act, which struck at the root of the evil by prohibiting the shipment from any state of birds killed in violation of local laws, and placed imported game on the same footing as birds or animals produced within the state where the game was sold.

This act confers upon the Department of Agriculture important powers also in relation to the importation of foreign birds and animals, which prior to its passage was without check. It specifically prohibits the introduction of certain species, such as the English sparrow, starling, flying-fox, mongoose, and such others as may be declared injurious to agriculture; for with the growth of our

commerce the danger of the introduction of noxious birds, mammals, and insects is ever present. To prevent the introduction of birds and mammals likely to become pests is one of the special duties of the Biological Survey.

GUARDING AGAINST DANGEROUS IMPORTATIONS

The English sparrow serves as an ever-ready example of the disastrous consequences of the unwise introduction of a species into a new home. Under the present law and system of inspection, this pest could never have obtained a foothold in America, since so well known were the bird's habits in its native land that its disastrous career on this continent would have been foreseen and its entry prohibited.

Under the mistaken idea that the mongoose would prove beneficial by devoting itself to the destruction of small rodents, and ignorant of the fact that the animal is omnivorous and one of the most destructive creatures in existence, more than one attempt has been made to import it into the United States, where its successful introduction would prove nothing less than a national calamity.

Attempts to bring in numerous noxious birds and beasts have been frustrated only by the vigilance of the inspectors. It is, however, necessary to guard not only against intentional importation of noxious species from mistaken philanthropic motives, but unintentional ones; and when it is understood that under the 433 permits issued last year for the entry of foreign birds and animals were included 274,914 canaries, 47,383 miscellaneous birds, and 654 mammals, it will be seen that mistakes of identity by importers might easily be made, and that under the guise of innocent species noxious ones might find entrance. Every shipment of birds or beasts, therefore, is carefully scanned by expert agents, who seize upon noxious species and prevent their entry into the country by compelling their destruction or their return to the port of shipment. The Lacey act is not intended to restrict legitimate trade or work undue hardship on importers. In the great majority of cases it can be enforced so as to cause only slight delay and yet prevent the entry of species which may become pests.

As will appear from this short sketch, the work of the Biological Survey is eminently practical in its nature and intent. Beginning with investigations of the food habits of a few of our most important birds, the scope of its work has widened until it involves the study of all our birds and mammals in their manifold relations to man. The essential objects of this branch of the work are to show from a basis of ascertained fact the particular species that are beneficial and those that are injurious, and to indicate the best methods of preserving the one class and of destroying the other. Incidental to its main object, it endeavors to collect and to supply to those interested all available information relative to the distribution and abundance of our game and of our birds and mammals. Its list of publications is already a long one. Many of its reports are purely practical, intended for the information and guidance of the farmer; others are more strictly scientific and are designed to serve educational purposes.

Strange as it may seem, the United States, one of the youngest of the world's powers, is a pioneer in the kind of economic work outlined in the present paper. European countries, however, are now recognizing the immense importance to agriculture of such investigations and their absolute necessity as the basis for national and international laws.

As the world's population increases and as vast regions of land now wild and uncultivated are brought under the plow, so must investigations of the kind entrusted by Congress to the Biological Survey ever assume more and more importance.

THE EAGLE, KING OF BIRDS, AND HIS KIN

By Alexander Wetmore

Assistant Secretary, Smithsonian Institution

With Paintings from Life by Maj. Allan Brooks

The Geographic presents in this issue the fifth of a series of paintings descriptive of all important families of birds of North America. The first (Humming Birds, Swifts, and Goatsuckers) appeared in July, 1932; the second (Ibises, Herons, and Flamingos) in October, 1932; the third (Crows, Magpies, and Jays) in January, 1933, and the fourth (Woodpeckers) in April, 1933. The sixth of this series will be published in an early number of the National Geographic Magazine.—Editor.

THE eagle, symbol of bold strength and courageous character, has been used so widely as an emblem of power that, by name and by effigy, birds of the group to which it belongs are known familiarly to many who have little experience or conception of them in life.

Eagles and their many relatives among the hawks and vultures are distributed throughout the world, except over the open seas, the barren Antarctic Continent, and the smallest and most isolated of oceanic islands. Wherever found, they appeal even to the novice in knowledge of things outdoors because of their manner of life and predatory habits. Robust of form and strong in flight, they are remarked at every appearance.

The emblem of the Sumerian city of Lagash, in the third millennium before the Christian Era, was an eagle, which was engraved on the tablets and seals of the leaders and was carried as a military standard by the army. An eagle also appeared on the seal of the King of Ur, and continued in double-headed form in Hittite art, on certain coins of the Mohammedans, on the flags of Turkoman princes, and so on into modern times.

The eagle symbol is probably derived from forms similar to our golden eagle or closely allied to that species, as several species of that type are found in the regions mentioned.

To early Greeks the eagle was the messenger of Zeus and the only bird that dwelt in heaven—a fancy based, perhaps, on the high-flying powers of these birds. A silver eagle standing on a spear was placed on the military standards of the legions of Rome, and this emblem has been used widely as a conventional badge of military power. To-day it is a common decoration on flagstaffs in many countries.

An American species of this group, the bald eagle, is found in the design of the coat of arms of the United States, which appears on the Great Seal. A representation of it is blazoned on many of our coins and decorations. It also appears on the President's flag, and on the President's seal in the bronze plate on the floor of the vestibule of the White House.

The fierce harpy eagle (*Harpia harpyja*), a bird of dauntless courage, called by the Aztecs "the winged wolf," is engraved on the official coat of arms and seal of Mexico and appears on the flag of that country. It is distinguishable from our species by its prominently crested head.

CONDOR APPEARS ON COATS OF ARMS

The great condor of South America figures in the coats of arms of Colombia, Bolivia, Ecuador, and Chile.

The eagles and their kin form the group of birds of the order Falconiformes, which includes about 288 distinct species, with many additional geographic races, so that in all there are recognized somewhat more than 700 living forms. The order is divided into four principal families.

The eagles, hawks, kites, and their relatives, forming the family Accipitridae (Plates III through XIII), include the largest number of forms. They are mainly birds of medium to large size, with broad wings, strong legs, feet armed with sharp claws, and strongly hooked bills. Many possess light-colored eyes, which, with their active interest in any movement that might indicate possible prey, give them a fierce and aggressive appearance.

Although many have rapid flight, others are slower and more sluggish in habit. Most of them delight in soaring in great

Photograph by David T. Griggs

YOUNG EAGLES TAKE OFF FROM THEIR NEST IN ALASKA

In three years these birds will perfect their plumage and they may live to be centenarians. Eagles are not popular with Alaska fishermen, for they take heavy toll of the salmon going up streams to spawn.

circles high above the earth, where they are conspicuous and are visible for long distances. Some of the species of this family are among the largest of flying birds.

FALCONS CAPABLE OF SWIFT FLIGHT

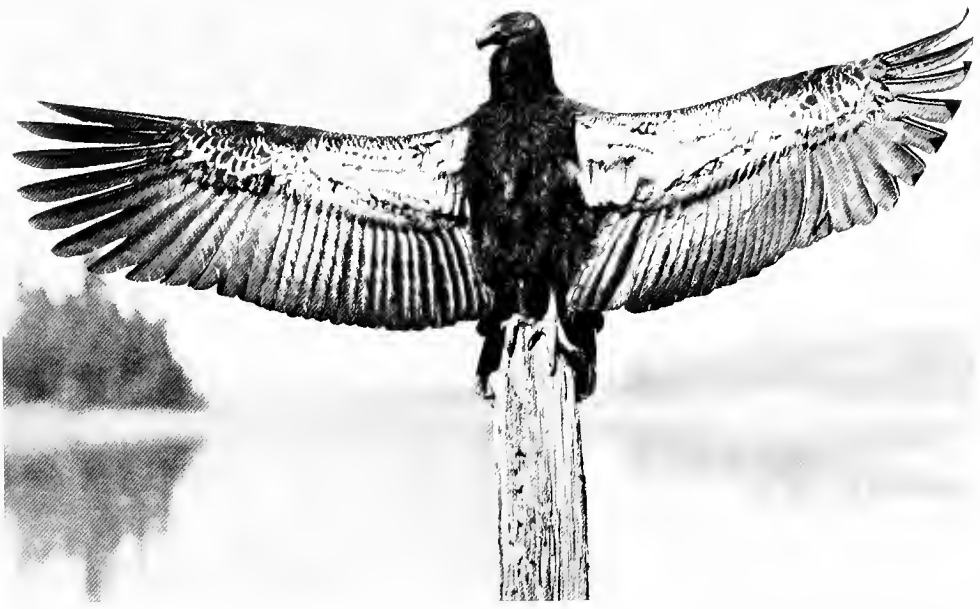
The falcons, with their relatives the caracaras, the family Falconidae (Plates XIV, XV, XVI), in general are smaller in size than the members of the other group of hawks, and have longer, more pointed wings, which give them swifter flight that may be maintained at high speed for long distances.

Though some, such as the chimangos, or carrion hawks, and the caracaras, may be in part carrion feeders, the majority, the true falcons, are fiercely predatory hunters, in the true sense of the word, whose appearance strikes terror among other birds. The bill of the falcons, sharply pointed at the tip, has a projecting tooth on the margin that is of assistance in tearing their food.

The New World vultures, family Cathartidae (Plates I and II), although hawklike in form of body and spread of wings, have relatively weak legs and feet which are not used to seize or carry prey. Their beaks, though strong, are not prominently hooked, and except for their flying muscles these birds are far less powerful than their relatives.

These are the scavengers among birds, for whom no food is too repulsive, that spend their days in scanning the surface of the earth for dead creatures on which they may feast. They are confined to the Americas, the carrion-eating vultures of other lands belonging to the Accipitridae.

The secretary bird, the only living species in the fourth family, Sagittariidae, one of the most remarkable birds of the entire order, stands nearly four feet high, having long, slender legs like those of a heron. Though it has strong wings, it ordinarily runs on the ground, traveling at need with great swiftness. It is found only in Africa, from the Anglo-Egyptian Sudan and Senegambia to Cape of Good Hope Province. It feeds on snakes, lizards, and various other animals, often killing them by stamping on them with its feet.



Photograph by William L. Finley

A FULL-GROWN CALIFORNIA CONDOR ENJOYS A SUN BATH

He differs from the South American members in dress, but not appreciably in size. His head and neck are much more colorful and there is no caruncle. The tremendous wing spread here shown gives this bird marvelous powers of flight.

The most aberrant types in the entire order are the American vultures, which are far removed from the hawks and eagles and in some ways have peculiarities that set them off from most other birds.

Aside from the peculiar types just mentioned, the various species of this order are fairly uniform in build and form, differing principally in length of legs, grasping power of claws, and size and degree of robustness of bill. Thus, the bill of the eagle is strong and heavy, but that of the everglade kite is extremely slender and elongated.

The bateleur eagle (*Terathopius ecaudatus*) has the tail so short that it does not project beyond the wings—an anomaly in a group that as a whole has long, strong tail feathers. In spite of this peculiarity, the bateleur sails with ease, using its wings as planes, though it is said to have difficulty in keeping aloft when there are no wind or air currents to assist it.

One of the striking phenomena of some of our American hawks has been the fall migrations, in which hundreds, or even thousands, move together in southward flight. Years ago, in eastern Kansas, in the pleasant weather of October, it was usual to encounter flights of red-tailed and American rough-legged hawks, in which these splendid birds drifted steadily across the sky for hours in never-ending procession. Occasionally, attracted by rising currents of air over some hill slope, they paused to wheel in enormous spirals.

MIGRATION OF SOME HAWKS SPECTACULAR

Often I lay on soft grass, in the warm sun, watching several hundred of these hawks turning slowly through the sky, some at such an elevation that they looked no larger than swallows. On occasion I have seen similar flights of the Swainson's hawk of the western Plains, these birds traveling in bands on migrations that carry them far into South America.

The migration flights of the sharp-shinned and Cooper's hawks in the East are better known, though they are seen only in favored localities. Point Pelee, which projects as a long peninsula from the Canadian shore of Lake Erie, for many years has been famous for its hawk

Photograph from C. M. Wagner and W. Boesser

NEW JERSEY OSPREYS MADE WISE CHOICE OF HOME SITE

From their nest in an old telephone pole in Middlesex County the birds have a clear and unobstructed view of the surrounding country and easily may detect the approach of an enemy.

flights. In October, 1931, in the course of a few hours, I saw there several hundred sharp-shins drifting down with the north wind, alternately flapping their wings and sailing with pinions outstretched, passing without pause out over the waters of the lake toward the distant American shore.

While there were never many in sight at one time, they passed at intervals of two or three minutes in a steadily moving stream. Elsewhere in the fall I have observed Cooper's and sharp-shinned hawks scattered over the entire sky, moving steadily toward the south. These flights of hawks are most marked in fall, for in spring the birds seem to travel northward over wider areas.

At a number of places it is regular practice to shoot these birds for sport, and many thousands have been killed in this manner. Occasionally, as near Cape May, New Jersey, they are used for food.

The different species of the hawk group vary widely in the extent of their migrations. Some, such as Swainson's hawk, make journeys that carry them from the western Plains south into Argentina, while others, such as the sparrow hawk, may be quite sedentary except in the northern sections of their range.

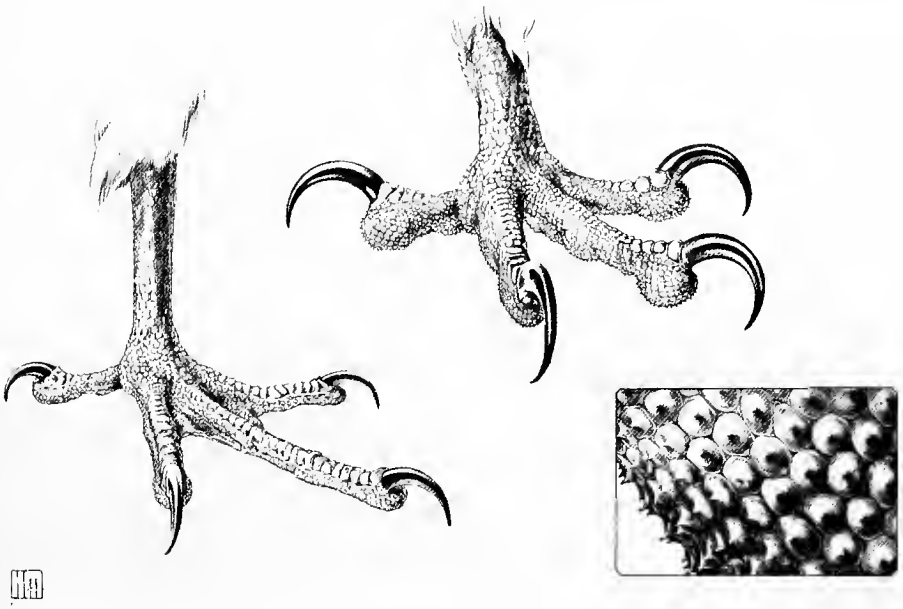
In general, birds of this group withdraw at least in part from the extreme northern areas that they inhabit, probably because food becomes scarce and difficult to obtain. The gyrfalcons, however, are typically northern, never coming far south, and rough-legged and allied hawks course over the northern plains in the greatest extremes of cold weather.

FLIGHT METHODS VARY

Flight in the hawklike birds varies considerably, according to the kind. Eagles, the large hawks, and the vultures, both of the New and Old Worlds, have broad wings which they flap slowly. Frequently they soar with set wings, utilizing air currents rising from the heated surface of the earth, or currents generated by winds. These birds frequently soar for hours with scarcely a wing beat, turning and wheeling in the sky, often at such

COASTING HOME

The American osprey is a strong and graceful flyer. When about to land at the nest he sets his wings and coasts in (see "The Nest Life of the Osprey," by Capt. C. W. R. Knight, in the NATIONAL GEOGRAPHIC MAGAZINE for August, 1932).



Drawing by Hashime Murayama

TWO TYPES OF FEET FOUND IN THE HAWKLIKE BIRDS

The foot of the osprey, at right, illustrates the development for grasping and holding, characteristic of the predatory forms of falcons and hawks. The foot of the turkey vulture, at left, is a weaker type, fitted for walking and perching and not for seizing living prey. The inset shows an enlarged view, magnified four times, of the spines on the foot pads of the osprey, which enable it to hold slippery fish, an arrangement found only in this species.

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TRIBESMEN OF RUSSIAN CENTRAL ASIA SET OFF FOR A DAY'S SPORT WITH THEIR HUNTING EAGLES

Photograph by Capt. Collingwood Ingram

A REMINDER OF THE DAYS WHEN HAWKING WAS THE SPORT OF KINGS

Very few practice the sport now, but in medieval days it was an aristocratic pastime, with more than one royal devotee. The falcon has just dispatched its quarry on Salisbury Plain, England.

altitudes that they appear as mere specks against the blue

The turkey vulture is a well-known species that is particularly adept in this art. In fact, it finds this method of progression so adapted to its needs that frequently it remains in its roost through the day when the air is heavy and still.

The falcons have longer, more pointed wings, that enable them to fly with great speed, and, though they may enjoy soaring, they do not practice this so constantly as the other hawks. The larger species can capture the swiftest-flying sandpipers and ducks on the wing without the slightest difficulty.

Photograph by W. L. Finley and H. T. Bohlman

ALMOST READY TO LEAVE HOME

This young golden eagle is about ready to fare forth from the eyrie, which has been his home for two months, and start learning how to make a living for himself out in the world. His parents are stern but effective teachers, and when they finally drive him away he will be well versed in the lore of the wild.

THE DUCK HAWK IS A DESPOT OF THE AIR

The flight of the duck hawk, perhaps the best known of the falcons, is truly exhilarating to watch, as it is executed with a dash and vigor that mark it from that of all other birds. On the Bear River marshes, at the northern end of Great Salt Lake, in Utah, I have spent many hours in observing this falcon, both in its hunting and when at play.

The birds at rest perched in low willows, or on logs or bits of drift, where they had clear view of the teeming bird life about them. When hungry, they dashed across the open flats at high speed, striking ruthlessly at any birds that appeared, from small sandpipers to large ducks.

Their appearance in the air was always the signal for chattering cries of alarm from blackbirds and avocets that put all their bird neighbors on the watch. These warnings had little effect, however, as the duck hawk, killing practically at will, was truly despot of this realm.

I have seen this falcon dash through closely massed flocks of flying sandpipers, striking out two or three with as many thrusts of the claws, allowing each bird to drop and then wheeling swiftly to seize the falling prey in mid-air before it reached the ground. Again, I have seen one in a stoop, swift almost as light, knock a redhead duck to the ground, where it landed with a broken wing and other injuries.

Photograph by Dr. A. A. Allen

SWALLOW-TAILED KITES SOAR AND CIRCLE ALOFT WITH BUOYANT GRACE

So well provided with wing and tail surface are these larger prototypes of the barn swallows that they spend nearly all of their time in the air. They even feed in the air, often on small water snakes, which they deftly snatch from among the reeds and devour aloft.

On one occasion a pair of duck hawks harried a helpless nighthawk, stooping at it playfully until one in passing gave it a quick squeeze with one foot. It then allowed the nighthawk to fall, when it was seized by the other duck hawk. Then the pair flew away, and the one with the booty at intervals dropped it, so that it could be seized in air by its mate.

THE DUCK HAWK A PRACTICAL JOKER

When not hungry, the duck hawk, feeling its superior strength, frequently indulges in harmless play at the expense of its bird neighbors.

Often I have seen them flying along the river channels, driving ahead of them a motley flock of blackbirds, herons, avocets, and other birds, herding them in disorder like sheep, but without offering to harm them. Again, as night herons flew ahead of my launch, a duck hawk would dart at them repeatedly, forcing them down lower and lower, until finally, with protesting squawks, they struck the water. They were not allowed to rise, but had to swim into the shelter of the willows to escape.

One pleasant afternoon in fall I heard a great roaring of wings overhead and looked up to see a cormorant that a few minutes before had been soaring peacefully high in air, dashing down with set wings toward the river, with a duck hawk a few feet behind. Just above the water the hawk suddenly accelerated, tapped the cormorant lightly on the back, then circled easily away, while the frightened quarry took refuge unharmed in the water. Frequently falcons at play dashed at top speed through milling flocks of flying sandpipers, scattering them like leaves in the wind, but not striking any of them.

The food of birds of the hawk group is highly varied, though it is taken entirely from the animal kingdom. The larger species of falcons subsist mainly on various kinds of birds and small mammals, but the smaller kinds, such as sparrow hawks and falconets, eat lizards, grasshoppers and other insects, and mice. The common red-tailed hawks and their allies, known universally as "chicken hawks," may on occasion eat birds or even visit hen-yards for prey, but confine their attention prin-

Photograph by Dr. A. A. Allen

LOOKING OUT ON THE WORLD FROM A MOSSY NEST

Mr. and Mrs. Kite, of the swallow-tailed kites, built their home in the top of a tall tree near a watercourse. Dry twigs, sticks, hay, and moss were used. The birds of this family breed over a wide range of territory and incubation may start any time from March to June.

cipally to mice and rats Therefore, they are in the main beneficial, as they destroy large numbers of rodents that are injurious to crops and orchards.

VULTURES AS "BONE-BREAKERS"

The bearded vultures of the Old World are said to carry turtles and large bones from the carcasses of dead animals to a great height, in order to drop them on rocks, where they break open so that the bird can eat the marrow. From this habit the Spanish call these birds *quebrantahuesos,* signifying "bone-breakers." The ancient naturalist Pliny relates that the Greek poet Æschylus (who died 456 B.C.) met untimely death when one of these vultures, mistaking his bald head for a stone, dropped a tortoise on it from the air!

Some species of hawks, particularly certain forms that range in the Tropics, eat snakes as their principal food. There is one group of species found in India and adjacent regions in which this habit is so constant that the birds are known as "serpent eagles." The osprey and some of the sea eagles confine their attention mainly to fish, which they capture alive by plunging after them as they approach the surface of the water.

As their name implies, the peculiar bat-eating hawks (*Machaerhamphus alcinus*) from the East Indies and Africa feed on bats. Since these hawks capture their prey on the wing, they are abroad in the evening and early morning, being at least partly nocturnal in habit. The honey buzzards of the Old World (*Pernis*) are fond of honey and of the immature stages of bees.

Swainson's hawk, a bird of large size, feeds extensively on grasshoppers, the broad-winged hawk is fond of frogs, the everglade kite subsists on large fresh-water snails, and the powerful harpy eagle feeds regularly on monkeys.

Possibly the strangest food in the group is the repulsive carrion eaten by the vultures. These birds spend the daylight hours soaring in the air, while they scan the earth below them in search of dead animals that may supply food. Small animals, dead fish, and birds are bolted entire or are torn into suitable fragments. The

Photograph by American Colony, Jerusalem

A BEDOUIN OF TRANS-JORDAN WITH HIS HUNTING FALCON

skin on large carcasses may resist the bills of the scavengers until softened by putrefaction, when the birds gorge on a meal of the utmost repulsiveness (see page 56).

While we may turn in physical revulsion from contemplation of this habit, we may ponder on the adaptations that seemingly give these birds absolute immunity to the poisons, generated in decaying flesh, that would destroy any creature of ordinary digestion.

The bird-eating hawks pluck most of the feathers from their prey and then tear the flesh into bits that may be swallowed. Mice are often swallowed whole, but rabbits and mammals of similar size may be partly skinned and the feet may be discarded.

The food passes down into a stomach that is thin-walled and capable of considerable distention, and in the throat there is developed a distensible crop that holds a large amount of food until the stomach is ready to receive it.

Bones, feathers, fur, and other hard elements that cannot be digested are formed into pellets and regurgitated to leave the stomach empty for another meal. These pellets accumulate beneath favored perches and offer a valuable index to the food preferences of these birds. Hawks, falcons, and eagles carry food in their talons to their young in the nest, but vultures, which do not have powerful feet and legs, feed their young by regurgitating the contents of the stomach.

Whether the carrion-feeding vultures locate the carcasses on which they feed through sight or through the sense of smell has been a subject of much controversy among naturalists, and, in spite of many observations on these abundant birds, it is far from being a settled question.

VULTURES POSSESS KEEN SIGHT

One group of observers contends that, as these birds soar back and forth through rising currents of air or against the wind, sometimes at high and sometimes at low elevations, they encounter the odor from carrion and follow this scent to its source. Others believe that in their flight the piercing eyesight of these birds brings to view possible sources of sustenance, and that vision accounts for the facility with which vultures locate their food.

AFTER FIVE WEEKS IN THE NEST, YOUNG DUCK HAWKS TEST THEIR WINGS

As soon as feathers began to develop, the young birds flapped their wings vigorously, often tipping themselves over in the process and sending bits of down flying in all directions. This nest is near Hanover, New Hampshire.

Photographs by C. A. Proctor and B. B. Leavitt

STANDING GUARD NEAR HIS NEST

Duck hawks are strong and courageous, and this one, having just alighted on the nesting shelf, seems to be challenging anyone or anything to try conclusions with him. The duck hawks are the nearest American relatives of the peregrine falcons, famous hunters of the Old World.

Photograph by George Shiras, 3d

A DUCK HAWK FINDS HIS PREY A WOODEN DECOY: SANDUSKY BAY, OHIO

The hunting method usually pursued by these birds is to rise in spirals until directly above the victim, and then to drop swiftly upon it. However, they are fast flyers and are capable of catching other birds in direct chase.

Photograph by C. A. Proctor and B. B. Leavitt

LUNCH TIME IN A DUCK-HAWK NEST NEAR HANOVER, NEW HAMPSHIRE

The fifteen-day-old youngsters have been expressing their appetites vocally and their complaints are at last producing results. The menu consisted entirely of birds, and, when the victim was small, only wing and tail feathers were wasted.
projecting from the bill of one of the chicks.

Photograph by Dr. A. A. Allen

A PAIR OF DUCK HAWKS HAVE CHOSEN FOR THEIR NESTING PLACE A HIGH AND SECLUDED LEDGE NEAR PAUGHANNOCK FALLS, NEW YORK STATE

The eggs were laid on the shelf of rock in the lower left foreground, where the young birds may be seen. One of their parents keeps a watchful eye out to see that no danger threatens them. The falls are 215 feet high, which is higher than Niagara Falls.

In warm weather, proponents of the scent theory have concealed bodies of animals so that they could not be seen, and claim that in a short time, as the carcasses became odoriferous, turkey vultures gathered. Even though the carrion was so concealed in buildings or under other cover that the birds could not get at it, they remained on hand, attracted by the odors, in the attempt to locate this potential food supply. Experiments dealing with this matter began in the days of Audubon and have been continued by other naturalists until the present day.

There is not the slightest question but that the turkey vulture will find food that is concealed in such a way as to be entirely invisible to a bird overhead, even though such a bird may be only a few feet distant. However, in most alleged instances of location by scent, keen sight has probably played some part.

That the turkey vulture is an observant creature, with keen perception where food is concerned, is obvious if one watches it a little, though there may be doubt as to the extent of its intelligence in other respects. These birds regularly patrol beaches to obtain dead fish, and recently have learned to watch the modern hard-surfaced roads, where speeding automobiles are constantly killing small birds, snakes, rabbits, cats, and other animals.

Also, they seem to know that the

Photograph by Alice Schalek

UNOFFICIAL HEALTH OFFICERS KEEP THE BEACH CLEAN AT SANTOS, BRAZIL

These carrion-eating vultures dispose of carcasses quickly and efficiently and the law forbids anyone to shoot them. The picture shows a group of the birds at their highly essential work.

movements of men through the country will bear scrutiny, as frequently men leave behind them food in the form of animals killed, or offal from large bodies that have been butchered.

To test this, it is necessary only to sit on the open ground while skinning a rabbit or some large bird, and if you are in a region where turkey buzzards are common, it will be only a few moments until one or two are wheeling overhead. If there is promise of food, they remain; if not, they continue their search elsewhere.

In South America yellow-headed buzzards (*Cathartes urubitinga*) have followed me into woodland where I was seated on the ground entirely concealed and engaged in examining birds that I had killed for specimens. The buzzards alighted a few feet away to watch me curiously. I have had buzzards come to eat the flesh from carcasses of their own kind which I had skinned where I had shot the birds. Possibly this was unintentional cannibalism, as there was nothing about the bodies to distinguish them from the skinned bodies of any other birds.

There can be no doubt that the buzzard has learned to watch the actions of dogs whose activities may indicate the presence of carrion concealed in caves or holes. There is also the probability that the presence of buzzing flesh flies that breed in carrion may be an indication to the buzzard of a concealed food supply. Therefore, admitting that the turkey buzzard has a well-developed olfactory nerve, and thus might be expected to have some sense of smell, to me present evidence indicates that it finds its food mainly, if not entirely, through its acute sense of sight.

MAN'S HAND IS AGAINST THE HAWK TRIBE

The hand of civilized man has been raised universally against the hawk tribe, and birds of this group are shot or otherwise destroyed at every opportunity. It is rare, indeed, for hawks to come within gun range of a hunter without receiving a charge of shot, and they are killed in many localities by setting steel traps on the tops of posts or poles that the birds utilize as perches.

In England it is the duty of gamekeepers to kill all "vermin" that appear on the property under their charge, hawks being included in this category. On a large estate near the Thames I once saw a "keeper's larder" where, near a frequented path, the gamekeeper had hung up his kills for display. These included the drying skeletons of sparrow hawks (a species related to the American sharp-shinned hawk), kestrels (allied to the American sparrow hawk), magpies, and jays, with a few small predatory mammals.

Belief in the destructiveness of hawks is almost universal. In most minds there is no distinction between hawks that habitually prey on birds and may destroy a certain amount of game, and the sluggish, heavy-flying species that feed consistently on wild mice and other destructive rodents, and so are beneficial to man.

The game commissions of many States have offered bounties for the heads of hawks and have expended hundreds of thousands of dollars in the destruction of untold thousands of them. The result is that in the eastern half of the United States these birds have decreased to less than a tenth of their former abundance.

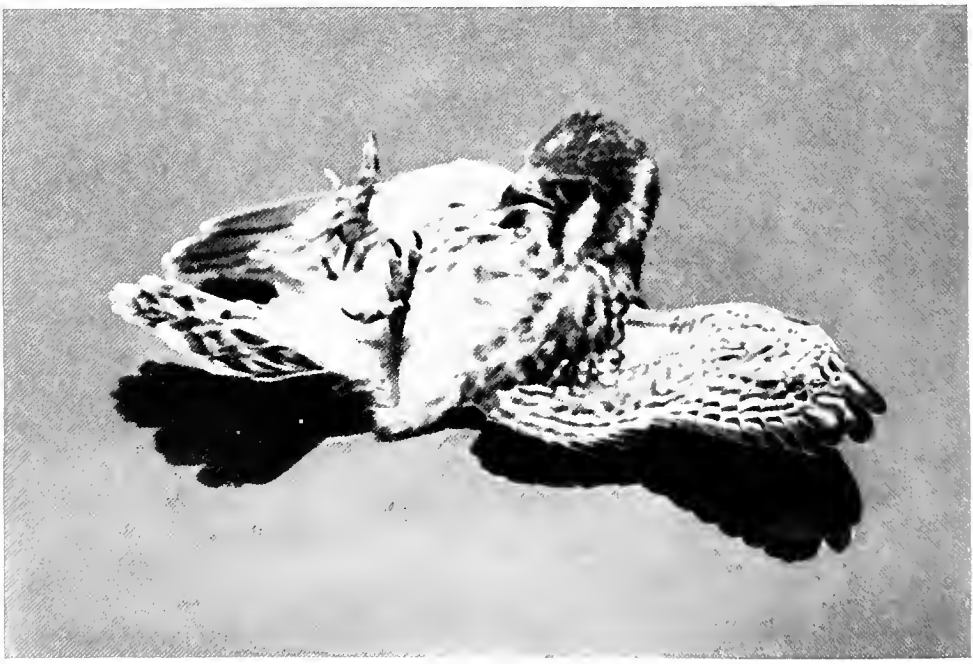
Since the decrease has affected the beneficial kinds even more heavily than those that are classed as injurious, there has been an increase in destructive rodents formerly held in check by hawks, with the result that these animals have done severe damage to agricultural interests.

The Cooper's hawk and the goshawk are the principal species that are destructive to game, with the marsh hawk to be added in certain localities where pheasants and other game birds that range in the open are concerned. It may be permissible to keep these hawks in check, and to include among those to be killed the occasional individual of the red-tailed hawk or other species that acquires the habit of coming to the farmyard for chickens. There is, however, no excuse whatever for the widespread slaughter of all kinds of hawks that has been the fate of these birds for years.

Sportsmen have justified the indiscriminate killing of hawks on the ground that they were conserving game; in other words, with the excuse that they were providing more game for men to kill. Nowadays, with nature lovers, who do not hunt, equaling sportsmen in numbers, some consideration may be given to the rights of those who enjoy seeing hawks alive and studying their interesting ways, aside from the value that most of these birds have from their beneficial food habits.

Photograph by William L. and Irene Finley

WEIGHING FROM 20 TO 25 POUNDS, THIS OLD CONDOR HAD TO BACK-PADDLE VIGOROUSLY IN LANDING ON THE PERCH



Photograph by Dr. A. A. Allen

DOWN BUT NOT OUT

A young sparrow hawk, not at all sure of the photographer's good intentions, assumes a characteristic defensive attitude. However, despite the belligerent pose, this species is perhaps the most friendly and sociable of all the hawks. When fully grown, the bird will not measure a foot in length.

Action should be directed against the injurious individuals rather than toward the group as a whole, for the killing of most hawks is as foolish a policy as would be the wholesale destruction of any other element that contributes to our welfare.

The majestic bald eagle, our national bird, has also fallen under the displeasure of some farmers and has been rather relentlessly hunted.

Bird lovers have taken up the fight on behalf of this great bird of freedom, declaring that he has been misrepresented and that his occasional thefts of poultry are more than offset by services in keeping our beaches clean of dead fish.

Photograph by Charles Martin

A SOUTH AMERICAN CONDOR WHOSE PERMANENT RESIDENCE IS WASHINGTON, D. C.

This monarch of the Andes is one of the prime attractions in the fine collection of birds, animals, and reptiles housed in the National Zoölogical Park. The bare skin of his head, neck, and caruncle is dull red, and contrasts sharply with the white "fur" collar and dark plumage.

ABILITY OF EAGLES TO CARRY WEIGHT EXAGGERATED

The carrying or lifting power of hawks and eagles has been frequently exaggerated. The largest eagles can carry off young lambs and fawns, but in these the weight is not great. In observations in Montana, Cameron found that the golden eagle could bear away jack rabbits that weighed seven pounds or more. One seized and bore aloft a small cat, but dropped it quickly when the cat realized its plight and got into action.

Larger prey may be killed, but it is eaten on the spot and not carried away. Though the strongest eagles may be able to raise a weight of 10 or 12 pounds, it is doubtful whether they could carry this for more than a few feet.

The hawk tribe consists of fierce, aggressive birds, and there is widespread belief in stories of eagles attempting to carry off children. Probably such tales are based in the main on the fierce manner in which these birds often swoop at those who intrude near their nests.

In Greek mythology we read the fanciful story of Ganymede, the beautiful Phrygian shepherd boy who was carried off by an eagle to Olympus to serve as cupbearer to the gods. Also, in every mountainous country where there are eagles,

Photograph by William L. and Irene Finley

NEARLY EIGHT WEEKS OLD AND HARDLY HANDSOME

A young California condor still in the downy stage, whose feet seem to be growing faster than the rest of him.

there are current stories of the predatory attacks of these birds on children.

Possibly in primitive times, if small babies were left exposed, an eagle might have attacked them, just as it would a kid or a lamb under the same circumstances; but such a happening in the present day would be quite improbable.

In the Philippine Islands the powerful monkey-eating eagle (*Pithecophaga jefferyi*), a bird weighing from 16 to 20 pounds, is believed by the natives to attack men. R. C. McGregor was told of an instance where one of these birds, in protecting its nest, killed a Negrito; but he did not place entire credence in the story, as it came to him through hearsay.

When their nests are disturbed, falcons and other hawks swoop fiercely at the heads of intruders, and on occasion may actually strike a climber and cut him with their claws. But such attacks are usually more threatening than serious, though they are executed with a vicious dash that might well frighten the timorous.

Among the Indians of North America is a widespread belief in a "thunder bird" of huge size. The legend may be based on former wide distribution of the California condor, or possibly on the extinct condor known as *Teratornis merriami*, a huge bird whose bones are found in Ice Age fossil deposits in California and Florida.

SOME HAWKS WHISTLE, CHATTER, AND LAUGH

The voice of most hawks is a harsh sound that in many instances is as wild in tone as the fierce birds themselves. Uttered as they float on broad pinions high in air, the weird cadences of their screams seem fitting and appropriate to the spreading landscapes they survey. Some species utter piercing whistles, others chattering calls. In some the notes are quite pleasing, though none possesses what might be termed a song. The adult turkey vulture is entirely silent except for a hiss, though the young are vociferous.

The strangest notes that I have heard from birds of this group have come from the handsome laughing falcons (*Herpetotheres cachinnans*) of the American Tropics. My first experience with these

"LET ME WHISPER IN YOUR EAR"

These old condors showed great affection for each other and for their chick. Condors do not nest every year, and raise only one chick when they do.

birds was in the Argentine Chaco near the Pilcomayo River, at that time a wild region where ranchers were just beginning to invade the territory of the primitive Toba Indians.

On my first evening in this remote section, I was engaged at twilight in setting traps for little animals at the edge of a forest. I remained on the alert for any possible dangers in a country that was new to me, as many tales had been told regarding the Indians.

Suddenly, through the trees a hundred yards away, came a loud shouting sound, repeated steadily, then varied at short intervals with a series of other calls, all uttered in curiously human tones. After a minute or two, another voice joined the first, and the two called rapidly in a strange medley that left me completely puzzled as to whether the authors were bird, beast, or human, as I crouched among the bushes, gun in hand, with my skin tingling pleasantly at the thrill of the unknown in a strange and possibly dangerous land.

It was a day or two later that I traced these weird, unearthly duets to the large, white-headed, bushy-crested laughing falcons that were found everywhere through the forests.

The flight and appearance of hawks and other birds, and certain of their anatomical features, were used by the augurs of ancient Rome in their prophecies of the future.

INDIANS USE EAGLE FEATHERS AS ADORNMENT

A more practical use of these birds was found among the North American Indians, particularly of the Plains and Pueblo groups, when beautiful headdresses were made from the large feathers of the golden eagle, and other ornaments and decorations were fashioned from the smaller feathers of this bird and from the feathers of hawks. The downy bases of the eagle feathers sometimes were twisted in strands that were woven into feather blankets of a peculiar and interesting type. Hawks and eagle claws were used to make necklaces and other decorations.

The Pueblo Indians kept hawks in captivity, as they did turkeys and macaws, presumably to use their feathers in their prayers and decorations. Numbers of

bones of eagles and hawks were found in the excavations of the National Geographic Society at Pueblo Bonito. In some cases certain rooms seem to have been given up to these birds.

Occasionally hawks have been eaten for human food, but this is not a widespread practice. In Puerto Rico and Haiti I found that in some sections the natives considered the red-tailed hawk an excellent meat. The sharp-shinned hawk is eaten occasionally in the United States. From personal experience I can say that they have a fair flavor.

HAWKS USED BY MAN IN HUNTING

From the earliest times of which we have record, hawks of various kinds have been trained by man for use in hunting.*

For this purpose young hawks are taken from the nest, or adult birds are trapped alive. In either case, the birds are accustomed to man and his ways and are trained to come to be fed until they are tame and can be handled. They have the eyes covered with a soft leather hood and thongs attached to their legs, by which they may be tethered if desired. In hunting, trained hawks are taken afield until game is sighted, when the hood is removed, so that the hawk may sight the quarry.

As it flies, the hawk ordinarily maneuvers so as to rise and strike down at the game from above. In the case of wily, fast-flying birds, there is often a prolonged pursuit, in which only the most skillful hawk may hope to be victorious.

The peregrine falcon, distributed over most of the world, has been a favorite with hawkers, because it is fierce and at the same time is tractable in training. Several other falcons have been used, but to less extent.

These birds kill their prey in swift flight in air, striking a quick blow with the foot that knocks the victim end over end and frequently kills it outright. The goshawk is also used in hunting. This species kills in short, swift flight, bears its prey to the ground, and holds fast with its long claws until its quarry is dead.

Among native peoples of Central Asia, the golden eagle is trained to hunt small antelopes, foxes, and even wolves. These heavy birds are carried afield perched on horses or on stands swung between two horses. In some cases they rest on a heavy leathern gauntlet on the forearm of the hunter, whose arm is supported in a forked stick resting in the stirrup (p. 48).

Scenes depicting hunting with hawks are found among the ancient paintings in the tombs of Egypt, and this sport was well known in India, Asia, and Europe at a very early date. Practiced originally to obtain wild game for food, it finally developed into the sport of the nobility and the wealthy. Though it fell into decadence with the development of gunpowder and guns, it is even practiced to-day in a limited way, both abroad and in our own country.

Though most birds of the hawk group range from large to medium in size, there is considerable variation in this respect.

The smallest are the little falconets of the Indian region and Africa. They are not much larger than bluebirds, but are as fierce as the largest falcons. They eat many insects and also kill small birds and mammals. They have been known to kill birds four times their own weight, and are so aggressive that in captivity they often dominate other hawks much larger and stronger.

The largest members of the group are the larger vultures of the Old World and the condors of America, which reach a length of 40 to 50 inches, with a spread of wings that is broad in proportion.

The nests and eggs of hawks vary widely in location and appearance. The majority build nests of sticks and branches in trees, where they are often located at a considerable height from the ground. Some of the larger eagles and vultures nest on cliffs and rock ledges, where the sites may be reached only by the boldest of climbers.

Marsh hawks nest on the ground in prairie or marsh regions; sparrow hawks occupy holes in trees. Falcons lay their eggs in cavities in the face of cliffs, or, in some species like the hobby (*Falco subbuteo*) of Europe, occupy the abandoned nests of other hawks or of rooks and similar birds.

In some species the same nesting site is used for many years in succession. Since new material is added annually to the nest, in many cases it may grow to huge proportions. This is especially true with birds like the ospreys and eagles.

* See "Falconry, the Sport of Kings," by Louis Agassiz Fuertes, in the NATIONAL GEOGRAPHIC MAGAZINE for December, 1920.

Photograph by George E. Stone

GALÁPAGOS HAWKS HAVE NEVER LEARNED THE FEAR OF MAN

The wild life of these Ecuadoran islands has evolved in almost complete isolation, and as a result has always been tame. The confidence which hawks have reposed in the human race has often been abused, but for some reason they are still outstanding in their fearlessness. The tree is a bursera, the small leaves of which are short-lived, leaving it bare most of the time. Its bark exudes an aromatic scent when it is brushed.

The eggs of this group are moderate in size relative to the bulk of the parent, particularly when the larger species are considered. They have strong, heavy shells, usually with roughly granular surface. In some instances the eggs are plain white, bluish white, or greenish white, but in most there are markings of brown, which appear slaty where overlaid by a thin film of the calcareous shell.

The eggs of most falcons are heavily spotted with reddish brown, being among the most handsomely and richly marked known.

Many species exhibit considerable diversity in the extent and amount of markings, the eggs in some cases varying from plain white without markings to those that have the background completely obscured by a heavy wash of warm color.

CALIFORNIA CONDOR

(*Gymnogyps californianus*)

The California condor shares with the condor of South America the honor of being the largest living hawklike bird found in the New World, exceeding in size the largest of the eagles, and being much larger than its relatives, the turkey and black vultures.

Formerly quite abundant, according to recent estimate by Mr. Harry Harris, possibly ten individuals still exist in California. Little is known of them in Baja California, save that Indians hunt them for ceremonial purposes. But it is certain that few remain, and the species is one that may easily become extinct.

In days past, the California condor ranged into open valleys and other regions where it was easily accessible, but, to see it now, it is usually necessary to penetrate the wildest and most difficult mountain sections.

CONDORS ARE EASILY DISTINGUISHED

By those who penetrate its haunts, the condor is confused with no other bird. Straining eyes may examine distant eagles and turkey buzzards, but when a condor is sighted there is no mistaking it for its smaller relatives. Its enormous size and the broad sweep of its wings distinguish it almost at a glance when it is far distant. When nearer at hand it is marked by prominent white patches on the under side of the wings.

The condor uses soaring flight as consistently as does the turkey vulture, but is more a master of the air and can travel at higher speed. The birds range widely over the mountains, but seem to have certain limits within which they may be found at all seasons of the year. Several may occur together, except during the nesting season, when they separate into pairs and resent intrusion of others.

Although not ordinarily quarrelsome, it is said that, when provoked, the condor can drive the golden eagle from its haunts.

The food of the condor is composed of the flesh of dead animals, either fresh or in a state of decay. The feet are not adapted for seizing, but the birds hold down their food while they tear it apart with their strong bills. A diet of carrion would seem to be taken partly because the birds have no other choice. In captivity they are fed on fresh meat, and some individuals, when accustomed to this ration, have refused to take flesh that was at all tainted.

The size of the California condor is indicated by its wing spread, which ranges by actual measurement from 8 feet 4 inches to 9 feet 9 inches. There are numerous reports of birds with a breadth of wing in excess of the maximum given, but these seem to be based on estimate and have not been substantiated. Though many statements that attribute larger size to the South American condor have been made, authentic measurements indicate that it and the California condor are similar in size.

The California condor places its single egg on the bare surface in a recess, cave, or pothole on a rocky cliff, often in a cavern formed by leaning slabs of stone, and formerly was reported nesting in hollow tree trunks and hollow logs. The egg, found from January to March, is white with a bluish or greenish tinge, and measures about 4½ by 2½ inches, or about the size of the egg of the domestic goose.

The young when hatched are covered with white down, except for the head, which is bare. From captive individuals it appears that these birds are not adult until they are more than three years old. Young birds utter curious hissing, growling calls, but adults are silent.

The nestlings grow slowly and are under parental care for about six months before they are able to fly. They seem to have greater longevity than most birds, since three living in captivity in the National Zoological Park in Washington, D. C., are now thirty years or more old.

AGES AGO THIS MIGHTY BIRD RANGED EAST TO FLORIDA

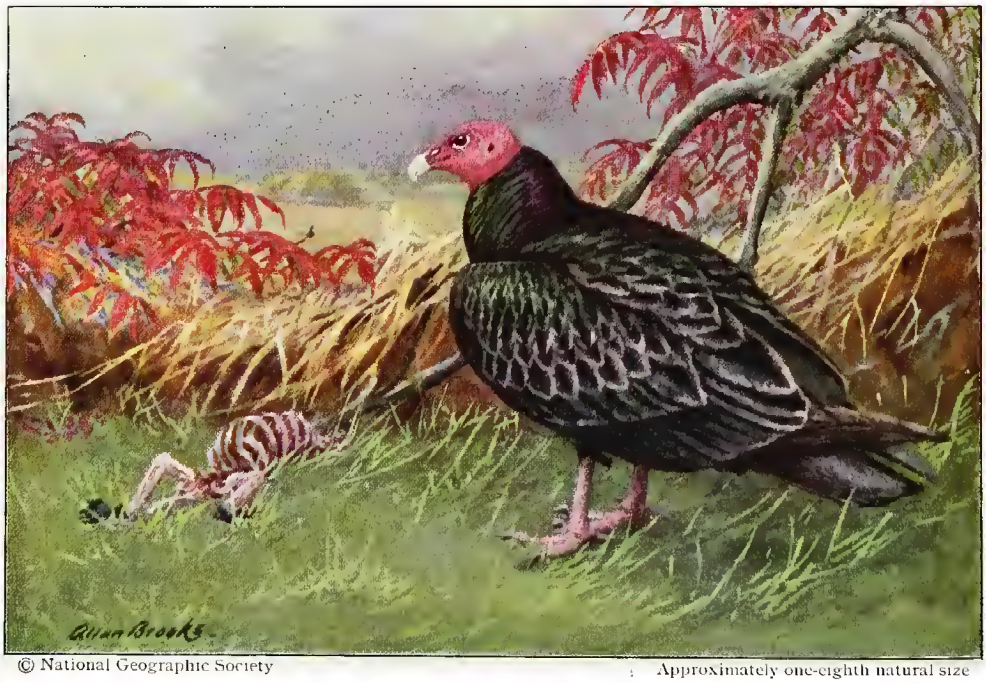
The California condor in historic times ranged from the Columbia River south along the western slopes of the Sierra Nevada, and from Humboldt County, in the same State, through the Coast Ranges into northern Baja California, extending casually into Oregon, Washington, and southeastern California.

It is now confined to the Coast Ranges in northern Ventura County, southwestern Kern County, and southeastern Santa Barbara County, and to the San Pedro Martír Range of northern Baja California. Its bones are found in ancient caves in Texas, Nevada, and New Mexico, and in Ice Age deposits in Florida.

These figures are approximately one-tenth natural size

CALIFORNIA CONDOR

Bird on perch and one flying near by, adults; upper and lower flying figures, immature



Approximately one-eighth natural size

BLACK VULTURE
Upper

TURKEY VULTURE
Lower

BLACK VULTURE

(*Coragyps atratus atratus*)

The black vulture is distinguished from the turkey buzzard, even at a distance, by its short, square-ended tail, and by the peculiar method of flight in which the wings are flapped rapidly, followed by a short sail with stiffly extended pinions. Large light patches across the ends of the wings form another prominent mark for field identification.

The black vulture subsists on carrion, and often gathers in greedy hordes that soon leave the bones of large carcasses picked clean. It is active and aggressive, and at its feasts will drive away the meeker-spirited turkey vulture. It is said to kill young chickens, young pigs, and lambs when opportunity offers, so at times it may be quite destructive.

Occasionally it utters a low, guttural note, quickly repeated, that is barely audible a hundred yards away.

Because of their scavenger services, these birds are seldom molested and often become so tame as to be almost domestic, coming into towns to feed familiarly with dogs on refuse in the streets and barely moving aside to avoid passing animals or men.

They often frequent heron and pelican rookeries, where they pick up dead fish beneath the nests, and also swallow young birds left unprotected.

The nest is placed on the ground, usually under dense bushes, but occasionally in hollow trees, logs, or recesses beneath bowlders. The eggs rest on leaves or on the bare ground. Where abundant, the birds often breed in colonies. Two eggs constitute the usual set, with one or three found occasionally. The color is light green, spotted rather sparingly with brown and lavender.

The young when hatched are covered with buff-colored down quite different from the white found in the turkey vulture. The nestlings are fed entirely by regurgitation.

These birds are not known to carry food or any other object, either in the feet or in the bill.

The black vulture is found from western Texas, southern Illinois, and southern Maryland south into Mexico and Central America, being recorded casually north of its regular range. An allied form is known in South America.

TURKEY VULTURE

(*Cathartes aura septentrionalis*)

A master of the art of soaring, the turkey vulture or turkey buzzard wheels in the sky by the hour, turning in lazy circles and spirals, seldom moving the wings except to adjust them to the air currents through which it moves to maintain its elevation. Although graceful on the wing, when at rest all attractiveness of appearance is lost.

With broad wings folded against its relatively slender body, its bare head and its awkward attitude, the buzzard seems uncouth or even repulsive.

Like other members of the family, it subsists on the bodies of dead creatures, eaten fresh or in advanced stages of decomposition. I have had them come to tear the flesh from the body of a dead bird that I had just skinned, and have found them feasting on putrid flesh.

WINDLESS DAYS KEEP THE BUZZARD AT HOME

Turkey vultures by day cover wide areas in search of food, and at night gather to sleep in some tract of woodland, several hundred often congregating in one roost. In early morning they sit with wings expanded to catch the warmth of the sun, and on dull, cloudy days, when the air is still, may remain in their roosts throughout the day, as without moving currents of air they find flying difficult.

The turkey vulture places its nest in some recess beneath large bowlders, in a hollow log or tree, or in sheltered situations beneath shrubs. The handsome eggs, usually two in number, rarely one or three, are creamy white, spotted with brown and lavender. Occasionally one is found without markings.

The young bird when disturbed utters a curious growling, hissing call, like some angry cat, turning its back the while and striking the ground sharply with the tips of its spread wings in a manner that is truly startling. The adult is silent except for a hiss made by expelling its breath from the windpipe.

The turkey vulture ranges from southern British Columbia, Wisconsin, and central New York south into northern Mexico. Closely allied races extend through Cuba and Central and South America to the Falkland Islands. The bird has been introduced into Puerto Rico.

SWALLOW-TAILED KITE

(*Elanoïdes forficatus forficatus*

The swallow-tailed kite, delighting in its aërial powers, spends hours on the wing wheeling and turning without apparent effort. The deeply forked tail, the white plumage, and black wings and tail form unmistakable marks for field identification.

This species feeds extensively on snakes and also eats lizards and large insects. All food is seized expertly in the feet, and the birds customarily eat while flying, tearing their prey apart with their bills. They are believed to be entirely beneficial.

The nest of the swallow-tailed kite is built in trees, often from 60 to 125 feet from the ground, and is composed of twigs and moss, the nesting material being seized while flying. Two eggs generally constitute a set, although from one to four may be found. These vary in ground color from dull white to a delicate cream, and are spotted and blotched with brown. The call is shrill and high-pitched, being heard mainly during the nesting season.

Formerly this beautiful hawk was common throughout the eastern United States, but in the last 30 years its numbers have lessened steadily, and now it is found mainly in the southern section.

The species breeds locally from Minnesota, Indiana, and North Carolina south into Florida and eastern Mexico, wintering south of the United States. An allied form is found in Central and South America.

MISSISSIPPI KITE

(*Ictinia misisippiensis*)

The Mississippi kite is another species that spends hours in the air in tireless movement.

The food of this bird consists principally of insects, with occasional reptiles and frogs. I once encountered a band of a dozen coursing over a range of low hills, and at intervals darting down to seize a cicada. Held in the hawk's foot, the insect buzzed protestingly until, without a pause in the bird's flight, it was swallowed.

The Mississippi kite builds a small nest composed of twigs, in part with leaves still attached, placed in trees from 25 to 60 feet from the ground. The birds breed in May and June, later in the season than most species of this family.

The eggs number two or three and are pale bluish white, without markings, though often stained by the decaying green leaves of the nest lining. Only one brood is reared each season. The immature bird in the first fall is whitish below, streaked with dark brown and buffy.

This kite nests from northeastern Kansas, southern Illinois, and South Carolina south to Texas and Florida. In winter it is found from Florida and Texas to Guatemala. It has been noted casually from Colorado to Pennsylvania and New Jersey.

WHITE-TAILED KITE

(*Elanus leucurus majusculus*)

Like related kites, this species is master of the air and flies with extreme ease and skill. It delights in high winds, breasting them like a gull without the slightest difficulty.

It is found over tree-dotted prairies and savannas, marshes, and semi-open valleys. Though fifty years ago it was common, it has decreased steadily until now it is to be classed among our unusual birds. Despite the fact that it has been afforded protection in recent years, the species does not seem able to increase.

The white-tailed kite, in feeding, frequently hovers with rapidly beating wings over one spot for several minutes, watching the vegetation beneath closely, ready to pounce down whenever prey appears. It lives on small snakes, lizards, frogs, and large insects, and seems to be entirely beneficial.

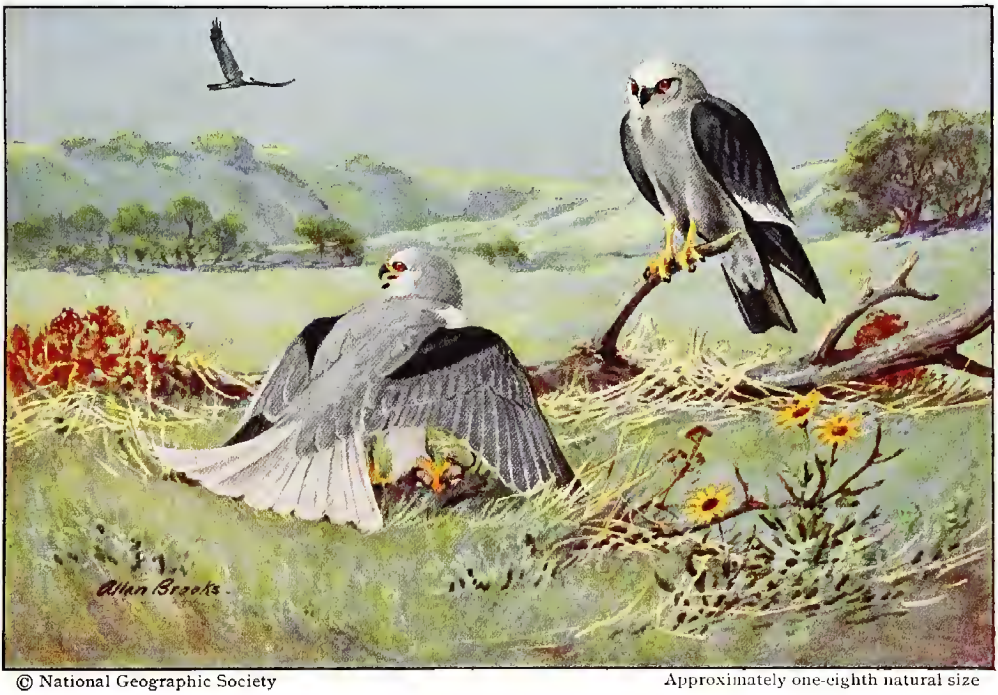
The note of this kite is said to be somewhat like that of the osprey, but terminating in a guttural or grating sound.

The nest, built of twigs and lined with soft materials, is placed from 25 to 50 feet from the ground.

The eggs, varying from three to five, are creamy white, heavily marked with blotches of brown. The young have the plumage tinged with brown and are indistinctly streaked above.

The white-tailed kite is found in California from the upper Sacramento Valley and Humboldt County, south to northern Baja California, and from Texas, Oklahoma, and Florida to Guatemala.

An allied race ranges in South America, and similar species are found in the other inhabited continents.



Approximately one-eighth natural size

SWALLOW-TAILED KITE
Perched and flying adults, above

WHITE-TAILED KITE
On ground at left

MISSISSIPPI KITE
Perched at right and flying in distance

Approximately one-eighth natural size

EVERGLADE KITE

Upper; adult perched and immature flying

MARSH HAWK

Lower; female at nest with young; male flying

EVERGLADE KITE

(*Rostrhamus sociabilis plumbeus*)

This resident of fresh-water marshes is suggestive in form, white rump, and method of flight of the much larger, longer-tailed marsh hawk. It enjoys soaring, frequently ascending to considerable altitudes, but does not have the graceful, accomplished flight of our other kites. The everglade kite is sociable, and, where plentiful, a hundred may be observed together. In Florida, however, it has been so reduced that flocks are unusual.

The birds utter a rasping, chattering call of little volume, and are especially noisy during the mating and nesting season.

For food this kite depends on the large fresh-water snails belonging to the genus formerly called *Ampullaria,* known now as *Pomacea.* The kite seizes them in its long claws and bears them away to some low limb or mound, where, with the slender, sharply hooked bill, it draws the snail from its shell.

Occasionally the kite extracts its food as it flies, dropping the shell when empty. I have seen accumulations of dozens of the shells gathered beneath favored perches. So far as known, this kite eats no other food. Such extreme specialization in diet is unusual among birds. The slender form of the bill and the claws, developed for this peculiar habit, is remarkable.

The everglade kite in Florida nests from January to May, the season varying locally. The nest is made of small twigs placed in a myrtle or other bush, in the top of a clump of saw grass, or, rarely, in a tree, being usually at only a few feet elevation and ordinarily above water.

The eggs number two to five or rarely six, two or three making the usual set. The ground color is pale greenish white spotted with rusty brown, the spots in most cases being so numerous as almost to conceal the lighter base. The young of the everglade kite are fed on the same large snails relished by the adult, the parent usually bringing food in the crop and feeding its family by regurgitation.

In the United States the everglade kite is found only in Florida. To the south it ranges in Cuba, eastern Mexico, and Central America, and a closely allied race occurs in South America as far as Argentina.

MARSH HAWK

(*Circus hudsonius*)

The marsh hawk, an inhabitant of open country, ranging over prairie regions, grasslands, and cultivated fields, is marked by its slender form, long tail, and a prominent white spot on the rump. Except during migration or in mating season, this bird seldom flies far above the ground for any great length of time.

It is entirely predatory, feeding on mice, ground squirrels, and other small mammals, as well as snakes, lizards, frogs, and insects. In addition, it captures a good many ground-inhabiting birds, especially in summer and fall, when young birds are about. At times it kills game birds and in some localities, particularly where pheasants are stocked, the marsh hawk has proved a pest. In general, however, it is beneficial, and should not be destroyed except where it is found to be actually injurious to game.

A FEATHER RUFF ADORNS THIS HAWK

As a peculiar feature, the face in this species is surrounded by short, stiffened feathers forming a ruff like that found in owls, a feature that is present in no other group of hawks.

The marsh hawk places its nest on the ground, usually in a marsh or on a prairie, ordinarily at the foot of a bush or a clump of grass, and in marshy ground on a tussock. It is composed mainly of dried weed stems and grass, sometimes with a foundation of twigs, lined with fine grasses and feathers.

From four to six eggs constitute a set. These are pale greenish or bluish white in color, usually without markings, though at times blotched and spotted with brown. The male is attentive to the female during incubation, bringing her food, which she often rises to seize in the air as he drops it.

As is often the case with ground-nesting birds, the young wander about on foot near the nest before they are able to fly.

The marsh hawk breeds from northwestern Alaska, central Quebec, and Newfoundland south to northern Baja California, southern Texas, and southeastern Virginia. In winter it is found from British Columbia and the northern United States south to the Bahamas, Cuba, Haiti, Puerto Rico, and Colombia.

SHARP-SHINNED HAWK

(Accipiter velox velox)

This small hawk, one of the most widely distributed of the group in North America, is an inhabitant of thickets and woodland. It may be readily identified by its short wings and long tail, the square end of the latter distinguishing it from the larger Cooper's hawk. Though fiercely predatory, flying swiftly in pursuit of prey, this bird spends long periods in resting quietly in trees or bushes. As it usually perches among limbs or leaves, it is often overlooked until it flies.

The sharp-shin feeds almost entirely on birds and is highly destructive. Although it preys mainly on small species, such as sparrows, warblers, and similar forms, it does not hesitate to attack birds as large as itself, regularly killing quail, mourning doves, and flickers.

In southward migration in fall, these hawks often follow definite lines of flight, so that thousands may pass leisurely by certain points in the course of a few days. Sometimes during these flights stuffed owls are used as decoys to attract the hawks, so that they may be shot.

The sharp-shinned hawk makes a bulky nest of twigs, sometimes without an inner lining, but often with a slight padding of soft bark or a few feathers. The nest is frequently placed in pines or spruces against the trunk of a projecting limb from 20 to 50 or more feet from the ground.

SHARP-SHINNED HAWKS WILL FIGHT FIERCELY FOR THEIR NESTS

Three to five eggs usually make a set, though as many as seven have been found in one nest. The ground color is pale bluish or greenish white, blotched and marbled with brown and lavender. The sharp-shin is bold in defense of its nest and I have had one strike fiercely at me, returning with chattering calls to the attack time after time.

The immature sharp-shin has the underparts longitudinally streaked with dusky. The female is much larger than the male.

This species breeds throughout most of the United States and Canada from the northern limit of trees south to Florida, Texas, and south-central California. In winter it is found from British Columbia and the northern United States south to Panama. Allied races are found in the Greater Antilles.

COOPER'S HAWK

(Accipiter cooperi)

This hawk, in appearance and habits, is a large edition of the sharp-shin. Since the sexes differ markedly in size, the female being much larger, a small male Cooper's hawk is about the size of a large female sharp-shin, the rounded instead of the square-ended tail offering the most evident character for distinguishing between the two.

The Cooper's hawk is the ogre in the world of our birds. Fierce and ruthless, it attacks grouse or other species as large as itself, and destroys smaller birds without the slightest difficulty. It darts through thickets with such ease that it is difficult for its victims to find cover for safe sanctuary. Rabbits and other small mammals, reptiles, and insects are eaten occasionally.

The bird is bold and fearless in pursuit of its quarry, and has been known to return several times to attack a chicken, even when people were present and threatening it. It is one of the hawks that merits the name of "chicken hawk" and must be considered entirely destructive. Indeed, it is responsible for much of the damage in the hen-yard for which its larger relatives that live more in the open get the blame. It is also a consistent enemy of ruffed grouse and quail.

This species often follows the lines of fall migration frequented by the sharp-shin, but is less abundant; so that it is killed by hunters along these flyways in smaller numbers.

Cooper's hawks may appropriate the last year's nests of crows or other hawks, or may build a new structure. In either case the nests are composed of coarse twigs lined with finer material of the same kind, the whole frequently mixed with fragments of bark.

The eggs range from three to five in number, with the ground bluish white or greenish white, sometimes plain, but more often spotted with brown. In the nesting season the Cooper's hawk is quite noisy, uttering loud, harsh notes that are rapidly repeated. The immature bird is streaked underneath with dusty.

The Cooper's hawk nests from southern British Columbia, southern Quebec and Nova Scotia south through the United States into northern Mexico. In winter it is found south into Costa Rica.

Approximately one-seventh natural size

SHARP-SHINNED HAWK
Upper; adult female

COOPER'S HAWK
Lower; adult male

Approximately one-seventh natural size

GOSHAWK
Upper

HARRIS'S HAWK
Lower

GOSHAWK

(*Astur atricapillus*)

The goshawk, one of the fiercest and most destructive of our birds of prey, exceeding the large falcons in this respect, inhabits the forests of the north and of the western mountains. It comes south sporadically from the far north during winters when there is a failure of its food supply, but at other times seldom is seen except along our northern border. Its flight is swift and powerful, and I have seen it easily overtake grouse and other fast-flying birds on the wing.

In the north the goshawk eats Arctic hares, lemmings, and ptarmigan. In its southern invasions it is the foremost enemy of the ruffed grouse, so that in the year following a goshawk flight there always is noted a decrease in these game birds.

With these propensities, naturally this hawk is highly destructive to poultry, seizing chickens and boldly carrying them away. When its hunting instincts are aroused, it seems to lose all sense of fear, so that it will return for chickens even after having been stung with shot. It does not hesitate to attack other predatory birds and will fight with large owls until both combatants are killed.

The goshawk builds bulky nests of sticks in either conifers or deciduous trees, but usually in heavy forest. The bird is fierce in defense of its home and will not hesitate to attack a human intruder.

The eggs vary from two to five, with three or four as the usual number. They are pale bluish white, often unmarked, but sometimes with a few spots of brown. The call is a shrill note sharply repeated, being heard principally in the breeding season. The young in the first fall have the under surface streaked like the immature Cooper's hawk.

Two races are recognized. The eastern goshawk, *Astur atricapillus atricapillus,* paler in color, breeds from Alaska, Quebec, and Nova Scotia south into British Columbia and the northern United States, extending south as far as western Maryland. In its sporadic southern flights it comes into the Central States and irregularly into the Southwest. The western goshawk, *Astur atricapillus striatulus,* nests in the Pacific coast region from Alaska south to California and northern Mexico.

HARRIS'S HAWK

(*Parabuteo unicinctus harrisi*)

This is a handsomely colored hawk, common only in a restricted area in the United States. Although accomplished in flight, so that it delights in turning in huge circles high in air, it is of quiet demeanor and often rests for hours on open perches from which it may survey the land.

In southern Texas it is remarked frequently on telephone poles along the highways. In this region it is fairly tame and unsuspicious, often allowing automobiles to pass without taking flight, but in other areas it has been reported as wary.

The call is a harsh scream, and the birds at times are quite noisy in the vicinity of their nests.

Though in South America a closely related race has been reported consorting with vultures and caracaras and feeding on carrion, such is far from the case here.

In Texas, Harris's hawk has been observed dashing quickly through mesquite thickets, searching for wood rats and ground squirrels, and in southeastern California Dr. Loye Miller found parts of a green-winged teal in the stomach of one, and bird remains, including a gilded flicker, in another. They are said also to eat lizards, and seem, on the whole, to be beneficial in their habits.

The nests are composed of sticks, small branches, and weeds, lined with rootlets and grasses. They are placed in trees or sometimes on the tops of the Spanish bayonet or the giant cactus.

From two to four eggs are deposited, these being dull white or with a faint greenish tinge, some without markings and some spotted irregularly with brown or lavender. The birds ordinarily offer no objection when their nests are approached, beyond uttering their usual calls and circling in the air overhead.

The young differ from the adults in having the under surface buffy white and broadly streaked with blackish brown.

Harris's hawk is found in southeastern California, southern Arizona and New Mexico and the lowlands of south Texas, extending to Louisiana and Mississippi, and ranging south into Baja California and Central America as far as Panama. It has been observed casually in Kansas and Iowa. A related race is found in South America.

RED-TAILED HAWK

(*Buteo borealis*)

This fine bird, under the name of "chicken hawk," is universally known, as it is conspicuous and widely distributed, although ranging by preference in hilly or mountainous regions where there are forests. It is strong and graceful on the wing and spends hours in soaring in wide circles, sometimes so high in the air as to be almost out of sight. Its flight is not particularly swift, and it often rests for long periods on limbs or the tops of dead trees, where it has a commanding view.

The red-tail is preëminently a mouse hawk, meadow mice particularly being a staple article in its diet. It also eats other mice, squirrels, gophers, rabbits, kangaroo rats, wood rats, moles and shrews, has been known to attack skunks, and also kills snakes and lizards. In summer and fall, particularly in the Western States, it consumes many grasshoppers when these appear in pestilential abundance.

Ground-inhabiting birds are eaten at times, but, on the whole, the red-tail is distinctly beneficial, meriting protection except where some individual acquires the habit of eating chickens. In spite of the good that it does, it is shot on every occasion and has been so reduced in many sections of the eastern United States that it is now a rare bird.

The nest of the red-tail is a large structure of sticks, sometimes with a slight lining of soft materials. The eggs vary from two to four, being creamy white, occasionally unmarked, but ordinarily spotted with shades of brown. In the South these birds begin to nest in February, the nesting period being governed in the North by the date of the opening of spring.

The voice is a high-pitched scream, a stirring sound usually being given as the birds circle high in the air. The immature bird in the first fall has the tail brown, barred with blackish.

This is one of the species that formerly appeared in southward migration in abundance, but the soaring flocks of early days are now things of the past and each year the birds seem to become fewer.

In its wide range from Alaska through central Canada to Nova Scotia and south through the United States, the red-tail is divided into five geographic races, and other forms are found in the West Indies and Central America.

RED-SHOULDERED HAWK

(*Buteo lineatus*)

This common cousin of the red-tail ranges in wooded country, and can maintain itself where groves and trees border cultivated fields. Though it delights in soaring, it seems somewhat less active than the red-tail. It may be distinguished on the wing by the narrow barring of the under-wing surface.

The food is highly varied, including mice, rats, snakes, frogs, fish, large insects, centipedes, spiders, crayfish, earthworms, and snails. It seems to take even fewer birds than the red-tail, and only occasional individuals acquire the chicken-killing habit or attack game birds. There are numerous instances on record where these birds have nested in woods adjacent to hen-yards without attempting in any way to molest the poultry.

On the whole, this hawk should be protected, though many are wantonly killed by hunters, so that the species is decreasing in many localities.

"RED-SHOULDERS" NEST HIGH OR LOW

The nest of the "red-shoulder" is made of twigs, placed in trees often at a considerable elevation, but occasionally as low as 18 or 20 feet. The number of eggs in a set varies from two to six, with three or four as the usual number. These are white, sometimes with a yellowish or bluish tinge, marked with shades of brown and gray. Eggs without markings are rare.

The calls of the red-shouldered hawk are loud, wailing screams that may be heard for some distance. They are mimicked by the bluejay so perfectly that it is often difficult to distinguish the imitation.

The northern red-shouldered hawk, *Buteo lineatus lineatus,* ranges from southern Canada to southern Kansas and North Carolina, migrating to the Gulf coast in winter. The Florida red-shoulder, *Buteo l. alleni,* which is smaller, nests from Oklahoma and South Carolina to Louisiana and southeastern Florida.

The insular red-shoulder, *Buteo l. extimus,* still smaller and paler in color, is found in the Florida Keys.

The Texas red-shoulder, *Buteo l. texanus,* with richer color below, nests from southern Texas to Tamaulipas; and the red-bellied hawk, *Buteo l. elegans,* with more rufous below, is found in California and northwestern Baja California.

Approximately one-seventh natural size

RED-TAILED HAWK

Upper; adults perched and flying above, immature bird flying at left

RED-SHOULDERED HAWK

Lower; adult (left), immature bird (right)

Approximately one-seventh natural size

BROAD-WINGED HAWK

Upper; adult perched, immature flying

SWAINSON'S HAWK

Lower; adult in light phase on ground, light and dark phases flying

BROAD-WINGED HAWK

(*Buteo platypterus*)

The broad-wing, smaller than the red-shoulder and red-tail, lives in woodlands, where it is seen only by those conversant with its habits, as it perches usually under cover of the leaves. In soaring it frequently rises until it is nearly out of sight. Swampy woodlands and broken country covered with forests are favorite haunts of this species, and as the trees are cleared it decreases in abundance.

It is entirely inoffensive in its habits. Except in migration, comparatively few are shot, as most depart for the South before the season for fall hunting.

The food is mainly mice and other small mammals, frogs, reptiles, and insects. It eats small fish occasionally, but seldom takes birds. Large caterpillars are a regular item in its diet. It is partial to grasshoppers, crickets, and large beetles, and has been known to eat centipedes. It must be considered beneficial and worthy of every protection.

The nests of the broad-wing are constructed of twigs, placed in a large tree, often at a considerable elevation. Green leaves are often found in the nest, and some birds add fresh leaves to the nest lining nearly every day. The eggs range in number from two to five, with two or three as the usual number. They are dull grayish white, or occasionally greenish, spotted more or less extensively with different shades of brown and lavender.

Occasionally these birds will dash at an intruder. I remember distinctly, as a small boy, the start that one of these hawks gave me by swooping at my head as I sat on a limb beside its nest, high above the ground, admiring the eggs and the nest construction. The ordinary call is a shrill, double-noted whistle high in pitch, which is accompanied by chattering, scolding notes.

The birds vary considerably in color and markings and occasional individuals are found that are entirely black.

The broad-winged hawk nests from central Alberta, New Brunswick, and Nova Scotia south to the Gulf coast and central Texas. It migrates south to northwestern South America, wintering mainly from southern Florida and southern Mexico southward. Allied races are found in the islands of the Lesser Antilles.

SWAINSON'S HAWK

(*Buteo swainsoni*)

Swainson's hawk lives in regions where tree growth is scant. Though strong in flight and delighting in soaring, it spends hours resting on some open perch where it may watch the country. Except when it has been unduly persecuted, it is tame and unsuspicious, allowing close approach without taking alarm.

The food of this hawk is varied and includes more insects than usual in a bird of its size. It feeds extensively on grasshoppers in late summer and fall, and also eats mice, rats, lizards, snakes, frogs, and rabbits. Though on rare occasions it may attack poultry, it is considered one of the most valuable hawks in the West in its relation to agriculture.

Swainson's hawk nests in trees or on cliffs, where its bulky home, composed of sticks, is often visible at a distance. The eggs, varying from two to four, are greenish white or yellowish white, spotted with brown and lavender, occasionally being without markings.

HAWK AND SONG BIRD NEST IN SAME TREE

In the regions of scanty tree growth inhabited by these hawks, it is a regular occurrence to find an isolated tree with nests of several species of birds clustered in it. Western kingbirds and Bullock's orioles often nest within a few feet of the large structure made by Swainson's hawk, and all live in harmony. Indeed, the home of a kingbird has been found located among the coarse sticks in the base of the hawk's nest.

In migration, both north and south, these hawks often gather in straggling bands, from 500 to 2,000 birds having been noted in such groups.

This hawk, like some of its relatives, has distinct light and dark color phases, these being illustrated in the flying birds of the opposite plate. Swainson's hawk has three of the outer primaries with the inner webs cut out or indented near the tip, and the red-tail has four. This difference will always serve to distinguish these birds in the hand.

This species breeds from British Columbia, Great Slave Lake, and Manitoba south to northern Mexico, and is found in winter in South America. Stragglers have been taken at many points in the Eastern States.

AMERICAN ROUGH-LEGGED HAWK

(*Buteo lagopus s.johannis*)

From its summer home in the north, the American rough-leg comes into the United States in fall migration, often traveling in flocks. As the name indicates, the rough-legged hawks differ from our other species in having the leg feathered to the toes.

The American rough-leg is large and powerfully built, but, in spite of its strength, it feeds principally on mice, lemmings in the north and meadow mice in the south being staple foods. Rabbits are eaten where they are abundant, and large insects, such as grasshoppers, are eaten occasionally. The bird is entirely harmless, as it seldom kills other birds or poultry.

This hawk nests in the far north, ranging there in open country, seldom coming into densely forested areas. The nests are composed of sticks, the cavity lined with dry grass and feathers, and are built on ledges along bluffs or are placed in trees. The same location may be used for years, and the nest grows in bulk until it is of large size.

Eggs are two to five in number, with three or four making the usual set. They are pale greenish white, fading to dingy white, spotted and blotched with brown of different shades, and shell markings of lavender and gray. One brood is reared each season.

FEATHER LEGGINGS KEEP OUT THE COLD

The birds vary considerably in coloration from light to dark, but may always be distinguished by the feathered legs, or tarsi. The feather growth is heavy, particularly in fall and winter, so that the severest cold may be withstood. In the West they remain in the Northern States during the coldest weather of winter.

The note, heard mainly during the nesting season, is a low mewing call, suggesting the sound made by a young kitten.

The American rough-leg nests from the Aleutian Islands, the Arctic coast of Alaska, and northern Quebec, south to northern Alberta and Newfoundland. In winter it is found from southern British Columbia, Colorado, and southern Ontario south to southern California, Texas, and North Carolina. Closely allied races are found in Europe and Asia.

FERRUGINOUS ROUGH-LEGGED HAWK

(*Buteo regalis*)

This handsome hawk, so large that it is often called an eagle, is found in regions of prairies and plains, avoiding heavy timber. It lives only in the western part of our continent, and in uninhabited sections still remains fairly common. However, when an increase in agriculture takes place in any part of its nesting ground, it is crowded out.

In much of its range it is known as "squirrel hawk," as ground squirrels and prairie dogs form a considerable part of its food. It also eats many pocket gophers. Birds, particularly meadowlarks, are captured during the summer season, and an occasional grouse may be taken, but these hawks are not known to harm poultry. They also eat large snakes. They are considered beneficial because of their destruction of harmful mammals.

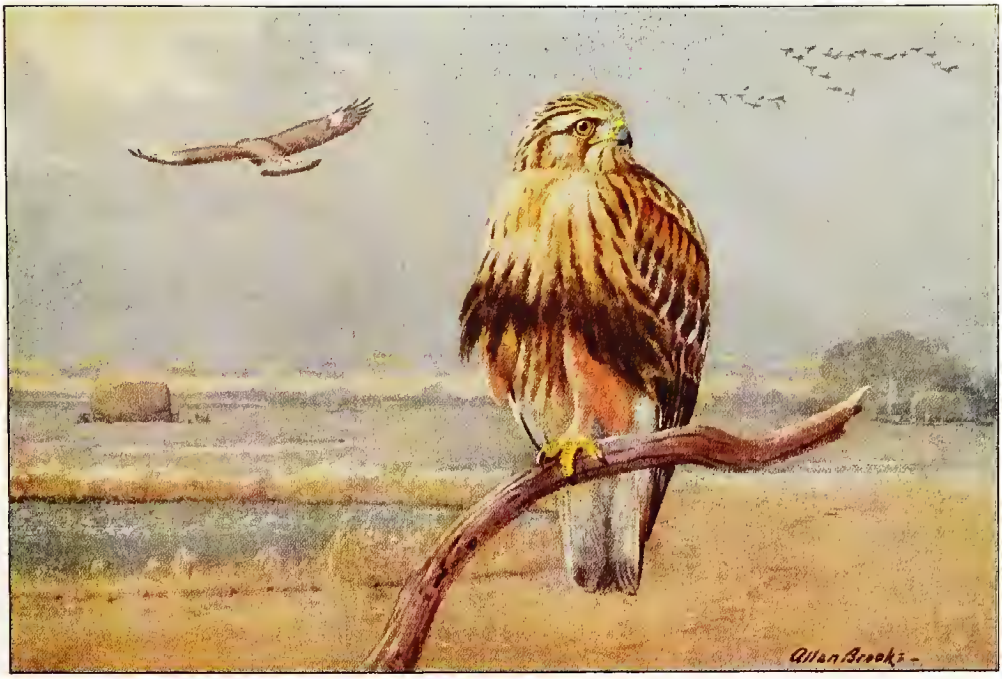
Frequently hunting in pairs, they capture game that might otherwise escape. In hunting prairie dogs, the hawks rest until the animal is away from its burrow, when one gets between the prairie dog and its hole, thereby making capture an easy matter. The birds are strong and powerful and can carry rabbits to their nests with ease.

The nests are placed on cliffs, on sloping hillsides, or in trees, sometimes in localities difficult of access, sometimes where they can be approached without trouble. They are often occupied for years, and occasionally grow to large size, Taverner recording one about ten feet high. They are composed of sticks, those in the base being often of large size, with a lining of grass and other soft materials.

The eggs are two to five and are greenish or creamy white, blotched and spotted handsomely with brown and lavender. One brood is reared each season.

On their nesting grounds these hawks utter screaming calls that have been likened to those of eagles, and the young are said to be quite vociferous.

The ferruginous rough-leg breeds from southern Alberta and Manitoba to northeastern California, New Mexico, and Kansas. It is found in winter from California and Montana to Baja California and northern Mexico, and has been observed casually in Wisconsin and Illinois.



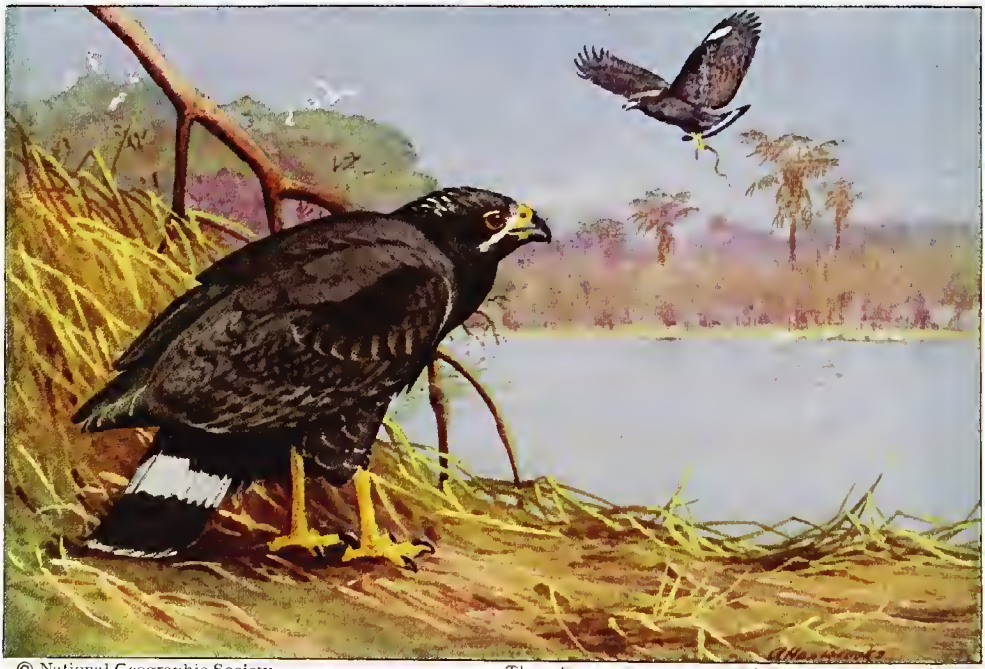
Approximately one-seventh natural size

AMERICAN ROUGH-LEGGED HAWK

Upper; ordinary light phase; adult perched, immature flying

FERRUGINOUS ROUGH-LEGGED HAWK

Lower; adult in light phase (left), dark phase flying (right)



These figures are approximately one-seventh natural size

MEXICAN GOSHAWK
Upper; adult (right), immature (left)

MEXICAN BLACK HAWK
Lower; adults perched and flying

MEXICAN GOSHAWK

(*Asturina plagiata plagiata*)

Of graceful, rapid flight, this handsome species frequents groves of cottonwoods and other trees along streams in the open valleys, or in the foothills of the mountains. It is migrant within our limits, appearing rather late in spring and moving south early in the fall. The birds are usually tame, as in the wild country they inhabit there is little to molest them.

LITTLE ECONOMIC EFFECT CAN BE ATTRIBUTED TO THIS HAWK

Lizards, abundant in its haunts, make up much of its food, and it feeds extensively on large insects, including grasshoppers and large beetles, which are said to be seized expertly on the wing. At need this bird can fly with a dash and speed which approximate those of a falcon. It eats various mice and rats, and also kills rabbits and ground squirrels.

It appears that this hawk is one of negative economic importance in the United States, and that, as an interesting species, it should not be disturbed or killed.

The nests of this goshawk are placed in trees. They are usually frail in construction, and made of twigs plucked green, so that they are still covered with leaves; this makes them difficult to see, as they match the dense green foliage in which they are placed. The nests are shallow and contain two or three eggs, the smaller number being more common. In color the eggs are pale bluish white, more or less stained from the nest lining of leaves; occasionally one is marked with a few spots of brown.

This species, although not brilliantly colored, from its contrasted markings is one of the handsomest of the hawks in our limits, its comparative rarity lending interest to the naturalist. It is an active bird, with powerful flight that enables it to dash through trees or other cover with ease, turning at need with the greatest facility. The call is a peculiar piping note that has been likened to the sound made by the long-billed curlew.

In the United States, the Mexican goshawk is found in southern Arizona, southern New Mexico, and the lower Rio Grande Valley, apparently being most common in Arizona. To the south it is found through Mexico, being replaced in Central America by a smaller race of paler color.

MEXICAN BLACK HAWK

(*Urubitinga anthracina anthracina*)

The present form is another that enters the southwestern borders of the United States in a limited section, where it is an inhabitant of dense groves of trees. Though quiet and given to resting for long periods on some partly concealed perch, it is a bird of swift and active flight and rises at times to soar in the open air, being particularly sportive in spring.

The nest is a large structure of sticks that is frequently occupied year after year. It is often placed in a cottonwood or in a pine from 15 to 60 feet from the ground. Part of the sticks used for nesting material may be gathered on the wing, the bird dropping gracefully, sometimes from high in the air, to seize a dead branch in some tree top, snap it off, and carry it away without pausing appreciably in its course. From one to two eggs are deposited, being grayish white with a slight greenish tinge, spotted with brown and lavender.

In the north the birds rear but one family each season, but in the Tropics, if one set of eggs is taken, they often continue their domestic duties with a second or even a third nesting.

In British Honduras, where these hawks are common and are little molested, they are said to be very bold, sometimes perching only five or six feet away while their young are being examined.

The food of these birds, from what little has been recorded, seems somewhat varied. They are said to eat a good many snakes and lizards, and also to consume frogs and fish. Sometimes they pursue birds, and along the coast of Central America they are reported to live to a considerable extent on crabs, large land crabs being favored food. They are said also to eat rodents of various kinds and large insects.

They are too rare within our limits to have any particular economic status, but should not be destroyed wantonly, as they are interesting and peculiar, and represent a group not otherwise found in our fauna.

The call of this bird is described as high-pitched and quavering.

The species is found from southern Arizona and the lower Rio Grande Valley in Texas south into Central America, being mainly migratory in the United States. Allied forms are found in tropical America.

GOLDEN EAGLE

(*Aquila chrysaëtos canadensis*)

The golden eagle, one of the most powerful of American birds of prey and a keen and courageous huntsman, is principally an inhabitant of wild and unfrequented areas. From its great expanse of wing it is readily identified. The bald eagle in immature dress is the only bird with which it might be confused, but as these two ordinarily range in different types of country, there is little opportunity to mistake them.

The golden eagle has feathers extending clear to the toes, but in the bald eagle the lower part of the leg is covered with hard scales. This difference serves to distinguish the two in any plumage.

Where prairie dogs are present in large numbers, these are favored food; a pair of eagles will destroy several hundred in the course of a season. At times they turn to sharp-tailed grouse when these are abundant, proving a scourge to the flocks. Jack rabbits, cottontails, marmots, and ground squirrels are killed in large numbers. In winter, when other food is scarce, they may come to dead carcasses, being sometimes hard put in severe weather when the meat is frozen, even with the great strength that they possess in bill and feet.

They also attack lambs and fawns on occasion, and E. S. Cameron records that three golden eagles working together pulled down and killed a pronghorn antelope during severe winter weather when other food was scarce. They will kill and eat coyotes caught in traps, and will also steal the bait when wolf traps are baited with meat. Snakes and wild ducks, and an occasional goose, also may figure in their diet.

Birds and jack rabbits usually are partly plucked before being eaten, but most small mammals are swallowed—skin, hair, and all. These eagles kill many rattlesnakes, being said to feint at them until they uncoil, when the reptiles may be seized without danger.

The lifting powers of this bird have been exaggerated, since it has been claimed that the golden eagle was capable of carrying prey weighing 15 or 20 pounds. Reports from reliable observers, however, indicate a weight of eight pounds as about the maximum which they can carry. When larger prey is killed, it is necessary to eat it on the ground. In the case of geese when they fall in water, the eagle is said to tow them to land. Frequent reports that these birds have attempted to carry off children are, so far as the experience of naturalists goes, without basis. However, it is interesting to note that these stories are prevalent through the extensive range occupied by golden eagles in both Old and New Worlds.

During most of the year golden eagles are undemonstrative, but in the nesting season they call in shrill, high-pitched tones, and the male often tumbles in the air somewhat like the male marsh hawk. This is accomplished from a high elevation by suddenly closing the wings and dropping headfirst toward the earth, checking the fall just before reaching the ground; then rising again to repeat the performance.

The nest is placed on the ledge of a cliff or is built in a tree. Often it is a large structure, as the birds may use the same site year after year and add to the nest each season. It is built of sticks and limbs, usually with a lining of some softer material, and often is decorated with twigs of green pine. Bendire describes one, from notes made by Denis Gale in Colorado, which was 7 feet high by 6 feet wide, and was said to contain at least two cartloads of material.

Two, or rarely three, eggs are laid, these varying from dull white to pale cream color, with blotches and spots of brown, pearl gray, and lavender. Where there are two eggs in the set, one is usually a little larger than the other. Some believe that the two young constitute a pair, though I know of no certain proof that this holds true.

A TRUE AVIAN ARISTOCRAT

Either from its size or demeanor, the golden eagle gives an impression of intelligence distinctly above that of other birds of prey. As one of our finest forms of wild life, it is to be hoped that the huge bird may hold a place in our fauna for many years.

The golden eagle breeds from northern Alaska and Mackenzie to northern Baja California and central Mexico, and in winter is found south to northern Florida and southern Texas. It formerly nested east of the Mississippi River, and possibly may still do so in North Carolina and Tennessee. Closely allied forms occur in the Eastern Hemisphere.

Approximately one-eighth natural size

GOLDEN EAGLE

Adult on ground, immature flying

Approximately one-tenth natural size

BALD EAGLE

Adult perched, immature flying

BALD EAGLE

(*Haliaeetus leucocephalus*)

Our national bird, the bald eagle, chosen in the early days of the Union, is figured on many of our coins, is a favored design in matters of patriotic interest, and in general is considered symbolic of our freedom. Its enormous size and the striking markings of the adult make it a prominent species that is noted on every appearance. A bird of great strength and of swift and powerful flight, it is master in its haunts and has no potent enemies except man. Its life is led in the vicinity of water and only casually is it found far from that element.

The food of the bald eagle is mainly fish. In Alaska severe complaint has been made that it destroys salmon during their annual runs up the streams to deposit their eggs. As the salmon cross shallow bars or cascades, leaping from pool to pool, there is no question that many are taken by eagles.

Elsewhere the eagle often fishes by plunging from a height, descending at an angle on its selected prey, sometimes going beneath the surface. Rarely it grapples prey so large that it cannot rise with it and is under necessity of towing it to shore. This eagle also robs the osprey, being fiercely predatory in such encounters.

Large birds are sometimes captured, including ducks, coots, and geese. Although the eagle is sufficiently swift to seize them in flight, it ordinarily gives chase on the water, where it is able to tire them by forcing them to dive until they become exhausted.

Although the bald eagle is said to feed on healthy birds, my own experience with it has been principally that it is constantly in pursuit of birds crippled by shooting or injured in some other way.

During the hunting season I have often seen an eagle swing over rafts of ducks, which it scatters. Then, if cripples appear, they are pursued, and if none is sighted the eagle passes on to other hunting. The taking of such injured birds can hardly be condemned. These eagles have been said on occasion to kill lambs and foxes, the latter furnishing an indication of the birds' strength.

In addition to living food, the bald eagle is prone to search for carrion, following regularly along shores for dead fish cast up on the beaches, and eating dead animals of other kinds as they offer. Because of this habit, many words of opprobrium have been hurled at it.

There was much discussion before the bald eagle was finally adopted as our Nation's emblem by act of Congress on June 20, 1782; Benjamin Franklin in particular favored the wild turkey. In spite of all that may be said against it, however, it must be conceded that the bald eagle is a bird of fine and noble appearance and that it is a master of the air.

EAGLES GO IN FOR NEST-BUILDING ON A LARGE SCALE

The nests of the bald eagle are large structures of sticks, usually placed in trees, often at a considerable height, though occasionally on cliffs, or even directly on the ground. Nests 5 to 6 feet in diameter and the same in height are not unusual, and nests 12 feet high have been recorded. Herrick found that one near Vermilion, Ohio, was used continuously for thirty-four years.*

Ordinarily two eggs are laid, with occasional sets of three or one. They are white, very rarely with slight markings of buffy brown. Where two eggs are laid, one is nearly always larger than the other. Incubation requires nearly a month, the duty being shared by both parents. The young remain in the nest for about two and a half months, and during that time the old birds are most solicitous of their welfare and safety.

The young bald eagles do not attain the plumage of the adult for three years, and during the first year they are actually larger than their parents.

The southern bald eagle, *Haliaeetus leucocephalus leucocephalus,* nests from the northern United States to Baja California, central Mexico, and Florida. The northern bald eagle, *Haliaeetus leucocephalus alascanus,* breeds from northwestern Alaska and British Columbia to the Great Lakes and Nova Scotia, coming in winter south to Washington, Montana, and Connecticut.

A related species, the gray sea eagle, *Haliaeetus albicilla,* is resident in Greenland, and is found also in Europe and northern Asia.

* See "The Eagle in Action," by Francis H. Herrick, in the NATIONAL GEOGRAPHIC MAGAZINE for May, 1929.

OSPREY

(*Pandion haliaëtus carolinensis*)

Known ordinarily as the "fish hawk," the osprey is found about large bodies of water. Being dependent on fish for food, it never strays far from water except during casual wanderings when in migration. Though it may eat an occasional water snake or frog, practically all of its food is composed of fish, most of which it captures alive.

In fishing, the bird flies slowly from 30 to 100 feet above the water, scanning the surface closely until a fish is sighted, when it turns and drops swiftly, sometimes even going beneath the surface. Rising with its victim held firmly in both feet, the osprey pauses for an instant, supported by broad-spread wings, to shake the water from its plumage; then flies to some perch where its meal may be enjoyed. As it rises, it adjusts its grip so that the fish is carried end on, thus affording a minimum of resistance to the air.

FISH HAWKS ARE NOT EPICUREAN IN THEIR TASTES

Any fish of proper size that come near the surface are taken. Toadfish are as acceptable as other varieties. Such species as menhaden, which go in large schools, are favorites. In summer on Chesapeake Bay I have seen fish hawks feeding regularly on eels.

The birds have habitual perches to which they carry food, the ground beneath these being strewn with fish bones accumulated from many meals. Where fishermen sort the catch from their nets, I have seen ospreys gather in flocks to pick up discarded dead fish, seizing these from the water or picking them from the sandy beach.

Occasionally ospreys are known to strike fish too large for them to handle, and when their claws become caught the birds are pulled beneath the surface and drowned.

In its fishing the osprey does not always continue unmolested, as the bald eagle, also with an appetite for fish, often resorts to robbery. Watching until an osprey has made its catch, the eagle descends on the fish hawk, in an effort to make it give up its prey, continuing in relentless pursuit with broadly beating wings until the smaller bird drops the booty.

If an osprey is obstinate, the eagle finally strikes, knocking it through the air to make it release the catch. As the fish falls, the eagle descends swiftly to seize it in the air, or picks it up from the surface of the water. On rare occasions an osprey with a small fish may escape, but ordinarily the bird is so burdened that its flight is hampered to a point where it can make no definite resistance.

Where two eagles combine in this robbery, the case is hopeless, for, wherever the osprey turns, one of the eagles is soon upon it and it can find no avenue of escape. The plate illustrates the beginning of such a scene, with one eagle descending on an osprey that has just made its catch, and another swinging about in the background.

Relieved of its catch, the osprey may strike angrily at the robber, but the larger bird easily wards off such blows with its broad wings. Occasionally, however, the tables are turned, for when ospreys gather in colonies several may band together and harry marauding eagles from the vicinity.

The nest of the osprey ordinarily is a huge structure of sticks, cornstalks, weeds, and other rubbish, placed in the top of a tree, on a rock ledge, on the summit of a pinnacle rock, or occasionally on the roof of a building or chimney. It may also place the nest on the ground.

Frequently grackles, night herons, and English sparrows place their nests in the base of the huge structure occupied by the osprey. The larger bird pays no attention to its smaller neighbors.*

OSPREYS RANGE OVER A LARGE PART OF THE NEW WORLD

The eggs, from two to four, with three making the usual set, are creamy white, spotted and blotched with brown and lavender. With their rich colors and bold markings, they are among the handsomest eggs found in this order of birds.

The osprey is easily distinguishable at a distance from the eagle and from other hawks by its white breast and long, angular wings.

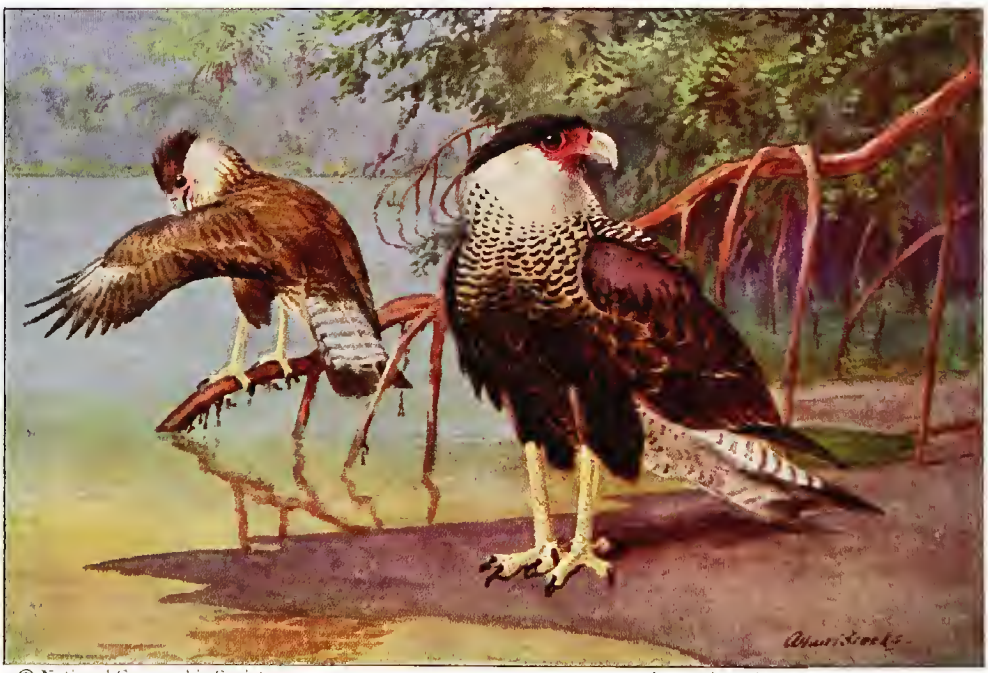
It breeds from Alaska, Hudson Bay, and Nova Scotia to Baja California and the Florida Keys, wintering from Florida and Baja California to the West Indies and South America. Allied races are found in the Bahamas and in the Old World.

* See "Photographing the Nest Life of the Osprey," by Capt. C. W. R. Knight, in the NATIONAL GEOGRAPHIC MAGAZINE for August, 1932.

Approximately one-eighth natural size

OSPREY

Two bald eagles flying above



Approximately one-seventh natural size

PRAIRIE FALCON

Upper; adult perched, immature flying

AUDUBON'S CARACARA

Lower; adult (right), immature (left)

PRAIRIE FALCON

(*Falco mexicanus*)

This pale-colored falcon has the active, graceful flight of the duck hawk. In a way, it is the arid country representative of that species, but may be distinguished from it by smaller size and paler, sandy coloration.

The nest is placed on a cliff, being often in a recess or small cave, where the eggs are laid on the bare surface, with only whatever rubbish may have accumulated for nesting material. Two to five constitute a complete set, three or four being the customary complement. The ground color of the eggs is creamy white, more or less overlaid with a suffusion of cinnamon, and blotches of reddish brown and chocolate. They are considerably paler than the eggs of the duck hawk.

The prairie falcon feeds on birds of various kinds, blackbirds, horned larks, mourning doves, and others of similar size being favorites. It captures quail and prairie chickens on occasion, and also secures domestic pigeons where flocks of these are found within its range.

I have seen them harry colonies of yellow-headed blackbirds so mercilessly that these unfortunates set up a loud outcry whenever a falcon appeared in the distance. The prairie falcon also feeds on mammals, taking gophers, ground squirrels, and various kinds of rats and mice. In addition, it takes insects, particularly grasshoppers when these are abundant.

In feeding, these hawks sometimes watch from cliffs or open perches in trees until suitable prey appears, or again fly lightly and gracefully along, traveling rather swiftly as they hunt. They have been known to harry marsh hawks and make these birds drop their prey. The falcon seizes its booty in the air as it falls.

About their nesting cliffs these falcons are quite noisy, uttering shrill screams and cackling calls when disturbed. At other seasons they are mainly silent.

The prairie falcon nests from southern British Columbia to Baja California and southern Mexico, extending east to the eastern border of the Great Plains. It is casual in occurrence in Manitoba, Minnesota, and Illinois.

A related species is found in the Southwest, the aplomado falcon (*Falco fusco-coerulescens septentrionalis*).

AUDUBON'S CARACARA

(*Polyborus cheriway auduboni*)

Although related to the falcons, this peculiar species, often called "Mexican eagle," has many of the habits and mannerisms of vultures. It is found in prairie regions where there are open groves, preferring open country to heavily forested sections. Its flight is straight and rapid, and it sometimes circles high in the air, especially on days of oppressive heat.

In Florida these birds frequently nest in cabbage palmettos; in Texas they occupy mesquites and other trees, and in Arizona giant cacti are sometimes selected. The nests are bulky masses of twigs, weeds, coarse grass, leaves, and Spanish moss, usually piled together in an untidy manner. The eggs number two or three, the ground color being creamy white when it is visible. Most eggs have the entire surface obscured by a wash of cinnamon rufous and blotches of reddish brown.

This bird eats lizards, snakes, frogs, and small turtles, and also takes small mammals. It is fond of rabbits, cotton rats and other mice, and grasshoppers and other large insects. Crabs and crayfish, too, are on its bill of fare.

The caracara is also partial to carrion of all kinds, and frequently comes to carcasses on which vultures are feeding. The caracaras make the larger birds stand aside, as they are strong and aggressive, striking with both bill and feet. On the coast of Texas caracaras have been seen in pursuit of brown pelicans to make them disgorge fish that they had swallowed.

Caracaras are active on the ground, their long legs and relatively short claws enabling them to walk and run with ease. Their voices are peculiar rattling, creaking, screaming calls, in uttering which the birds frequently throw the head backward until it touches the back.

On Guadalupe Island, Mexico, off the western coast of Baja California, there was formerly found the Guadalupe caracara, *Polyborus lutosus*. The last of this species was recorded about 1905.

Audubon's caracara nests from northern Baja California, southwestern Arizona, central and southern Florida, and Cuba south through Mexico and Central America. It has been recorded accidentally in Ontario. An allied race occurs in northern South America.

DUCK HAWK

(*Falco peregrinus anatum*)

The duck hawk, finest of the falcons of our continent, lives in regions where cliffs furnish it aeries. Truly a master of the air, it kills at will, and its food is composed almost entirely of birds.

Resting on a commanding perch or flying easily, the hawk, when its appetite is aroused by some luckless bird, descends with a rush of wings so swiftly as almost to elude sight, and strikes its unfortunate victim like a veritable thunderbolt. Ducks, shore birds, robins, meadowlarks, flickers, pheasants, grouse, pigeons, and many others have been recorded as its victims.

When it has tiny young, it obtains warblers, sparrows, and other small birds to feed them. No form of bird is safe from it, as it has been known even to capture the agile chimney swift. A duck hawk comes nearly every winter to the old Post Office Department tower in Washington, and lives on pigeons captured as they fly over the grounds of the Smithsonian Institution or above the near-by buildings. Mammals are seldom taken.

The duck hawk usually places its nest on a cliff, often in a spot where it is practically inaccessible. Occasionally it resorts to large hollows in trees, or very rarely to old nests of eagles or hawks. The only nesting material consists of whatever rubbish may have accumulated on the chosen site, this usually including bones and other fragments from birds the duck hawk has eaten.

Three to five eggs are laid, four being the usual number. These are creamy or yellowish white, irregularly blotched, streaked, or otherwise heavily marked with various shades of bright brown.

The parents are noisy during the breeding season, uttering quick, cackling calls. When their nests are approached, they circle rapidly about, harrying unmercifully other birds that chance to pass, and even killing ruthlessly when enraged.

The duck hawk nests from Alaska and the west coast of central Greenland to Baja California, Kansas, and Maryland. In winter it ranges south to Panama. Peale's falcon, *Falco peregrinus pealei,* a darker race, nests on the Aleutian and Commander Islands, coming south in winter to Oregon. Allied races are found in the other continents of the world.

GYRFALCON

(*Falco rusticolus*)

This hunting falcon of the north in early days was the type most prized by the devotees of the sport of falconry. Swift in flight and possessed of almost endless endurance, these birds were desired above all other hunting hawks.

They range far beyond the limits of tree growth, apparently to the limits of land. They become so accustomed to resting on the ground or on rocks that in captivity they actually seem to prefer such locations to a perch.

The gyrfalcons of North America appear to like birds better than other food, capturing them ordinarily on the wing. In the far north they often nest in the vicinity of colonies of auks, great piles of whose bones accumulate beneath the gyrfalcon homes.

From Labrador to Alaska these falcons are the scourge of the ptarmigan. They also capture gulls, guillemots, shore birds of various kinds, and snow buntings, as well as lemmings and Arctic hares. On St. George Island, one of the Pribilof group in Bering Sea, Hanna records that one winter gyrfalcons came in abundance and nearly exterminated the little wren and the rosy finches.

The gyrfalcon nests on ledges on the face of cliffs, placing its eggs on accumulations of its own pellets, or, where there is woody vegetation, it sometimes occupies nests of sticks. The eggs, usually three or four, are creamy white, very heavily marked with reddish brown, and are among the most handsome eggs of their group. Nesting may come in May in the far north, so that the nests are frequently hung with icicles.

The races of gyrfalcons found in North America are in some confusion because of the considerable variation in color among these birds. In Greenland there is found the white gyrfalcon, *Falco rusticolus candicans,* which also has a dark phase in which the plumage is mainly gray. This race may breed also in eastern Arctic America, and is casual in winter south to British Columbia, Montana, and Maine. A darker form, varying from gray to nearly black, known as the black gyrfalcon, *Falco rusticolus obsoletus,* nests from Point Barrow to Labrador, and in winter ranges south into the northern United States.

Approximately one-seventh natural size

DUCK HAWK

Upper; adults (left), three young (right)

WHITE GYRFALCON

Young

BLACK GYRFALCON

Approximately one-sixth natural size

SPARROW HAWK

Upper; male (right), female in nesting hole

PIGEON HAWK

Lower; adult male (right), immature female (left)

SPARROW HAWK

(*Falco sparverius*)

The handsome sparrow hawk, most familiar of American falcons, has adapted itself readily to the changes brought by our civilization, being so evidently harmless that it has escaped much of the destruction aimed universally at its larger companions. It is equally at home in the diverse environments found between the green pasture lands of the east and the arid cactus forests of Baja California.

The sparrow hawk feeds principally on mice, large insects, lizards, and frogs. On occasion it attacks birds, and may kill quail, jays, or other birds as large and heavy as itself. About cities it destroys many English sparrows and starlings.

Often it hovers in the air with rapidly beating wings, intently watching the grass below until a mouse or other prey comes far enough out in the open to be caught.

CITY LIFE SEEMS TO AGREE WITH THE SPARROW HAWK

The sparrow hawk nests in cavities, old nesting holes of the flicker or other large woodpeckers being favorite shelters, and has come to occupy bird boxes about houses. It frequently lives in cities, and in Washington is found about the roofs of the Smithsonian buildings. The number of eggs in a set ranges from three to seven. They vary in ground color from white to cream and cinnamon buff, spotted and blotched with brown.

The call of this hawk is a rapidly repeated *killy killy killy,* from which it is often known as "killy hawk."

The eastern sparrow hawk (*Falco sparverius sparverius*) nests from the upper Yukon, southern Quebec, and Nova Scotia to northwestern California, eastern Texas, and northern Alabama.

The desert sparrow hawk (*Falco s. phalaena*), which is somewhat larger and paler, breeds from southern New Mexico and southern California south into Mexico.

The San Lucas sparrow hawk (*Falco s. peninsularis*), smaller in size, is found in southern Baja California, and the little sparrow hawk (*Falco s. paulus*), also of small size but darker in color, resides in Florida and the Gulf coast region.

Allied races range through the West Indies and Central and South America.

PIGEON HAWK

(*Falco columbarius*)

The pigeon hawk derives its name from its curious resemblance to a pigeon in certain attitudes, or in mannerisms of flight that it may assume, though at other times it is obviously and unmistakably a falcon.

It is found in wooded areas or in semi-open country, depending upon where its search for food may take it. It is a bird of swift and graceful flight and travels at high speed with little apparent effort.

Like related falcons, the pigeon hawk feeds extensively on birds. Its speed of flight and its strength are attested by its capture of swallows and even of the chimney swift, and its killing of meadowlarks, flickers, and small doves. Mice are taken occasionally and large insects more frequently.

When not hungry, this active little hawk delights in chasing birds merely to display its mastery, threatening but not actually harming them. Jays and crows may be the butts of this sport, or again the hawk may pursue flocks of sandpipers. When in search of a meal, its whole action changes and it kills speedily and ruthlessly.

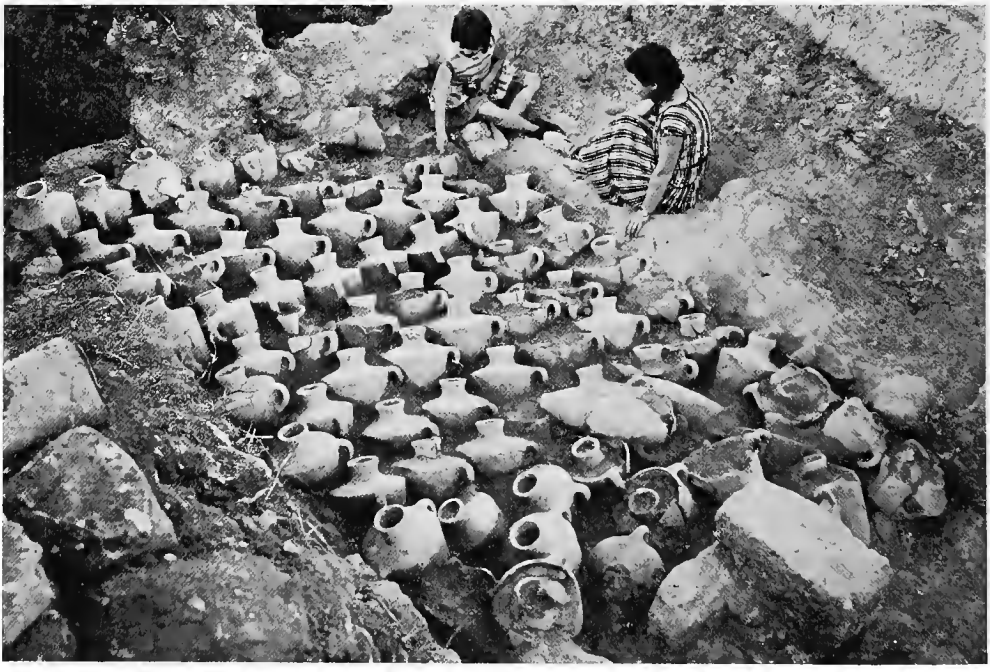
The pigeon hawk builds a nest of twigs and bark lined with softer materials, and places it in a tree, often only a few feet above the ground, on a rock ledge, or occasionally in a hollow tree. Four or five eggs constitute a set, being pale creamy white, with a wash of reddish brown and spots and blotches of deep brown. About the nest the birds utter piercing cries and chattering, scolding notes.

The eastern pigeon hawk (*Falco columbarius columbarius*) nests from eastern Canada to Maine and Manitoba, migrating in winter to the Gulf States and northern South America.

The black pigeon hawk (*Falco c. suckleyi*), blackish brown in color, nests in western British Columbia, wintering in the coastal region south to northern California. Richardson's pigeon hawk (*Falco c. richardsoni*), lighter in color than the ordinary form, is found from Alberta and Saskatchewan to Montana and North Dakota, wintering from Colorado to northwestern Mexico.

The western pigeon hawk (*Falco c. bendirei*), darker than Richardson's, breeds from northwestern Alaska to California, in winter ranging to Mexico.

GIGANTIC STONES WHICH HAD BEEN PLACED AS COVERS OVER MANY TOMBS AT RAS SHAMRA PROVED SERIOUS OBSTACLES TO THE EXCAVATORS



MORE THAN 3,300 YEARS AGO THESE JUGS OF WINE AND OIL WERE BURIED WITH A SYRIAN KING FOR HIS USE IN ANOTHER WORLD

ADVENTURES WITH BIRDS OF PREY

By Frank and John Craighead

With Illustrations from Photographs by the Authors

FALCONRY—taming, training, and flying the most spirited and courageous birds alive! It seemed almost supernatural to us, a feat accomplished in ages long past but surely impossible for modern boys.

Then one day, in an old National Geographic Magazine, we came across an article on falconry by that great artist-naturalist, Fuertes.* Soon afterwards, we saw a trained hawk owned by a resident of our home city, Washington, D. C. So falconry wasn't impossible after all! We decided we would give it a try.

With The Geographic as a starter, we began reading up on falconry, and with the coming of spring, the time for getting hawks, we had a fair theoretical knowledge of the subject.

FIERCE COOPER'S HAWK IS HARDEST TO TRAIN

Judging from descriptions of European hawks, our American Cooper's hawk would be the best bird for hunting in the mixed woods and open country of the eastern United States. The books, however, failed to mention the fact that, of all the birds used in falconry, the short-winged hawks, such as the Cooper's, are by far the hardest to train (pages 110 and 112).

Unknowing and consequently undismayed, we were starting at the age of 14 on the most difficult task of falconry, training the fiercest of the short-winged hawks.

Up along the Potomac River, not far from Washington, we finally found what we sought—a pair of Cooper's hawks, hunting. These birds are about the size of a crow, with short wings and long tail. They are not falcons, and they differ decidedly from those long-winged, high-flying birds. Instead of depending upon endurance and speed of flight, they hunt low through the bushes, catching their prey by a stealthy approach and sudden, lightning-like dash. These tactics are effective, and the birds are highly efficient hunters.

On the rare occasions when they fly up above the trees, they flap three or four times and then glide. This they were doing when we sighted them.

At once we began to look around for possible nesting sites. There were several old crows' nests in the vicinity, clearly visible through the leafless branches of early spring. With a pair of telephone lineman's spurs which had been given to us, we began climbing the various likely-looking trees and peering into the nests.

This, we found, was an ambitious program, as climbing with spurs is hard, tiring work until you get the knack of it. The novice hugs the trunk so hard he is worn out before he gets up twenty feet; he feels that the spurs will not hold. Confidence comes with experience.

At last, after clambering up four or five tall, straight trunks, we found four pale bluish eggs with very faint brown splotches lying in an abandoned crow's nest high in a pin oak tree, overlooking the wooded valley. We let them alone, of course, and climbed down. The parent birds now were nowhere in sight.

During our trips to the nest on subsequent week ends, the old birds never showed themselves. Unlike some other kinds of hawks and falcons, which circle around, bawl you out loudly, or even dive at your head, the Cooper's hawk will not often visit its nest if a human being is near it. If it is on the eggs or feeding its young, it sneaks off, unnoticed, before you can get close.

BABY HAWKS GET A NEW HOME

For some four weeks we watched and waited until the young birds were about ready to leave the nest. In fact, when we climbed up and peeked at them, they fluttered out of it and down to the ground.

Carefully picking up all four, we put them in a basket and carried them home. Cooper's hawks are not noisy birds, and, although they showed plenty of footwork, they made no loud disturbance. Young duck hawks would have been raising the roof.

Two of the birds we gave to some other boys who had been going out to the nest with us. The two females we kept. Among hawks the female is "deadlier than the

* See "Falconry, the Sport of Kings," by Louis Agassiz Fuertes, in The National Geographic Magazine, December, 1920.

FIERCE YELLOW EYES GLARE AT HUMAN INTRUDERS

The young Cooper's hawks, a male (left) with his somewhat larger sister, have just left the nest, though their tail feathers are not yet half grown. These birds often fly for some time before they are fully feathered, and seem to develop more strength than do many other species at the same age. The two shown challenging the camera were caught and trained by the Craighead boys.

male"—bigger, stronger, more spirited, and hence far better adapted for use in falconry.

Comfortably established in a cloth-canopied basket, first under the stove and later in the cellar, our two little hawks devoted themselves to the business of eating and growing feathers. By the time they began to jump up on the edge of the basket and act restless, we knew they were almost ready to train.

It is important not to begin training too soon, however. The first step is teaching the bird to come to the hand for food, and it is necessary that the hawk be hungry—not starved, of course, but possessed of a good, healthy appetite. If training is started before the feathers are all grown out, "hunger streaks" will appear in the plumage and the bird's flying ability will be impaired.

Our hawks were well fed on beef and liver, with finely ground greenbone to keep them from getting rickets, and an occasional mouse, starling, or sparrow.

TRAINER MUST AVOID SCARING THE BIRDS

About three weeks after we had brought our birds home we were able to begin their actual training. The first step was to fasten to the legs the leather straps, about six inches long, called jesses; to these a leash was attached (page 114). It is important not to scare the hawks by any abrupt movement, as they may become chronically timid and nervous.

We spent more time training those first hawks than we gave to half a dozen later ones. We carried the fierce, untamed birds on our gloves for several hours each day, then took them out again after dark, when they perched more quietly on our wrists.

Teaching the birds to come to the hand for food was the next step. Standing a few feet from the perching hawk, one of us would hold out his gloved hand with a piece of meat on it and whistle for the bird

to jump or to fly to its food.

Plenty of patience was needed as we waited from five to ten minutes at a time for these nervous Cooper's hawks to come to us, and we flew them half a dozen times to a feeding. Each day the distance was slowly increased until they would come a hundred yards to our fists.

A good deal of this work was unnecessary, but we were inexperienced and could only guess when our birds were sufficiently trained. For two months we flew them to our fists on long strings before finally turning them loose with considerable apprehension.

Now, after six years of experience with hawks, we fly our birds loose after a week of training at the most. Moreover, we do not worry whether they will return to our outstretched hand. We know they will.

DROPPING IN ON DUCK HAWKS

Lowering himself down the jagged cliff on the large rope, husky John Craighead has a smaller one tied around his waist and legs. This "life line" enables him to rest and acts as a safeguard should the climbing rope become frayed on the sharp edges or a falling rock knock him out. On this 300-foot precipice in northern Pennsylvania the authors found a nest with four young hawks (page 123).

We can still recall vividly turning our first hawks loose — the birds skimming along the ground, then rising, up, up, to the topmost branches of a pin oak tree.

TRAINED AT LAST!

They ignored us while taking account of their surroundings, and then tested their wings with a few short flights directly away from us. Were we really going to lose our hawks after months spent in patient training? Of course not. It was the way of all hawks on being released for the first time, though we did not realize it then. They were just seeing how it felt to be free.

After nearly an hour, sure enough, hunger and habit brought them back. They were flown on a string for two days before we again gathered courage to release them. It is well to fly them free for at least a week before flying them at game, so that they can grow strong and learn to handle themselves.

Our great triumph came when our hawks caught their first wild quarry, for from that time on we could consider ourselves falcon-

ONLY THREE WEEKS OLD, COOPER'S HAWKS ALREADY "FEEL THEIR OATS"

Of all the birds trained by the Craigheads, these fierce and aggressive hawks were the most difficult to handle (page 109). With a week's growth of feathers, the young on this nest in Virginia, near Washington, D. C., are able to flutter from limb to limb and will soon be flying from tree to tree.

ers. Incidentally, in hunting with falcons, the game has a lot more than a fifty-fifty chance; probably nearer eighty-twenty.

A PIGEON FOOLS A HAWK

The first time one of our hawks flew at game she was fooled completely. Her keen eyes sighted a flock of pigeons in a wheat stubble field, and she headed for the spot at top speed. Seeing their danger, the pigeons were off, "every man for himself." The hawk went for the one that had been the last to take the air.

The pigeon, with at least a hundred yards start, flew straight for a barn. With the hawk in pursuit, he whizzed through one door and out another on the opposite side. There the wily old bird banked sharply, flew around the barn, went in the first door and hid up among the rafters.

The inexperienced hawk was utterly baffled. She had lost the pigeon when it made the turn. She flew to the edge of the barn and perched there, as if too ashamed to come down. Finally she did return, and thereafter she gave a much better account of herself, turning out to be a far more effective hunter than her sister. We named her "Comet."

COMET LIKED RABBIT HUNTING

Hawks, we found, vary individually as much as people. Some are lacking in spirit, puny, slow. Some are much faster than

"COME ANY CLOSER AND YOU'LL FEEL MY CLAWS!"

If the photographers had approached a few more steps, the young barn owl would have flipped back on his tail so he could use his needle-sharp talons for defense, kicking his feet in the air like a spoiled child. When tamed, these birds make attractive pets and have even been trained to hunt (page 124). The Craigheads had one which they named "Windy" because of his hissing.

KEEN-EYED PRAIRIE FALCONS, EAGER TO LEAVE THE NEST

Though able to fly, they were so far above the ground in their cliffside home in Wyoming that they were afraid to take off, even when the authors climbed down to the eyrie. The Craigheads found that this bird, when trained, was not so fast as the duck hawk, but seemed shiftier on the wing.

LASHING THE AIR WITH POWERFUL WINGS, ULYSSES TAKES OFF ON A HUNT

Dangling from his legs are the jesses, six-inch leather straps, which have just been disengaged from the leash in Frank Craighead's hand. Though free to fly where he pleases, the trained duck hawk always returns to his master. Ulysses has been a favorite of the authors for nearly four years (pages 116 and 117). Usually they let their hawks return to the wild after one season of hunting.

others; they are just born faster, or else they try harder. Such an exceptionally able hawk was Comet.

Rabbit hunting was her favorite sport. Often, as we tramped along through the brush with Comet on our glove, her remarkable eyes would spot a rabbit wholly invisible to us and she would be off. At first, in her eagerness to make a kill, she would swoop at her prey even in thick undergrowth, hitting the bushes a terrific blow and damaging her feathers. Later she learned the trick of following her quarry until it reached a clearing.

Flying from tree to tree, Comet followed one rabbit in this way for more than half a mile and at last struck it in a small, open space. But Mr. Cottontail was wise and quick. He dived through a narrow crotch in a small locust tree, leaving his attacker tightly wedged there.

Sometimes, when shaken off, the hawk would catch up to a rabbit on foot, her long, powerful legs enabling her to make surprising speed. Once the rabbit ducked under a wire fence. The hawk, hotly pursuing, hit the wire and all but knocked herself out. Another time she chased a rabbit halfway down a groundhog burrow.

Since a full-grown rabbit weighs three times as much as a Cooper's hawk and can kick out vigorously with all fours or plunge into a brier patch, Comet took plenty of punishment even when she made a direct hit

"WHAT'S GOING ON DOWN THERE?" WONDERS THE MOTHER BROAD-WINGED HAWK

Her sharp eyes have noticed a movement in the blind at the foot of the tree. From there the camera, fastened to a limb near the nest, was operated by a string. The Craigheads did not capture the two fluffy nestlings, photographed near Washington, D. C., because they had learned from experience that broad-winged hawks are not fast and fierce enough to train as hunters.

from the air. Before long, all of her tail feathers were broken so badly that it was hard for her to fly and almost impossible to make quick stops or turns.

GIVING COMET NEW TAILS

The only thing to do was to give the bird a new tail. As we had no Cooper's hawk tail feathers, we "imped in" those of a male marsh hawk by inserting small needles in the old stubs, fitting them into the new quills, and putting glue on the junction.

This improvised tail worked well until it went the way of the original one. A crow's tail was used next and then the soft, flexible tail of a barred owl, which proved most satisfactory because it would bend without breaking, but it made poor Comet look like no bird the world has ever seen.

Since that first year, we have procured and trained for falconry some ten species of hawks. Some, because they were slow and sluggish in flight or had very little intelligence, we found to be of no use. Others were swift and courageous, intelligent and keen.

On the honor roll we would put the duck hawk, prairie falcon, Cooper's hawk, goshawk, pigeon hawk, sharp-shinned hawk, and even the little sparrow hawk.

At the foot of the class are the red-shouldered, broad-winged, and red-tailed hawks. These are soaring hawks, compara-

CYCLONE, TRAINED PRAIRIE FALCON, CLUTCHES THE LURE

To call him back from a flight, the trainer swings in the air a padded horseshoe with meat attached. Cyclone's ferocity in striking this lure suggested his name. Sometimes he knocks it several feet along the ground. The trainer then picks up the bird, whose talons grasp the torn padding of the horseshoe.

tively sluggish in flight, and they rarely hunt anything but rats, frogs, and snakes. Even these hawks can be trained, however, and we have found that owls, as well as hawks, can be taught to do man's bidding (pages 113 and 124).

A FEATHERED THUNDERBOLT STRIKES

Of all the hawks we have trained, the duck hawk remains our favorite. One of the best stoops or dives we have ever seen a trained bird make was shown us by Ulysses, one of our duck hawks, when chasing a crow (pages 114 and 117).

In flying our falcons we usually put two or more birds in the air at once. They circle above our heads anywhere from a hundred to several thousand feet and then drop on their quarry as it passes beneath them.

Ulysses had been soaring for almost an hour and was barely perceptible to the human eye. But he could easily distinguish the crow that came flying past, three or four hundred feet above us.

For a few seconds we thought the crow was going to pass unmolested, but when Old Corvie was in the exact center of the field, and farthest from cover, Ulysses banked and started down, dropping earthward in a perpendicular dive. As he gathered momentum he pumped his wings in a few short, powerful strokes that seemed to double his already terrific speed.

He dropped so fast that from directly beneath him it looked as if a speck had suddenly expanded into a large, hurtling wedge of streamlined feathers. His feet were back against his tail, which was closed; his wings were half closed to his sides; his beak cut the air, and his eyes seemed to blaze straight ahead at the seemingly motionless crow.

The whistling and whining sound of the diving hawk's wing feathers warned the crow, and he turned over to head for the safety of the ground. But so great was the

speed of the falcon that before the crow had completed this maneuver the pursuer had struck and zoomed above his quarry, ready for another attack if necessary.

There was no need of a second stoop, for the impact of the direct hit had sprayed crow feathers in every direction. They drifted down in zigzag circles behind the falling crow. Before the last had reached the ground Ulysses was standing beside his fallen quarry.

A WINGED THUNDERBOLT PERCHES ON HIS TRAINER'S HAND

Ulysses, so named because of his propensity for wandering, is the duck hawk whose swift attack on a crow is described on the opposite page. This is an American counterpart of the noble falcon of Europe's age of chivalry. Technically, only the female is called a falcon; the male is termed a tiercel.

SOME HAWK PERSONALITIES

We called this hawk "Ulysses" because of his habit of wandering a long way off.

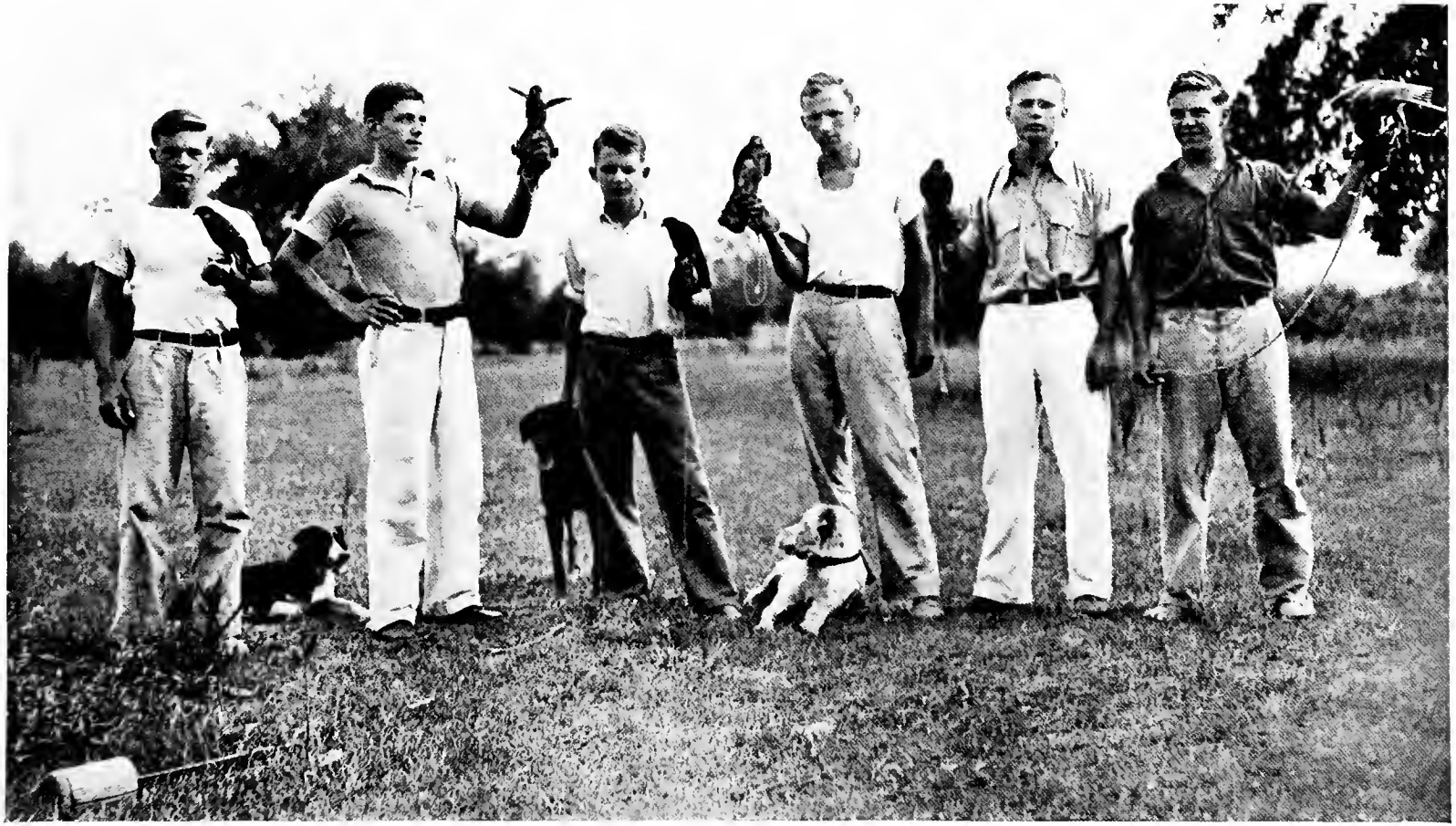
A prairie falcon captured in Wyoming was named "Cyclone" because he hit so hard. He usually hurt himself when he struck the lure, the heavy padded horseshoe with a piece of meat attached which is swung around to call the big falcons back after they have been hunting (opposite page).

Another memorable bird was Bad Boy, a male sparrow hawk, so named because when small he had a way of getting out of his box and then digging his talons into our hands when we tried to put him back. He became so tame that he lived in the house with us like a dog and in fact became great friends with Spike, the family hound.

On his favorite perch on the dining room door he would catch small pieces of meat tossed to him, shooting out his claws at just the right instant or flying off to snag them in the air.

One day, when hungry, he made a murderous dive at a neighbor's pet canary, stunning himself against the unseen glass window and scaring the poor bird almost to death.

Sometimes one hawk will attack another. Once Comet, perched in a maple tree, launched herself at a male Cooper's hawk which one of our friends was carrying on his fist. A quick yell saved the hawk's life. The boy whirled just in time—and Comet's talons ripped a long rent in the back of his sweater.



YOUNG AMERICA TAKES UP THE ANCIENT SPORT OF FALCONRY—TAMING AND FLYING THE MOST SPIRITED BIRDS ALIVE

In Washington, D. C., as in other parts of the country, interest in hawking has grown rapidly in recent years (p. 120). This group of falconers of the Nation's Capital comprises (left to right) Frank Craighead, with a trained pigeon hawk; Chestin Eshleman with a sparrow hawk; Morgan Berthrong with a pigeon hawk; Larry Hufty with a Cooper's hawk; Robert Stevenson with a pigeon hawk; and John Craighead with a tiercel duck hawk. Except the pigeon hawks, all the birds were found at nests within a few miles of the White House. The falcons are friendly with the dogs, which help scare up quarry in the field. In the left foreground is a perch on which a hawk is placed when not being flown.

BIRDS OF A DIFFERENT FEATHER FLOCK TOGETHER AT THE AUTHORS' HOME IN WASHINGTON, D. C.

Nine birds of prey, captured by the Craighead boys and their friends, perch together peaceably enough so long as they are kept apart. When hungry, the larger ones would attack the smaller if allowed within reach. The backyard aviary includes, left to right: a sparrow hawk, young female duck hawk, barred owl, two great horned owls (on arched perches), old male duck hawk, young male duck hawk, another sparrow hawk, and a screech owl. All the birds are trained in falconry except the two young duck hawks.

LEARNING TO FLY, YOUNG SPARROW HAWKS ARE FEARFUL OF THE TAKE-OFF

Not yet old enough to hunt, these residents of Jackson Hole, Wyoming, are fed grasshoppers by their parents. By eating caterpillars, beetles, spiders, and other insects, as well as mice, this smallest of North American hawks benefits farmers. One, owned by the authors, was named "Bad Boy" (p. 117).

For a number of years now a small group of boys has been practicing falconry in Washington, D. C. We catch, train, and fly our hawks together. We use the old falconers' terms, and train our hawks much as they did, but we do not employ the same kind of equipment nor hunt the same kind of game. We fly our small hawks at English sparrows instead of larks. Our large falcons we fly at starlings instead of grouse, and at crows instead of rooks or herons (page 118).

Falconry in this country is by no means confined to Washington. It is being practiced by enthusiastic followers in all parts of the United States and is rapidly gaining favor. We falconers receive numerous letters from all parts of the country asking us how to train a hawk and where we get our birds.

PHOTOGRAPHING HAWK AND RAVEN HOME LIFE

One spring, a very good ornithologist friend of ours, Mr. Richard Rauch, of Harrisburg, Pennsylvania, gave us some valuable pointers in cliff climbing and told us of a cliff in northern Pennsylvania where a duck hawk and raven nested close together. We were especially anxious to photograph an old raven, because we could find no record of this having been done.

On April 24, with provisions for several days, we arrived at the cliff. Inside of

HALF ANGRY, HALF SCARED, IS THIS MONTH-OLD RED-SHOULDERED HAWK

The Craigheads caught and trained one of these birds, but found that it was too sluggish in flight to be desirable for falconry. When hunting, red-shouldered hawks perch on a dead tree or other convenient lookout post, or soar in wide circles while watching for prey.

three-quarters of an hour we located both the ravens' and the duck hawks' nests within seventy-five yards of each other.

The falcon was sitting close, incubating her eggs, and did not fly until the loose end of our rope dangled in front of her. She then left her eggs with a startled cry and dived at us as we hurried down the rope. Her screaming and diving only served to guide us to her four mahogany-colored eggs.

We left the hawk to return to the eggs while we hunted the north face of the cliff for the ravens' nest. We found several old nests before locating the one containing four scrawny, bedraggled-looking young that seemed to be all mouth and voice. The wise old ravens had slunk off and did not give their nest away by futile diving and screaming, as did the bolder duck hawks.

In photographing birds, we have found it pays to gain their confidence step by step, so instead of immediately building a blind near the ravens' nest we roped our cameras on the cliff near by, camouflaged them with stones and moss, and arranged to snap the shutter by means of a string running to a blind at the foot of the cliff.

The northern raven of the Eastern States is one of the shyest, rarest, and smartest of birds, so it was with a great deal of foreboding and doubt that we entered our blind to await the arrival of the old raven.

The damp cold numbed our cramped limbs and the minutes dragged away like

A GREAT HORNED OWL HIDES FROM ITS ENEMY, THE CROW

On its first flight from the nest, the young bird has taken refuge in the hollow of a gnarled black oak, in Virginia. Owls and crows seem to be natural enemies, like cats and dogs. A good way to hunt owls is to listen for the hubbub of rasping caws that crows make when teasing a victim.

hours. At last, after a three-hour wait, the raven returned and we snapped the shutter of the concealed camera. We thought of our discomfort no longer in the realization that we had a picture of an old raven, the bird that we had been told would test the skill of any nature photographer.

However, we knew that getting good pictures in this way would be largely a matter of luck. An outcrop of rock almost completely hid the nest, and we could tell when the ravens returned only by the gurgling sound of the young ones being fed. Our chances of pulling the string at the right time were very slim.

On our second trip to the ravens' nest we decided to leave no more pictures to chance. Hoping the birds had become accustomed to us, we built a blind about seven feet from the nest. There we succeeded in taking both movies and stills. It seemed as if we could almost reach out and touch the old raven as she regurgitated food to the young (p. 129).

HOW RAVEN FENDS OFF HAWK

The raven is not only smart but courageous. When we disturbed the duck hawks they would vent their anger on the poor ravens. Instead of turning tail as most birds do when a duck hawk stoops, the raven would wait until the hawk was about to strike, then turn over on its back and thrust its feet straight up into the face of the speeding duck hawk.

It is hard to say whether the duck hawk was afraid to hit the raven or merely wished to frighten it. At all events we never saw the hawks strike while the ravens were in the air, although they often raked feathers out of the backs of the big black birds while the latter were perched in a tree.

While we were putting up our cameras near the nests the ravens would fly from tree to tree, tearing bark off dead limbs and breaking twigs and buds with their strong beaks in such a frenzy of rage that it seemed as if they would like to tear down the whole

mountainside. The female duck hawk on the other side of the cliff screamed and circled above us, giving an occasional backward glance over her shoulder to see if her eggs were unharmed.

If she did not return quickly after our departure, the male would drop from the sky hundreds of feet above the cliff and force the female back to her nest by a series of lightning stoops. Every time the female flew away from the cliff, the tiercel would head her off and drive her back.

Finally she would return, subdued, to incubate her eggs, while the raven, near by, hastily fed her young, both unaware that their family life was being recorded by the big bright camera eye that had frightened them so much.

A HAWK'S-EYE VIEW OF THE PHOTOGRAPHERS' BLIND

The burlap hides a seat built in the top crotch of a leafy tulip tree in Chevy Chase, Maryland. From this blind the authors took motion pictures of red-shouldered hawks (page 121), beside whose nest Frank Craighead stood when he made this photograph of his brother.

After frequent visits, we saw the young ravens safely out of the nest and on the wing, but fate decreed that the young duck hawks then forming in the egg were never to feel the swish of air on their streamlined bodies. We climbed the cliff one day to find that some predatory animal, probably following our trail across the cliff, had eaten and destroyed the eggs of this monarch of the skies.

We were disappointed that we couldn't get our pictures, but it was worse to know that four young duck hawks, of which there are already too few, would never hunt over those valleys and mountains.

We soon located another nest, high on the face of a particularly dangerous cliff overlooking a small town, and with two friends we set out to climb the steep mountainside.

DANGLING IN SPACE

When we finally reached the top of the cliff we were tired and hot, but one look over that perpendicular drop of 300 feet sent our temperatures down a number of degrees. It was like looking straight down the side of the Washington Monument. We were used to climbing cliffs, however, and realized that once over the edge we would

A YOUNG FALCONER TRAINS OWLS AS WELL AS HAWKS

Two great horned owls, eager to be on the wing, are perched on Frank Craighead's gloved fists. The dangling loop is a leash attached to leather jesses fastened to the legs. Using the same methods employed in training hawks for falconry, Frank and his twin brother John trained owls as pets and even taught some of their barn owls to fly at mice. But the short, unspectacular flights of the owls lacked the thrill of the lofty spiraling and swift stooping of the falcons. Besides, owls do their best hunting at night when the trainer's eyes cannot follow them. The birds shown here, a little more than two months old, were captured along the Potomac in Virginia and later were freed in Rock Creek Park, in Washington, D. C.

WITH EXCITED CHIRPS, TWO DOWNY EAGLETS GREET THEIR MOTHER'S RETURN

The young bald eagles know that mealtime is at hand. On the menu is the catfish (lower left) which the majestic parent will tear into small pieces and feed to her little ones. Eaglets are covered with a fluffy, whitish down for two or three weeks before their feathers appear. To photograph this eyrie, the authors had to climb 80 feet up a big sycamore tree on an island in the Potomac near Washington, D. C. (pages 127 and 132). The bald or American eagle, officially designated as an emblem of the United States in 1782, appears on the Nation's seal and on many coins. Benjamin Franklin objected, accusing the eagle of "bad moral character." He nominated a "much more respectable bird," the turkey gobbler!

FIERCE AND ALERT, THIS YOUNG GREAT HORNED OWL SCARED THE AUTHORS' DOG

"She had just left the nest, near Great Falls, Virginia, but was too weak to fly far. We chased her until she perched on a small limb, which she was unable to grip tightly enough to keep upright, and caught her while she was hanging upside down. Placed on the ground, she fluffed out her feathers, snapped her beak, and glared at us with bright yellow eyes. Our dog was sufficiently impressed to do his barking from a safe distance."

lose all fear in the thrill of the climb.

After tying our ropes to a stout tree and getting our camera equipment in readiness for the descent, we argued as to who would go first. As we all wanted the honor of the first climb and the thrill of finding the eyrie, we flipped a coin. I (John) won the flip and went over first (page 111).

Once over the cliff I could not hear a word from above. Morgan Berthrong went over to the far end of the crag, where he could hear my voice, and relayed my instructions to tighten or slacken the rope.

We had overlooked the fact that the cliff was overhung. When dangling on the end of a hundred feet of rope, with the ground two hundred feet below, I found myself ten feet to the left of the nest and fifteen feet away from the cliff. As I hung there in space I wondered if I had not been hasty in taking first chance.

Frank and Morgan were afraid to attempt swinging me for fear of loosening rocks, and they had about decided to haul me up when I solved the problem myself by taking a deep breath, shoving off a projecting rock, and swinging in a large semicircle which landed my body squarely on the nesting ledge but left my stomach falling in space. Like the parent birds, I had flown to the nest.

The nesting cavity was so small that it barely contained the four half-grown hawks. There was no place to stand, so I signaled and was quickly hauled up by a series of jerks, drops, and bumps.

ONLOOKERS CALL AN AMBULANCE

I explained the difficulty of photographing and we decided instead to bring up two hawks to train. This would be a help to the father of the family, as the female had been shot three days before our arrival and the tiercel was having a difficult time feeding his ravenous brood.

According to the flip, Morgan was second, so over he went. He was busily engaged in putting a screaming, fighting hawk into his knapsack when an ambulance far below came whizzing in to the foot of the cliff. Nervous spectators, on seeing me make the descent, had telephoned for an ambulance,

DOWN COMES JOHN CRAIGHEAD ON A ROPE AFTER PHOTOGRAPHING BALD EAGLES

He spent several hours aloft taking pictures of the birds in their eyrie, 80 feet above the ground in a huge sycamore (page 125). The boys usually climbed the tree with spurs, but in descending it was easier and quicker to tie a rope around the waist and be lowered by friends on the ground. Once, in trying to climb up the rope, Frank nearly fell (p. 132). A true American, the bald eagle ranges north to Alaska and northern Quebec and south to central Mexico. One of these "birds of freedom," named "Miss America," was taken to England and trained in falconry by Captain C. W. R. Knight, who has also flown British and African eagles.

A MOTHER FALCON COCKS A KEEN EYE AT THE LENS AS THE CAMERA CLICKS

Starting to incubate her splotched mahogany-colored eggs, the female duck hawk squats down behind them and slowly shuffles forward, quivering all over to fluff out her feathers so that the warm down next to her body will cover the eggs. This was the first bird of prey photographed by the Craighead brothers in the wild. To focus their camera, the boys had to lie on their stomachs with one foot dangling over the cliff overlooking the Potomac River.

and there it remained, a disturbing element, until we had finished climbing.

Frank insisted on going over to select his hawk and we hoped we were not tempting fate or the rope by letting him go. Nevertheless, the staring spectators and the ambulance worried us. But Frank said, "To heck with them. If we fall, a broom is what they need, not an ambulance."

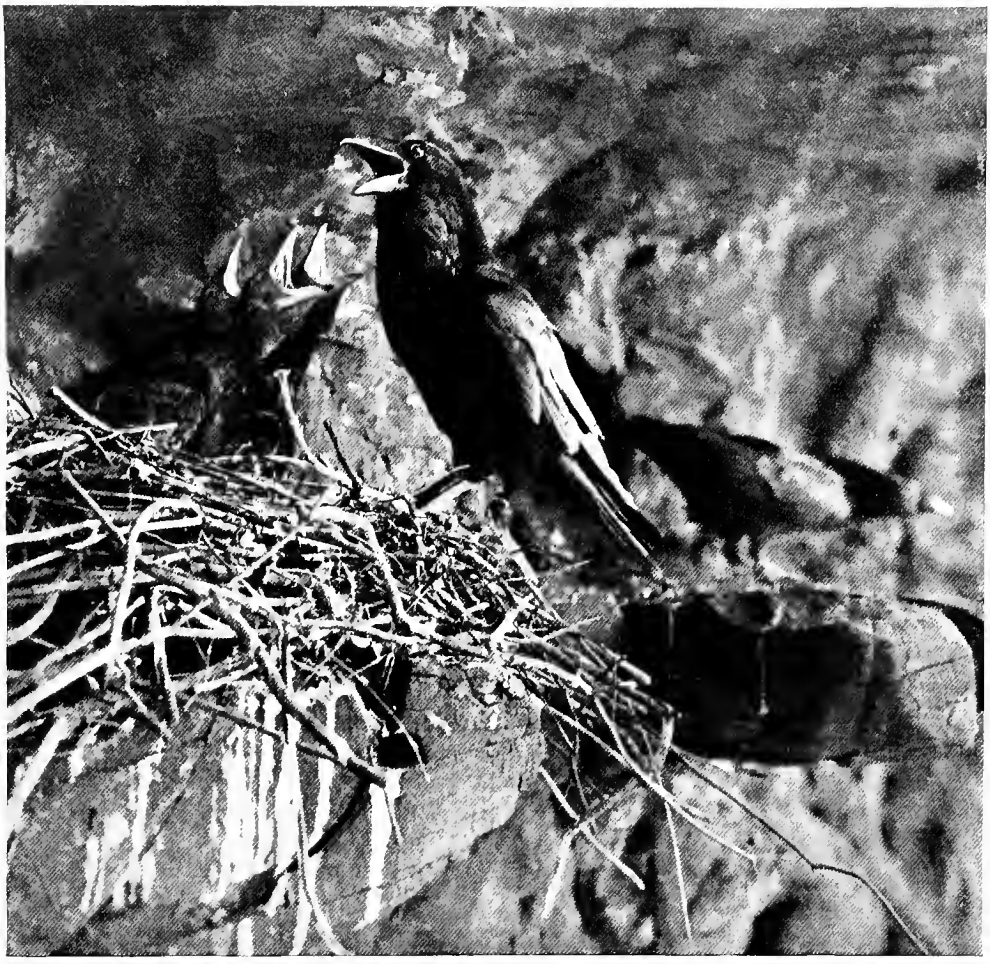
NO PLACE TO BE CARELESS

Frank was lowered, picked a lively young falcon, and started to climb up, but the hawk had other ideas. She got her head and one foot out of the knapsack and when he tried to shove her back she clamped on his hand with her talons. While we held him suspended he pried his hand loose and then climbed to the top, much to our relief.

We have found it never pays to be careless or overconfident while undertaking to climb a cliff. Several summers ago, while quite inexperienced in such work, we climbed to the eyrie of a prairie falcon in Wyoming, about fifty miles south of Yellowstone National Park. As we discovered too late, a steel helmet would have been a valuable piece of equipment.*

Frank, who is always lucky on flips,

* See "Week-Ends with the Prairie Falcon," by Frederick Hall Fowler, in THE NATIONAL GEOGRAPHIC MAGAZINE for May, 1935.



A RAVEN "GLEE CLUB" SINGS LUSTILY AT MEALTIME

The three hungry young birds, their mouths agape, wait impatiently while their wary mother and her mate (right) make sure that the camera is harmless. Carrion and other food, swallowed and partly digested by the old bird, is regurgitated to the young, which are fed in this way until they are able to fly. The nest is made of large sticks and lined with horsehair, taken probably from dead animals on which the ravens have fed (page 120).

climbed over the cliff, while Steve, Julian, and I held tightly to the rope, with our feet braced against a large bowlder. In our haste and ignorance, we forgot to remove the loose rocks near the rope. We saw the danger only after a large rock had hit Frank a glancing blow on the leg.

In attempting to remove the rocks, we loosened several others which fell the fifty feet to the ledge before we could utter a warning and then crashed on down the eight-hundred-foot slope. We could not see Frank from the top and we feared to call to see whether he had been struck. We were certainly relieved when we heard a string of cuss words come from the ledge.

We got our pictures and hawks without further mishap and started to pull Frank up, but we loosened so many rocks that we decided to lower him instead. The rope was fifteen feet short, so we threw Frank a piece of clothesline to tie to the lower end. The clothesline broke when Frank was ten feet from the bottom.

This incident taught us that a cliff is no place to practice trial and error methods. Whether photographing from a tree or a cliff, our motto now is: "Try to be careful. It is not likely that you can be careless more than once."

Between trips to the duck hawk and raven eyries we spent our time photograph-

DIRECT HIT! A MOTHER OSPREY STRIKES A CLIMBER ON THE HEAD, ALMOST KNOCKING HIM OUT OF THE TREE

Luck and a quick hand at the shutter combined to make this striking picture. Swooping down upon Morgan Berthrong's bare head, the furious bird raked furrows across his scalp with her sharp talons. The boys had heard—but apparently *she* never had—that ospreys won't hit a man. Dazed, Morgan could not remember afterward how he had scrambled to the ground. John Craighead, at the nest, leveled his motion-picture camera, while Frank shot the scene from below (page 134).

SETTING UP CAMERAS TO BE OPERATED BY REMOTE CONTROL

Near a pigeon hawk's nest in Minnesota, Frank Craighead fastens a standard-sized motion-picture and two still cameras. The branches were too weak to support a blind, so the photographers concealed themselves on the ground and operated the cameras by pulling strings (page 132).

WINGS AND TAIL CHECK SPEED AS AN OSPREY LANDS

She hurries back to the nest in Yellowstone National Park to protect her two young from the hot sun by spreading her wings over them like a tent. Along the Atlantic coast, ospreys often carry wet seaweed to the nest to keep their little ones cool.

ing a bald eagle that had its nest on an island in a lonely stretch of the Potomac River near Washington (pages 125 and 127).

Although the eagles did not show as much anger at our intrusion as the duck hawks, they were far more difficult to photograph because they returned to the nest only once or twice a day to feed their young. Their nest was 80 feet up in a huge sycamore tree that took almost an hour to climb. To save time we sometimes used a rope instead of spurs.

ALMOST AN ACCIDENT

We had a near calamity when I (Frank) started to climb to the nest to take down our cameras. I had just arrived on the island after a strenuous paddle through a half mile of rapids when I started up the rope.

Ten feet from the limb I began to slow down perceptibly; five feet more and I was almost at a standstill. I was straining every muscle, realizing that I had to make the limb or fall. There was no going down, for it would require more effort to do so than it would take to make the remaining five feet.

My arms were numb and my stomach muscles quivering as I finally got opposite the limb, but still I was by no means safe, for the limb was three feet to one side. I had to throw out my feet and swing myself up over it. My first attempt failed as my feet slipped off the smooth sycamore branch. My arms, now feeling like dead sticks and not a part of my body, slowly straightened out.

For a second I thought how easy it would be to let go, but I did not give this thought time to grow. With a desperate attempt I again swung my legs up against the limb, gave a shove away, and came swinging back onto the branch and safety.

To add to our hardships, the eagle assumed a stubborn attitude and would not return to the nest until nightfall, when it was not practicable to take photographs. Several pictures were finally obtained by waiting all day, sleeping beneath the tall trees at night and waiting until five o'clock the next evening.

HAWKS ATTACK THE CAMERA

We had an interesting time photographing a sharp-shinned hawk. This nervous hundred-yard dasher was the first bird we had photographed that attacked the camera. Both male and female hit it so hard that we feared they would tear the bellows. Ten feet after taking off from a limb they were going at a terrific speed and they did not slow down a particle when they hit the camera.

The fast, shifty sharp-shin is a wonderful hunter. One morning we found six small birds, all of them fresh and completely deplumed, lying on the edge of the nest. We have watched the sharp-shin dodge through the thickest brush after its quarry and know it to be one of the most ruthless and expert of all bird killers, yet we found a nest of young whippoorwills directly under the hawks' nest, and, not a hundred feet farther on, a towhee's nest containing four eggs.

These birds that would have been easy prey for the sharp-shin were living in perfect harmony with the hawk.

This was not our first experience with peaceful birds nesting near predators. Almost invariably we found phoebe nests on duck hawk cliffs, and wrens and several starlings were nesting in the lower part of an eagle nest we photographed.

We had our hardest luck with the sparrow hawk and Cooper's hawk. Out of the four sparrow hawk nests we located, the eggs of two were destroyed by animals before we had even begun photographing; a third was taken by an egg collector, and the fourth was impossible to photograph. We especially wanted a picture of an old Cooper's hawk at her nest, but we were unable to locate a nest until too late in the season.

TO CANADA IN QUEST OF THE PIGEON HAWK

When the hawks and owls in the vicinity of Washington had finished their annual nesting, we decided to take a trip to Canada and photograph the pigeon hawk, which is a northern bird and a late nester. With two falconer and photographer friends, camping and camera equipment, and $35 apiece, we started out in a '28 model car purchased with funds obtained from the sale of our first pictures for publication.

Out of seven nests that we located, some with the help of Frank and Bill Powell, two well-known naturalist guides whom we met at Saganaga Lake, Ontario, we found only one nest suitable for taking still pictures and only one for movies. The ma-

A BIRD IN THE HAND IS WORTH TWO IN THE AIR, THINKS THE FALCON

After an unsuccessful chase, the female pigeon hawk flies back to John Craighead's glove to be consoled with a dead starling. This pugnacious bird of prey was captured by the authors in Minnesota, near the Canadian border. They named her "Lucifer."

jority of the nests were constructed in the topmost branches of swaying evergreen trees, where it was impracticable to put up a camera. The nest we finally decided to photograph was on an island in a Minnesota lake, just this side of the Canadian border (page 131).

The pigeon hawks were very aggressive and dived and screamed at us as we put up our cameras on a near-by tree. The male pigeon hawk, although hardly bigger than a sparrow hawk, hit the opened metal film slide of our camera with his talons, bending it at right angles. The female struck us so often on the head as she flew past us that we ducked unconsciously every few minutes while changing the films in the cameras.

One of our friends was struck on the leg so hard that the hawk drew blood in spite of heavy trousers.

Being very pugnacious, the pigeon hawk returned readily to the nest, even when three cameras were placed six feet away. The male did the hunting while the female perched near by, ready to protect her young.

The female usually fed the young, so the male had to transfer his prey to her. We saw this done in several ways. On one occasion the male returned with a small bird, transferred it from his feet to his beak, and perched on a spruce limb. The female then flew past and took the bird out of his beak with her feet while flying.

FOOD TRANSFERRED IN THE AIR

At other times both birds would be in the air when the transfer was made. When the male returned with food we heard him call to his mate while he was still invisible to us across the lake. The female, on hearing the call, flew over the lake and the male then dropped the bird from above. The female turned over in the air, caught the bird, and carried it to the nest. At times we saw these same hawks catch

dragonflies in the air and eat them while on the wing.

After getting our still pictures, we started taking movies of a more suitable nest, located on a low, swampy peninsula. Our blind was a brown mosquito netting camouflaged with leaves and branches. It served to hide us from the hawks, but not from the millions of mosquitoes, black flies, and "no-see-'ems."

FULL OF MOSQUITO POISON

We camped a whole week in the mosquito-infested swamps near the pigeon hawk nest. We fought mosquitoes all night, only to rise with the sun, enter our blind swarming with insects, and fight them again.

We laugh now to think of those sleepless nights and those hours of misery in the blind, but at the time we were considerably worried over our swollen ears and neck glands. We did not know they were caused by the large amount of mosquito poison injected into our systems. Instead, we visioned a number of terrible diseases.

We had found one place where photography was not fun. Once in the blind, although dressed in heavy clothes, with a mosquito netting over our heads and an insect gun in our hands, we were eaten alive. We sprayed dope, slapped mosquitoes, cussed the whole insect class, and did everything but keep still. The pigeon hawks paid little attention to the slapping and mumbling within, so we got our movies for the Biological Survey and they turned out fine.

HIT ON THE HEAD BY AN OSPREY

Last summer we went to an island off the Eastern Shore of Virginia to photograph the fish hawk, or osprey.

The first nest we picked—a huge affair of sticks—was about forty feet above the ground in a dead pine tree. As we approached, the old ospreys screamed and dived at us, but at first their diving did not excite us, for we had learned that all hawks resent a visit to their homes.

These birds, however, dived so often and came so close that Frank decided to stay on the ground and try to get a picture of the parents swooping at us, while Morgan Berthrong and I (John) climbed up to the nest to take pictures of the young birds.

When I climbed into the nest with the young ospreys, Morgan crawled out on a dead limb to take a picture. He had his legs wrapped around the limb and was looking through the ground glass of his camera.

I was busy taking movies of the young ospreys when I heard a sudden swishing noise and a dull, solid thud. I looked up and saw Morgan slumped on the limb, with one hand up to his head. He clutched a dead stub, righted himself, and then managed to mumble that the osprey had hit him.

I could hardly believe him at first, although the female hawk had dived at us several times and had come very close, so close, in fact, that I could see her large, scaly feet only a few inches from my face.

With a little help Morgan managed to crawl back down the limb. I saw that his forehead was bleeding. Somehow he got safely to the ground and we examined his wound. Besides two cuts that started on his forehead and ran the length of his head, he had a very large bump and a severe headache that lasted all day.

JUST SAVED HIS EYES

Morgan said he had heard the hawk coming while he was focusing the camera. He dropped the camera and looked up to see the hawk only a foot away. He just had time to turn his face down before the osprey struck. He didn't remember how he got down the tree, but he had seemed to realize that he must not let go, for if he fell it was a long way to the ground.

Frank, who was below when the accident occurred, had taken a picture just as the osprey struck (page 130). Morgan felt much better when he learned that being hit by a fish hawk had brought some reward as well as discomfort, although he resented Frank's enthusiastic remark that it would have made an even better picture if he could have snapped Morgan falling out of the tree.

We went back up to the nest and got our pictures, but we kept a wary eye on the old hawk.

By this time we had assembled quite a bit of material, so we managed to scrape up a little more nerve than it requires to go over a duck hawk cliff, and took our pictures and the story of our observations down to the Editor of THE NATIONAL GEOGRAPHIC MAGAZINE.

PHOTOGRAPHING THE NEST LIFE OF THE OSPREY

By Capt. C. W. R. Knight

With Illustrations from Photographs by the Author

BECAUSE of the depredations of the egg-collecting community of Great Britain, the osprey, or fish hawk (*Pandion haliactus*), has not appeared on the list of British nesting birds for the last twenty years.

At one time this unique bird nested annually in certain of the wilder parts of Scotland, but was ultimately doomed to extinction by the systematic and persistent robbing of the nests.

Recently I stood on the shore of a beautiful lake in Inverness-shire and looked across the rippling waters at the tiny island on which the last pair of British ospreys strove pathetically, year after year, to rear their young.

How the collectors could have managed, as they did, to get away with the eggs is almost inconceivable; for, in the first place, they must have run a considerable risk of being seen as they crossed the water to reach the island, and to do so in darkness would have been well-nigh impossible; then barbed wire was entwined around the trunk of the tree, which would not tend to simplify operations; and, lastly, the taking of the eggs must have been accompanied by a considerable degree of danger, for the huge nest was built at the top of an apparently dead branch that stood out from the top of the tree, and it is difficult to imagine how any one could have reached over it.

Nevertheless, the eggs *were* taken, and in spite of barbed wire, padlocked boats, and a watcher who was specially employed to guard the nest. It is recorded that on one occasion the robbery took place at dawn, in a snowstorm, and the enthusiast, who undressed on the shore of the lake, swam across to the island, and got away with the one egg that the nest contained, must at least have been, if unscrupulous, a man of some determination.

THE MOST FAMOUS OSPREY COLONY

Two summers ago I had the good fortune to spend some weeks on Gardiners Island, off the eastern end of Long Island, where, because of the interest and consideration of Mr. Lion Gardiner, who owns it, and Mr. Clarence Mackay, who leases it, the most famous colony of ospreys in the world enjoys a primeval freedom.

The birds that return each year to the island for the purpose of rearing their young probably exceed 300 pairs, and, because they have never been disturbed, they construct their nests in every conceivable situation. One sees the huge piles of sticks, branches, and rubbish at the tops of inaccessible trees, on bushes, buildings, walls, the roots of upturned trees, seashore wreckage, even on the seashore itself.

INTIMATE STUDIES OF NESTING BIRDS

My object was to try for some really intimate studies of the home life of the osprey, and from such a vast collection of nests, many of them in satisfactory photographic positions, I had difficulty in deciding which would be the best for my purpose. In the end I selected one that seemed to possess several promising features: it had a dark background, to my mind a most important asset; its owners seemed to be of a less distrustful disposition than most of the others; there were three well-incubated eggs in the nest—a desirable stage at which to commence operations; and, lastly, there was what we regarded as a mascot on the nest in the shape of rag doll's head!

Ospreys are much addicted to the habit of bringing to their nests various decorative oddments, such as the dried carcasses of birds, crab shells, pieces of board, derelict shoes, bits of clothing, and so on. Such treasures, generally washed up by the tide, are picked up in the osprey's feet as it swings by, and so conveyed to the nest (see illustration, page 249).

One of the most interesting curios that I discovered on an osprey's nest was a book called "Lucille, Bringer of Joy." (We at once christened the parent osprey "Lucille," in the hope that she would be a bringer of joy by allowing us to get some nice pictures.) Among the pages of this

THE MALE OSPREY HOVERS OVER HIS NEST WITH FOOD FOR THE FAMILY

The fish hawk bears a good character in the avian world. He is harmless to most other birds, and so well do they know it that smaller species often build their nests in the interstices of his bulky home. Although courageous in defense of his nest and young, the osprey is seldom an aggressor.

ODDS AND ENDS FIND THEIR WAY TO THE OSPREY'S NEST

This bit of carved wood weighed nearly a pound. It was found in one of the nests on Gardiners Island (see text, page 247).

EGGS OF THE FISH HAWK VARY IN SIZE, SHAPE, AND MARKING

As a rule, the female lays from two to four eggs, rarely five. They are of a light buff base color, blotched with shades of claret and brown. The eggs measure from 2¼ to 2¾ inches in length and from 1½ to 2 inches in diameter.

A PAIR OF FISH HAWKS, EMIGRANTS FROM THE UNITED STATES, REACH SCOTLAND

The author with two of the ospreys which he brought back from Gardiners Island, off Montauk Point, New York, and liberated in their ancestral haunts of Inverness-shire (see text, page 260, and illustration, opposite page).

THE SPOT IN INVERNESS-SHIRE, SCOTLAND, WHERE THE OSPREYS FROM GARDINERS ISLAND WERE LIBERATED IN JULY, 1929

COASTING IN FOR A PERFECT LANDING

The female is approaching a nest built in the sand dunes. Once a nesting place is chosen, the birds are most persistent. An instance is recorded of a pair of ospreys which selected a telephone pole as a home site, and in spite of the fact that the nest was torn down several times by harassed linemen, the birds continued to rebuild. Finally a new pole was set up to one side and the wires moved to it, leaving the birds in triumphant possession of their favored spot.

BRINGING A MEAL HOME FOR THE FAMILY

The osprey will not carry a fish tail-first, presumably because a head-first hold affords better control of the jerking, twisting prey.

FISH HAWKS PREFER TO NEST IN HIGH, EXPOSED POSITIONS

Large, isolated trees without too much foliage are their first choice. To the osprey, like the eagle, almost anything serves as building material.

PREPARING FOR HIS INITIAL TAKE-OFF

Soon after the young ospreys learn to fly they begin to practice catching fish. Many failures and the resultant duckings dampen their feathers but not their enthusiasm.

FARMERS LIKE TO HAVE OSPREYS BUILD IN THEIR TREES

The presence of these birds of prey serves to protect poultry, for they never touch domestic fowl themselves and they will not tolerate the presence of other hawks near their nests. Along some parts of the Atlantic seaboard, farmers place old wagon wheels atop tall posts in the hope of attracting ospreys to nest there.

THE PARENTS SHARE THE RESPONSIBILITY OF RAISING THE FAMILY

The osprey displays deep affection for its young, and one of the parents is almost always within call of the nest, ready to defend the chicks. When fish are brought to the nest, the mother tears them into small pieces for her offspring.

FEATHERED LIGHTNING IN SLOW MOTION

The two lower pictures illustrate the position, feet in front of beak, which the bird assumes before striking the water (see text, page 259).

book I discovered the motor license of its one-time owner.

A HIDING PLACE OF WRECKAGE IS BUILT

Intimate photographs of such a keen-eyed, watchful bird as the osprey cannot be obtained without a deal of prolonged preparation, careful reasoning, and hard work. We (two of the Scotsmen who live on the island and myself) commenced operations by building up, a few feet away from the selected nest, a great pile of wreckage—crates, boxes, and heaps of seaweed—the rough semblance of the actual hiding place, from which I hoped that I could one day obtain the longed-for photographs.

In my experience this preliminary, the building of the hiding place and the way in which it is carried out, is of the utmost importance where the photography of shy birds is concerned. My rule is, "Work with a definite object in view and never be about the place too long." A bird kept from her nest for any length of time is liable to become apprehensive, suspicious; and, if that once happens, woe betide the photographer and his hopes of those intimate, home-life pictures!

Work on the hiding place proceeded gradually, and the heap of wreckage grew as the time passed. Each day more boxes and seaweed were added; each day we breathed a sigh of relief, as we saw from a distance that the old osprey was in no way perturbed by the appearance of the growing pile. At last, one day, with the utmost expediency, the great heap of wreckage was transformed into an actual, habitable blind—a blind roomy and dark within and camouflaged on the outside with the familiar wreckage, branches, and seaweed.

The stage was set; the great moment had arrived. When my companion and I had fixed the camera in position and made everything ready for photography, we retired to a distance to watch developments. We were, of course, rather skeptical as to whether our subject would accept the changes we had made in the appearance of the hide and breathed a silent prayer of thankfulness when we saw her glide toward the nest, alight, and settle down to brood her eggs.

The next day I attempted close-up photographs. My companion accompanied me to the hide, and, when everything was arranged, walked away as obviously as possible, hoping thereby to divert the attention

of the birds from the fact that I still remained behind.

To my relief, everything proceeded according to plan and I obtained the first of my records.

THE YOUNG OSPREY RESEMBLES A PHEASANT

In due time the young ospreys hatched—little fellows covered with prettily marked, brownish down, rather like young pheasants.

While the female brooded them, the snowy-breasted male perched and remained on the stick at the back of the nest, as if to complete the family group. Presently he flew away, to return later on with a fish probably weighing three or four pounds. This the female took from him and, holding it in her foot, tore off tiny pieces with her beak and distributed them among the family. Her extreme tenderness as she did so can only be compared with that of an eagle as she feeds her young.

Such a fierce-looking, wild-eyed creature, and yet so extraordinarily gentle! During the whole of this meal the male osprey remained on the nest as if deeply interested in the proceedings, and only made his exit when the female, having distributed all the food, prepared once more to brood the family (see page 255).

The whole attitude of the family—father, mother, and little ones—was one of complete harmony, and I consequently was amazed when, a few days later, two of the youngsters commenced to fight with such determination that I feared for the life of one of them.

While filming golden eagles in Scotland I obtained some extraordinary pictures, which show two young eagles fighting so desperately that in the end one of them killed the other. For a while I feared that I was going to be a witness to a similar tragedy on this osprey's nest, for one of the little ones seized the other by the scruff of his neck, biting and shaking him unmercifully and in spite of his squeals of protest. In the end, however, the less pugnacious became the aggressor and attacked his opponent with such vigor as to vanquish him completely.

During the whole of this battle the mother osprey stood looking on, as if half inclined to interfere and yet deeming it advisable to refrain from so doing. In the

A STUDY OF AN OSPREY ALIGHTING

Few birds fly with more grace or drop from the sky to seize their prey with greater speed than the fish hawk.

ENJOYING A FREE LUNCH IN HIS NEW HOME

The author took two pairs of the Gardiners Island ospreys back to Scotland and liberated them in the hope of reëstablishing the birds as residents. Fish were put out for them each day until they became so much at home that they caught their own.

FEET THAT MAKE IDEAL FISH TRAPS

The osprey's talons are long, sharp, and powerful. The outer toe may be used reversibly.

ABOUT READY TO START OUT ON THEIR OWN

The young birds, nearly full grown, are about to leave the nest and give their wings a try. The parents continue to supply them with food for some time after this initial venture into the outside world. Nests are not commonly built on the ground like this one, except in localities where years of protection have made the birds confident of their security.

end she let them fight it out, and the family settled down once more to a peaceful life.

The arrival of the male bird with a fish was invariably heralded by the shrill "tew-tew-tew" of the female, and sometimes by the shriller, long-drawn "teew-teew-teew" of the male, as he hovered, high in the air, with a fish in his talons.

In spite of accounts describing the attacks of ospreys on ducks, cats, and even children (!), the bird seems to subsist entirely on fish, and one of my fondest hopes was to obtain pictures of the great bird as it crashed into the water and emerged with a fish in its talons. I thought of trying for records of the bird picking up a fish that had been thrown out of the nets by the fishermen (a thing they often did), but decided that that was not exactly what I wanted, for in taking a floating fish the osprey merely swings by and picks it up by "striking" as it passes.

THE PLUNGE OF THE FISHING OSPREY

What I wanted was a record of the headlong plunge, the total immersion of the bird, and the manner in which it would emerge with the fish grasped in its talons. In the end I accomplished my purpose with the help of a special lens and by waiting for several days on a part of the shore whence I had sometimes seen ospreys fish-

ONE OF THE HANDSOMEST OF THE HAWKS

The osprey acknowledges only the great bald eagle as his master.

ing. These motion-picture records show the feet-first plunge, the period of entire submersion, and the subsequent "shake," or "rouse," as falconers say, to get rid of the water drops.

It surprised me to find what a number of birds made their homes within a few feet of an osprey's eerie—piping plover, spotted sandpiper, tern grackle, and night heron. The last named was particularly interesting in view of the fact that the osprey dislikes the night heron intensely (possibly because herons will swallow young or small birds) and loses no time in letting the herons know it. To see an osprey "stoop" at a heron was a familiar sight, and we also heard the rush of wings and the squawk of the heron as it tried to shift from the stoop.

On two occasions while I was on the island, herons were struck by ospreys; once the blow proved fatal. According to one authority, Richard Blome, the osprey was used in bygone days as a trained falcon for taking "fish and teal." Judging by its prowess where the herons were concerned, there is no reason why it should not have been, and one can only marvel at the manner in which the herons persisted in nesting in trees already occupied by ospreys' nests. When the young ospreys, having continuously and thoroughly tested the weight-carrying capacity of their wings, decided to take to the air, they proved to be accomplished flyers. On its first flight, one of them disappeared over the hill behind the nest, flying beautifully. For some time they would return to the nest periodically for the food which the parents would bring to them, but eventually, able to fend for themselves, they deserted it altogether.

AN ATTEMPT TO REINTRODUCE THE OSPREY INTO SCOTLAND

In the hope of reintroducing the osprey into Scotland, and having obtained the necessary permission from Mr. Gardiner and Mr. Mackay, I took home with me two pairs of the birds, all strong on the wing and all from different nests. They were liberated on that little island in the Scottish lake where the last British ospreys nested twenty years ago (see page 250).

The surrounding country is owned by Colonel Cameron, of Lochiel, who will afford the birds every protection possible. It is to be hoped that they will one day nest there again.

WEEK-ENDS WITH THE PRAIRIE FALCON

A Commuter Finds Recreation in Scaling Cliffs to Observe the Nest Life and Flying Habits of These Elusive Birds

By Frederick Hall Fowler

With Illustrations from Photographs by the Author

TWELVE times a year I present myself before the ticket window of our local railroad station in California, slide through the necessary coin, and cry: "Without!"

Back through the window comes a monthly commutation ticket to the distant city—"without" Sundays. Sundays are mine to do with as I will, and for several years I have willed to spend them far afield.

Formerly Sundays and the latter halves of Saturdays had shown a growing tendency to get mixed up with all the other days—days on which with ceaseless care I pursued my interesting but exacting profession of civil engineer, computing with endless labor the stresses in dams and beams, the yield of rivers, and the peaks of floods.

"Without!" was fast losing all significance. A change was imperative, and that change took me back to an interest of my not-too-distant youth—the pursuit of birds.

Before long I was renewing my acquaintance with that interesting bird, the prairie falcon,* in the canyons extending eastward in the Coast Ranges and opening into the northern San Joaquin Valley.

Let me introduce him as he presented himself to me one breezy day when I was making my way along the base of a nesting crag (see page 622).

Suddenly the male swept over the crest, saw me, gave a prolonged scream, and started upward. He did not spiral up in long circles, as these birds usually do, but in short loops and at as steep a pitch as his wildest efforts would permit.

Up, up he went, with an occasional breathless scream, until he was fully 300 feet above me and probably half again that distance down wind. With a few last upward-reaching wing strokes he attained his pitch and balanced for a moment to turn toward me.

* See "Eagles, Hawks, and Vultures," by Alexander Wetmore, with 30 portraits in colors by Allan Brooks, National Geographic Magazine, July, 1933.

Then, with a few more strong wing-beats, he started down like a stone from a sling. Once on his way, he closed his wings until they were not more than one-quarter open and held as motionless as the vanes on an arrow. His tail, also, contrary to the ideas of many bird artists, was closed nearly to a point. His head, with beak pointing straight at me, was in such a position that I could note perfectly the dark markings, or "mustaching," so characteristic of the falcons.

One hundred feet above me, sensing that his aim was perfect, he closed both wings completely and came like a bullet.

At 30 feet I forgot all I had ever learned of a falcon never striking a man, and ducked. At the same moment he opened his wings very slightly, set his rudder upward, and whizzed by, not more than ten feet above my head. His speed upward appeared nearly as fast as during his descent, although at first he did not fly a stroke.

When the momentum of his swoop had expended itself, he fought his way upward as before and came at me again, this time down wind.

It was a wonderful opportunity to observe just how a falcon must look to a fleeing meadowlark that gives one last glance over its shoulder before the fatal stroke.

PHOTOGRAPHING A BIRD'S HOME LIFE

With a still and a movie camera, instead of the gun of my earlier years, I stalked the prairie falcon. Finally I set out to watch and record the nest life from the laying of the eggs until the young take wing.

It soon became evident, however, why the falcon's eggs are a prize of the collector. Two years passed before I found a nest within a reasonable distance of my home that was not robbed within a week after the eggs were laid.

This "nest on the cliff," as it came to be known in our pilgrimages, was high on a sandstone ledge in the head of a small canyon near the top of a ridge—a region of mountain pastures nearly 2,000 feet above

A SIX-FOOTER CAN VISIT THESE FALCONS ONLY IN A PRAYERFUL POSE

"This hurts me more than you," the author may truthfully remark to the young ones visible on the ledge. At the cost of barked shins and bumps on the head he climbed up each week, gently lifted the youngsters into a box, and took them to the base of the cliff to be weighed and photographed for science (see illustration, opposite page).

sea level (see page 617). The two previous years the eggs had been stolen by "party or parties unknown," and the falcons, without laying a second time, had frequented the various cliffs in the neighborhood for the rest of each summer and well into the fall. This time, although the day was April 1, we were not fooled.

Our sudden appearance over the crest of the ridge was greeted by a slight movement on the ledge and a long and angry scream. There, across the canyon, but not 50 yards away and almost level with us, was the falcon, rising slowly from its eggs and screaming an angry protest. Running a few steps, she launched out from the edge of the ledge and circled above us, screaming. Once or twice she set sail, as if to return to the nest, but changed her mind and remained on the wing.

AT LAST—THE REDDISH EGGS!

At least four reddish-brown eggs lying in a shallow depression in the sand and small fragments of rock at one end of the main ledge could be seen through the field glasses.

Their rich coloring reminded me of the description once given by a small boy I had lowered over a bluff to report on the contents of another falcon's nest.

"Four eggs," he called.

"What color?" I asked.

"Gee, I don't know!" Then, after a moment's pause, "Just the color that makes you want to reach out and grab them!"

Even the protracted screaming and high flying of the female had not brought back the male, who was probably absent on some distant hunt; but when the cliff was revisited in the afternoon he appeared quickly in answer to her short alarm cry, and circled and screamed overhead at a great rate.

He was overburdened with a tremendously full crop, however. This made him look like a pouter pigeon, shortened his breath, and forced him to rest on the dead limb of an oak tree down the canyon. The perch, we found, was one of two favorite lookouts used by both birds.

We were back at the cliff with rope and camera less than a week later (April 7). This time the old bird stuck to her nest like a setting hen, while we scrambled around on

JUST TWO AND A HALF OUNCES OF SLEEPY FALCON

Here at the tender age of three days he could keep his eyes open for only a moment. He frequently lost his balance and curled up as if still in the shell while tape and camera were recording his size (see illustration, opposite page). But all at once he began to grow amazingly, doubling his weight in the next four days. In 24 days an enormous appetite had boosted the figure to 20 ounces, an increase of 700 per cent!

the cliff 15 feet above her head and drove in a steel pin to anchor the rope. She finally decided to leave, however, when the loose end of the rope was thrown down the face of the cliff just in front of her.

One who has long since arrived at years of discretion, weighs 200, and is not particularly fond of high places takes no chances. My anchor pin was a stout three-foot length of drill steel, and to it was attached not only a "hand line," which I firmly grasped, but a "bosun's chair," in which I sat while being lowered straight down ten feet to the edge of the ledge. On the upward journey I would dig my toes into the cracks in the rocks, climb the hand line until my breath gave out, and with the last gasp yell to those above to haul in on the bosun's chair.

Gaining the first foothold on the end of the nesting ledge was always a precarious feat, since the rock above overhung slightly. By balancing a moment, however, and getting a little slack in both lines, it was easy to swing under, and then everything was safe, comfortable, and cosy.

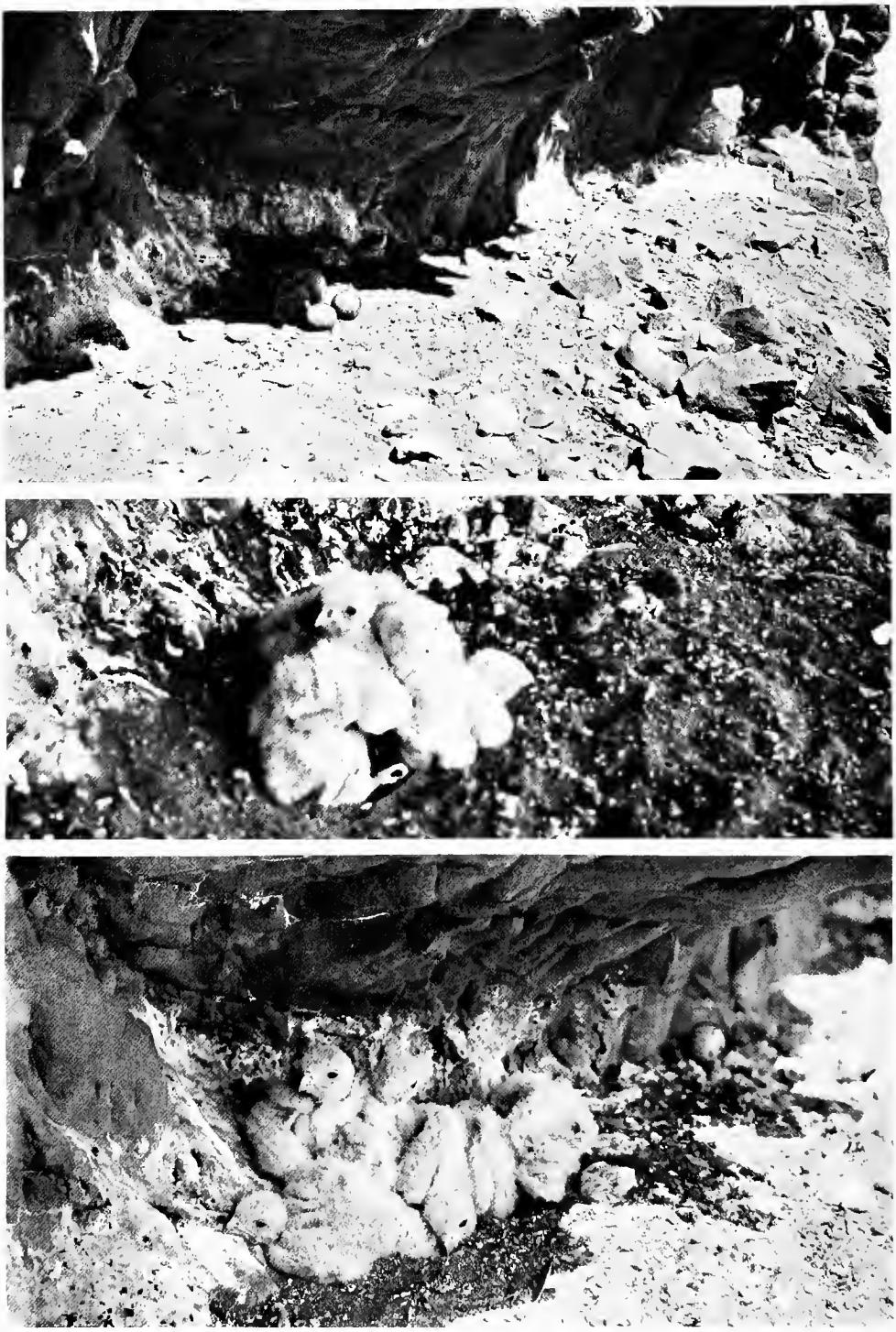
As soon as I had time to get a firm footing and look around, I found the nest contained five instead of four eggs—and they were beauties (see illustration, page 614).

I could have remained indefinitely, seated comfortably on that sandy ledge, high up the cliff, admiring both the beautiful markings of the eggs and the view spread below me; but the anxious cries of the parents from cliff and tree and the fear of their deserting the nest sent me scrambling back up the cliff and away.

The next week-end found me sneaking up behind the sheltering ridge in fear and trembling lest the egg collector on whose bailiwick I was trespassing had been there in my absence.

But luck was still with me. The female was on the eggs, sat tight, and let me take a half-hidden seat under a scraggly oak. She was very nervous at first, but betrayed it only by keeping her head well up, like a poorly made wooden decoy, and turning a watchful eye not only on me, but on everything far or near that looked suspicious.

As her fear wore off, she lowered her head between her shoulders, but did not at any



FIVE LITTLE FALCONS AND HOW THEY GREW—

On a high cliff ledge were laid the eggs, creamy white and heavily marked with chestnut and cinnamon—"just the color that makes you want to reach out and grab them," as a small boy put it. Next appear the downy "quintuplets," nine days old, uttering yawns and faint whistling peeps. At 16 days, four of the five seem too drowsy to hold up their heads. The prairie falcon does not construct a nest, but frequently pirates the stick home of a raven or some other bird of prey.

—FROM EGG TO INDEPENDENCE IN 33 DAYS

In their snowy fleece coats, the 23-day old youngsters (top) rest after a meal of meadowlark. As if ashamed of such a banquet, one hides under the pile. A week later feather growth is well started and they wander to a far corner of the ledge. At 33 days old and nearly ready to leave the nest, they pose for a last close-up (below)—first, peevish "Blackie"; then aggressive "Red"; good-tempered "Green"; solemn "Blue," and "White," just outside the picture (see text, page 621).

NATURE SCOURS DEEP POTHOLES IN A SKULL-LIKE ROCK TO MAKE A BIRD APARTMENT HOUSE

A pair of prairie falcons once lived in a hollow just above the large niche at the left, but they went house-hunting elsewhere when a dance hall and frequent picnic parties in this region north of Altamont, California, destroyed the solitude they demand. In the opposite side of the grotesque, grayish-brown rock is a second large niche in which stands the tomb of an old-time rancher.

ABOVE THESE HAPPY HUNTING GROUNDS PRAIRIE FALCONS WHEEL AND SWOOP

Hungry nestlings on the cliff ledge from which the picture was taken gazed out over the tree-dotted ridges of California's Coast Ranges, watching for their parents to return with tempting ground squirrels or meadowlarks (see illustrations, pages 614 and 615). A pair of golden eagles dwelt in the oaks on the peak at the left and sailed in wide circles high above it. When they swung too close to the falcons' eyrie, they were greeted by angry screams from the latter and then by a marvelous diving aerial attack which made the eagles shift their course.

time let it hang forward with beak down. Bluebottle flies, attracted to the nest by scraps of meat left by the falcons, were flecked off her head and beak with a quick twitch.

THE WATCH ON THE LEDGE

An hour and five minutes by the clock I watched, and then the male sailed in, without a sound from either bird to announce his coming, and alighted on the ledge about five feet from the female's head. For a few moments after his arrival he uttered low and not unmusical screams and stood with head hung straight down, looking at his feet—a pose more common with the Cooper's hawk than with a falcon.

After a few moments he ran quickly along the edge of the ledge to the side of the brooding female, who had not yet recognized his presence by movement or call. The moment he arrived, however, she suddenly half-raised, with lower feathers still puffed out, ran quickly out along the ledge, and sailed away without uttering a sound.

The male looked the eggs over and started to settle himself upon them in her place, but his smaller size made it more difficult to cover them and the operation appeared to worry him. He hunched and shuffled around carefully, but uncomfortably, and finally tucked two eggs under his breast feathers by nudging them along with his beak.

Once fairly settled on the eggs, his anxiety did not seem to end, and he humped himself up and buckled down to his task as if the eggs had been on springs and might shoot out from under him if he relaxed his efforts for a moment.

Within five minutes of getting settled, he suddenly jumped up and sailed off the ledge without a run. I think his scare was due to noticing me for the first time, for no other intruder had approached.

SLEEP OVERTAKES THE NEST SENTINEL

After perching near by and cackling half-heartedly, he finally returned and settled on the eggs as laboriously as before. He wanted to be wild and wary, but times were too dull. He became sleepier and sleepier and finally dozed off completely. From time to time he awoke to fleck flies off his beak, but only once in four hours did he move his body.

Finally the sun began to strike the spot, and after 1 p. m. he kept a sharp lookout for his mate. When she sailed in, about 2:35, he awaited no formalities, but immediately jumped from the eggs into full flight.

The female looked at me and cackled hoarsely, but soon settled herself on the eggs with little of the difficulty and discomfort her spouse had experienced.

Soon after, I uncoiled my cramped legs and called it a day. Five and a half hours of steady watching, much of it through field glasses, had been repaid by an interesting glimpse into the division of labor in a falcon family (see illustrations, page 620).

Further observation was delayed for two weeks by a trip east, and when I slid down the rope to the ledge on April 29 I found five amiable young falcons huddled into a single mass of white down, from which heads, legs, and wings protruded indiscriminately (see pages 614 and 615).

The covering of down was scant enough, so that their very pink skins showed plainly through it. One or two of them sat up from time to time and preened themselves. They indulged, too, in many yawns and gave faint whistling peeps.

Between swoops in front of the cliff the old birds sat in dead trees or on the face of the bluff and yelled their disapproval of me.

"BABY SCALES"—FOR YOUNG BIRDS

A strong breeze was blowing from the northwest on the afternoon of May 2, when we again visited the cliff, and the male was standing by the nest with his back to the wind, screening the young. On our approach he sailed off to his own particular lookout down the canyon; as I went over the top the female appeared and both began the usual circling and cackling.

The youngsters showed very marked growth, had far more down and far less pink showing through, and were much more alert than on my visit three days before. The chalky-white knob, or "egg tooth," on the end of the bill was nearly gone.

For identification, I first tried clipping the extreme tip of one claw; but this proved somewhat unsatisfactory because of the growth and wear, so I marked the five with colored strings. With these as guides, a separate weight record was started that continued for the rest of their nest lives, much to the annoyance of the entire family.

By the time the ceremonies for the day were over, the young seemed both bored

AMONG FALCONS THE FEMALE IS BULKIER THAN THE MALE

Loud screams from the base of the cliff instead of from the nest greeted the author one morning when the youngsters were about 37 days old. All had left the home ledge at the blind and the most enterprising one departed up the canyon when approached, leaving his nest mates for a few final poses.

and chilly and were trying to huddle under the scales—a poor source of warmth and comfort.

Longing for a series of pictures of the young and parents together, but lacking a telephoto lens, I recalled the inventive Private Jones (familiar to the lovers of Bruce Bairnsfather's wartime drawings), who constructed "Little Plugstreet, The Sniper's Friend," a camouflaged sheet-iron tree trunk. Within it the inventor passed a hair-raising morning, overtaken by daylight and under heavy fire while bogged down in a Belgian turnip field.

Our "Little Plugstreet" was a chunk of concrete cast around two boxes set side by side—one large enough to contain a nine-by-twelve-centimeter still camera with a very fine but short-focus lens, and the other a small moving-picture machine.

With much tugging and puffing, we lugged this heavy contraption to the top of the cliff and swung it down to the ledge on the quiet morning of May 6, while both parents circled and screamed.

Arrival of this large freight shipment on the ledge had the young well bluffed. When I came to interview them they were all backed up against the wall in a "sell your lives dearly, boys," pose, and they opened their mouths in unison every time I made a sudden move.

FLASHES OF A FALCON FAMILY

Mother at the top tucks in her babies, covering them with her warm breast. Just below, father glances around with an air of vigilance before sheltering the young in his turn. Next, he gently feeds the weak, eight-day-old youngsters. At the bottom he loafs. Later the parents are in an endless rush to obtain food for their offspring.

This fright soon wore off, however. The youngsters decided that the one being marked and weighed was also being fed, and all crowded forward to get their share.

FALCONS UNDISTURBED BY "PLUGSTREET"

When finally set in place, Plugstreet faced the nestlings at a distance of six feet; but, although about the size of a cracker box, it did not appear to us greatly out of place against the gray sandstone of the ledge. Whether the old and wary falcons would view it in the same light was another question.

As we anxiously watched from a distance, we were delighted to see them both sail in and alight almost on top of Plugstreet without giving this new addition to their furniture the slightest attention.

After a few moments they both sailed out, circled twice, and then the female, returning to the ledge, scuttled over to the young. They had long been milling around, hungry and chilly, and were happy enough when she gathered them under her. It was interesting to note that she seemed more anxious to warm them than to feed them.

On my arrival on May 9 the young were much more warlike and had developed more than during any period so far. The two on the outside of the pile—on the side toward me—were suspicious and full of fight, a third was screened by their bodies and hence neutral, while a fourth was completely buried under the pile and did not seem to know that I was around until I finally dragged him out for weighing. The surprise was too much for his disposition, which, by the way, early in life developed a set toward peevishness. He yelled all during weighing, while he was hobbling back to the nest, and then turned and kept on cursing me.

As a gentle introduction to the sounds which might be heard the next week-end, a fully wound alarm clock was concealed in the rocks just in front of Plugstreet. Steadily ticking, it made a noise not far different from the well-muffled whir of a movie motor; also, the trip lines for the two cameras were strung from the ledge to a brown canvas blind under an oak across the gully.

"Up and at 'em!" was the slogan on the following Sunday morning. It was May 13, and before 9 we were on the ledge and attaching the camera lines, to the tune of angry screams and hoarse cackling of the parents.

Plugstreet was so located that to sight the camera I had to kneel in front of it, leaning over as if praying to Mecca. While I was in this devotional attitude, with the camera pointed back between my legs, a trial pull on the line started the movie machine. The result was 20 feet of film that shows a puzzled group of young falcons framed between and half hidden by a pair of abnormally large boot heels.

Shortly before 11, however, the lines were successfully adjusted and I crawled into the blind across the gulch.

A LONG WAIT IS REWARDED

For an hour and a half there were no developments. It was hot and flies buzzed sleepily. Ten minutes more and I would have been sound asleep; but precisely at 12:25 the male sailed in past the front of the cliff and screamed musically, but did not land. His approach brought a loud chorus of appeals from the cliff, but they gradually died away as he departed. In five minutes he was back, and lit near the nest to look things over. The young were placing breakfast orders at a great rate, and just as I was about to spring one of the cameras he went off again.

At 12:55 he reappeared and, with a few screams to announce the meal, lit on the ledge. He had a meadowlark and, scuttling up to a point between Plugstreet and the young, was promptly surrounded by the whole yelling mob.

When they continued their eager crowding, he picked up the game in his beak, dodged back, holding it as high as he could reach, and ran in a half circle around the group to the nest. During this circuit he looked like a pouter pigeon in action. They swarmed about him again, and he had to step lively to avoid being tramped on by his vigorous family.

BLACKIE'S CHARACTER WARRANTS HIS NAME

My tugging at the camera lines finally parted them, and a loose end, whipped in front of the ledge, sent the watchful bird into the air in an instant. Inspection showed that the regular camera had not gone off, due to the line fouling on a point of rock, but that the movie had nearly run down.

The young, which by this time were familiarly known by the colors of their respective bands, hissed as usual and for the first time clawed at me ineffectively when I caught them for weighing. Blue was the tamest, Red nearly departed around the corner to the farther extension of the ledge, and Blackie, who on my preceding visit had been found on the bottom of the pile and had shown an evil temper, now yelled vociferously, again displaying the mean character that was his outstanding trait in all the time I knew him.

By May 16 life on the ledge had changed radically. Instead of huddling together, the young were wandering about. Out on the extreme end of the shelf, seven or eight feet from the nest, was Blackie, who had adjourned from the main party with a meadowlark's wing, which he was industriously picking. The remains of one or more ground squirrels were scattered about and all the young were "full to the eyes."

Blackie, gathered in with a butterfly net, was deposited in a black bag that I hoped would quiet the birds during weighing. When placed on the scale platform, however, he did a war dance and considerable time passed before quiet was restored.

ALWAYS HOPING FOR A MEAL

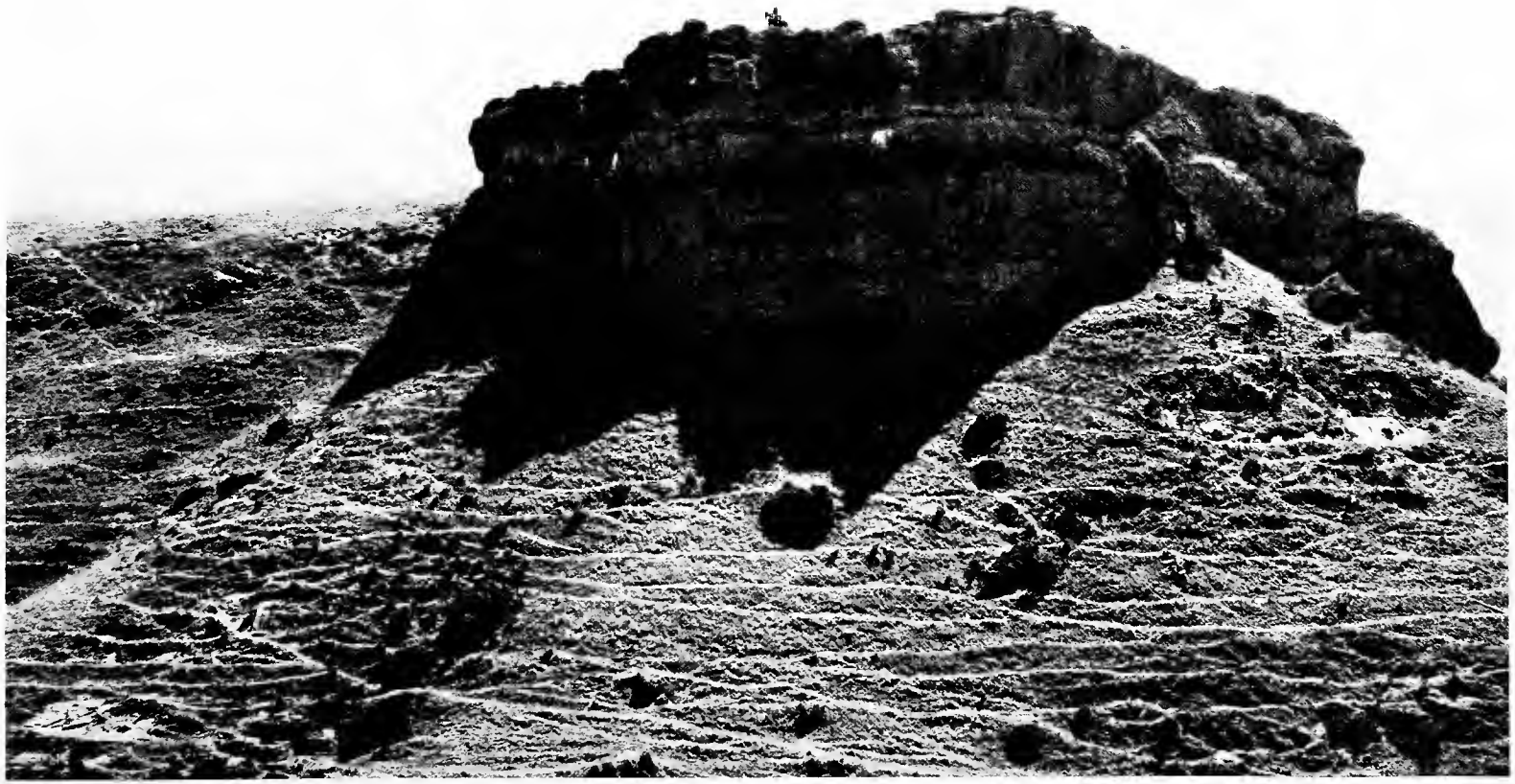
To say they hated that butterfly net was putting it mildly; but, after each one was weighed in turn, they stood around at my elbow and "watched the other boys get theirs." Hope still sprung eternal in their downy breasts that some time I would produce a ground squirrel or meadowlark, and then a general feed would be in order.

The young found their voices for the first time for other uses than calling for food, and tried to answer back the old ones, as they cursed us from the cliff and tree.

As I was weighing the youngsters a gopher snake came gliding along the rock just below the edge of the shelf, and I rolled him over down into the brush at the bottom, where he would do no harm.

Within half an hour after I had rigged the cameras and lines and taken my station in the blind, on the foggy morning of May 20, one of the old birds came in with food. A strong pull on the lines exposed the still camera and ran the movie for the full time, but a final tug again broke one of the strings and routed the proprietor of the free-lunch counter.

After this feeding the young all wandered down to the end of the shelf (see page 615) for a snooze. Captured in the butterfly net for weighing, they seemed to hate it more



A FALCON THAT LIVED IN THIS TALL BUTTE DIVED UPON THE AUTHOR LIKE A "HELL-DIVER" AIRPLANE

Only at the last moment did the bird veer slightly and flash by, not more than 10 feet away (see text, page 611). The rusty-colored rock above and grayish sandstone below form a favorite nesting site for falcons, sparrow hawks, barn owls, rock wrens, linnets, and a twittering host of cliff swallows. Insect size on the summit appears a horseman, the district fire guard. Sheep and cattle trails weave a complicated pattern across the lower slopes.

"FULL TO THE EYES," HE LOOKS LIKE A POUTER PIGEON

Within two feet of the camera in the blind (see illustration, page 625), this young falcon gazes long and steadily out over the promised land that stretches away for miles below him. A thrifty parent has just finished stuffing him until his crop bulges through its sparse downy covering. He draws in his breath with unearthly asthmatic croaks.

THE PRAIRIE FALCON IS STREAMLINED FOR SPEED

The falcon, here about three months old, was tamed by the author. Another one, dubbed "Nize Baby," because he ate up all his hamburger steak, was trained for falconry. One day a sparrow hawk, little more than half his size, swooped down, struck him savagely on the back, and so startled him that he flew away and never came back.

than ever. Blackie, of the evil temper, stood and cursed until I left.

The half hour's observation from the blind showed that the young were moving around very freely. Often one would run four or five feet and then exercise its wings. They also kept grabbing at small objects and occasionally pecked at each other playfully. Eating and sleeping, however, were still their main occupations.

Our repeated visits had probably convinced the old falcons that expostulation was in vain. They spent less time on the wing and permitted closer approach while at rest.

By May 23 the young were so far advanced that the riot usually attendant on weighing would probably have sent most of them flapping down the hillside. The scales and the black bag were therefore laid aside.

While pretty well scattered along the ledge, they did not seem particularly timid, and of their own accord lined up in a most satisfactory manner for the family group (see page 615). This, although we did not know it at the time, was to be our last close contact with the family.

OFF TO SEEK THEIR FORTUNE

When we reached the cliff on the afternoon of May 30, although the male came out to meet us, all of the young had left the nest ledge.

Their screams, answering the frantic yells of the parents, finally disclosed two of them sitting on a sunny ridge of a rock about 200 feet east of the nesting ledge and at about the same level. While we watched them, one flew strongly toward a saddle in the hill just above the nest cliff and disappeared behind it.

I tried to get near enough to the other to get a picture, but he went the same way when I had approached within 25 feet. With a tail wind, both youngsters set a fast pace in their first long flights. I caught just one more glimpse of them, perched in the sage and withered grass of the hillside, their breasts showing a rusty orange in the afternoon sun. Then they were gone.

We located the others resting almost motionless on the opposite end of the cliff from the nest. It was impossible to reach and photograph them. They seemed safe and contented, and so we coiled our rope, cut the camera lines, bade them an affectionate farewell, and departed homeward.

Flight characteristics observed at comparatively close range formed a thrilling feature of our falcon studies.

No one who has ever worked his way to the crest of a cliff above a falcon's nesting ledge will forget the first wild screams that greet his arrival, the arrowlike rush of the bird as it launches forth into space, turning its head to view the intruder, and the astounding exhibitions of wild and headlong flying and swooping that may follow.

BUCKING A STRONG WIND

The character of the entertainment will depend upon the individual birds, the state of their tempers, and in many cases on the strength of the wind.

We visited one cliff during a fierce gale. The female, a very large and strong bird, was sitting on the edge of the old raven's nest she had pirated for a house and absolutely refused to launch out against the wind until I suddenly dropped a coil of rope in front of her.

The results were startling. As the falcon launched herself, an unusually strong gust of wind caught her from beneath. The first lightninglike stroke of her wings shot her upward, hardly a yard from the front of the cliff and almost within arm's reach.

Upward and backward, 50 feet, she went, and then with wonderful and spectacular contortions headed into the gale. That day there was no such thing as circling. The gale was so strong that with wings scarcely opened she was buffeted about like a leaf high over head. Even while thus continually headed into the wind, she had a rough time and frequently a side gust would ruffle her feathers, blow her tail around almost at right angles to her body, and partly capsize her.

Often I had opportunity for contrasting the design of modern monoplanes and the structure of swift-flying birds, of which they are more or less crude copies. I never tired of watching a falcon come sailing in from a great distance, with wings held steady and fully extended in a very symmetrical and strongly curved downward bow.

A FALSE START IN HOUSEKEEPING

I once saw a pair of falcons make a rather interesting false start in housekeeping. After a single egg had been laid on a bare shelf, they deserted it completely for no apparent reason and raised their family in a deep pothole 30 feet below.

Another peculiarity in nesting behavior was noted at the "nest on the cliff" in 1929. Instead of placing their eggs in clear view on the ledge, as they had done the previous year, the falcons chose a pothole six feet below it. In this position the eggs could not be photographed, so we shifted the whole set to the old nesting depression.

Then for the next half hour we watched one of the keenest-sighted of all birds fly directly past its eggs, clearly visible and very conspicuous on the ledge, and go back into the pothole from which they had been removed. While in the pothole the old bird mooned around as solemnly as an owl and uttered puzzled clucks.

This seems to be a typical falcon reaction, for a fellow observer reports that a duck hawk once refused to follow its clearly visible eggs when they had been moved only two feet! It, too, went back to the exact spot where the eggs had been laid.

After we had watched the antics of the old bird in the pothole until it was certain she would not follow her eggs, they were put back. Soon after, they disappeared and are now probably resting in some collection.

A "BOX SEAT" ONLY SIX FEET FROM THE NEST

From inside the hanging blind the author watched and photographed his falcon friends nesting in the upper cleft, and even "dined" with them (see page 626). The spot seemed a wilderness, but no sooner was the mysterious box in place than herders, driving sheep to summer ranges, began to concentrate and inquire about it. Two years before, a falcon family occupied the lower ledge under the overhanging rock (see illustration, page 612).

THE VARIED DIET OF THE FALCON

What is the normal diet of the prairie falcon? To this question there is no definite answer.

Food remnants found at one nest by the writer and analyzed through the kind coöperation of Prof. J. O. Snyder, Department of Zoölogy, Stanford University, by Miss Lydia S. Bowen, then a graduate student, gave a minimum of 45 birds and nine small mammals (gophers and ground squirrels). The most surprising item was a tasty order of eight burrowing owls.

The classified list of birds was as follows: 2 mourning doves, 8 burrowing owls, 3 horned larks, 9 California jays, 15 western meadowlarks, 3 Brewer's blackbirds, 2 California shrikes, 1 rock wren, 1 chicken, 1 unidentified.

The female of this pair was one of the largest and the male one of the smallest falcons I have ever seen, but both were superb flyers and mighty hunters, whose

ALMOST READY TO LAUNCH THE "PIANO-BOX" BLIND

On two steel cables it was lowered over the cliff, near the edge of which the author's son is standing. Entering from above by rope ladder, the observer placed his camera on a shelf, lashed down the cover, and awaited the return of the old birds (see illustration, page 625). When the big box first appeared at their very door, the falcons circled suspiciously, but instead of deserting the eggs they finally sailed in to the nest and continued rearing a family.

prowess was reflected in their varied list of game.

Other families studied in previous years and under different conditions were fed chiefly on ground squirrels. A fellow observer found in the Mojave Desert region a nest of five young raised to a healthy maturity on a diet of chuckwalla lizards, with an occasional collared lizard by way of variety.

My first attempts to secure movies and stills of parents and young together had been tantalizing and only partly successful. One trip down a cliff for each still shot or movie run is too much of a good thing.

Two years later, therefore, a comfortable and roomy box blind, stoutly framed and securely supported by light steel cables from two drill-steel pins, was swung into place at a favorably located nesting site.

An old cotton comforter spread in the bottom and on the bench deadened my footfalls and made a soft seat. Cracks between the floor boards let in a cooling breeze.

The eggs, which were hatched after the blind was first lowered into place, but before it was occupied, were laid in an old raven or owl's nest instead of on the bare ledge.

The nest itself was within six feet of the cameras, and when the young began to move about the distance was often from two to four feet.

To say that I was on intimate terms with the family is putting it mildly. We even dined together, they eating ground squirrel or meadowlark on the outside, while I had a vacuum bottle of coffee, with sandwiches, fruit, and cake inside the blind.

At first the whir or click of the cameras put the old birds to hasty flight, but soon they became absolutely calloused to these noises and even to the sound of tearing off the paper tabs of the film packs.

It was astounding that one of the wildest of birds could be filmed at such close range that the portrait attachment had to be used, and the operator could have reached out to the bird with his hand.

SHADOWY BIRDS OF THE NIGHT*

By Alexander Wetmore

Assistant Secretary, Smithsonian Institution

THE evening air of late February in the Everglades of southern Florida is soft and mild. Delicate scents from unseen blossoms come with the breeze, together with the voices of myriad frogs in incessant but attractive chorus from the marshes. Suddenly, from the moss-festooned live oaks in this peaceful background, comes an outburst of demoniacal laughter, guttural in sound and startling in its abruptness, causing in me pleasant tremors of excitement.

Playing the beam of light from an electric torch through the branches, I discover presently two glowing spots of ruby red, reflections from a pair of eyes. As my own eyes adjust themselves to the feeble illumination, I can distinguish dimly the shadowy form of a great barred owl. The hubbub stops immediately, for the bird is puzzled by the spot of light; but as I continue along the trail the owl, now behind me, utters a loud, prolonged *whoo-oo-oo-aw* that resounds eerily among the trees. Until daybreak I hear at intervals the wild ululation of its calls filling the darkened woodland.

The voices of owls are more familiar than their persons, as most of them are active principally at night, and without special search the birds themselves are difficult to see. Their presence, unseen but constantly evident, has caused imagination to play about them until in practically every country in the world there have grown up fables and superstitions regarding owls.

FABLED BIRDS OF WISDOM AND OF DOOM

The little owl of Europe, about as large as the American screech owl but without the ear tufts of that species, has long been an emblem of wisdom, and in early years was accepted as a special ward of Pallas Athena of the Greeks. Romans, to whom this goddess became Minerva, did not retain this reverence for the bird, considering it of evil omen and a messenger of bad news. Death was foretold by owls alighting on the housetops, and their calls near by at night aroused fear and foreboding.

The vogue of the owl as an emblem of wisdom is not due to any special intelligence of the bird, but to the conformation of the head, with the two eyes so placed that they look directly ahead like those of man.

As the companion of night-flying witches, or as one of the ingredients in the brews concocted by these trouble-makers, the owl developed a black and unsavory reputation, attested by many references to its evil omen in Shakespeare and other writers.

Among American Indians, owls, though feared at times, were in better repute and were the basis of various lively legends. Zuñi tales include stories of one called "gray owl" that lived in a house as a man does. The Pima Indians held that at death the human spirit passed into the body of an owl and, to assist in this transmigration, they gave owl feathers, kept for the purpose in a special box, to a dying person.

ELVES AND GIANTS AMONG OWLS

Among the Plains Indians, the Arikara included an owl group as one of their eight mystic societies, and in the sacred rites of this body they used the stuffed skin of an owl with disks of cunningly fitted buffalo horn for eyes. This emblem was displayed during their ceremonies to represent night, the eyes being symbolic of the morning star.

Owls are found throughout the world from the Arctic regions through the continents and to remote islands in the sea. More than three hundred kinds are known, ranging in size from the tiny elf owls, no larger than sparrows, to the powerful horned owls and eagle owls, which are two feet or more in length.

Scientifically, all owls are included in one order, the Strigiformes, in which two families are recognized, one for the barn owls (Tytonidae) and the other (Strigidae) for all other species.

Regardless of their size, owls are instantly identified by their broad faces with prominent disks of feathers about the eyes, coupled with sharp, curved beaks and claws, and long, fluffy feathers. Their nearest relatives are the whippoorwills, nighthawks, and goatsuckers.*

* This is the tenth article, illustrated by paintings by Maj. Allan Brooks, in the important Geographic series describing the bird families of the United States and Canada. The eleventh article, with paintings in color by Major Brooks, will appear in an early number.

* See "Seeking the Smallest Feathered Creatures," by Alexander Wetmore, in the National Geographic Magazine for July, 1932.

Formerly it was thought that owls were allied to hawks and falcons, but on careful study it was found that these two groups differ radically in structure. The resemblances are superficial and are due to the form of the beak and claws, which have undergone similar development from seeking the same kinds of foods.

Most owls are nocturnal and by day sleep in caves, hollow trees, tangles of leaves, or whatever may offer protection. When they are found by other birds, there is high excitement, jays, cardinals, and the like gathering to scold and chatter at these enemies of the night. Crows are more aggressive and often drive the largest owls to seek more secure cover where they may avoid their cawing tormentors.

The homes of owls are located in hollows of trees, caverns in rocks, or in stick nests built by hawks, crows, or other birds. Often no nesting material of any kind is used. The eggs are white, occasionally tinted with buff or pale blue, but without markings, and are peculiar in being usually elliptical or nearly round. The young are covered with white down and remain in the nest under care of the parents for a considerable time.

QUICK TO DEFEND THEIR FAMILIES

In defense of their young, owls are often aggressive and swoop at any and all who chance to pass, sometimes with startling effect when the attack is delivered without warning. A friend climbing to the nest of a great horned owl (page 228) was struck so savagely in the back by one of the parents that the strong talons of the bird drew blood through his heavy clothing.

While walking at dusk near a woodland camp in eastern Kansas, I was startled by something that, without warning, struck my bare head. The aggressor was a little screech owl (see page 233) with a family of young near by. At other times I have had owls knock off my hat, assisted no doubt by my involuntary flinching as the bird brushed past. In Puerto Rico, country people informed me gravely that a native owl stole the hats of persons who walked the trails at night and carried them off to use them for nests, a superstition probably based on attacks such as those described.

All owls have soft plumage composed of long, fluffy feathers. The wings have softened margins, so that in flight the birds move without sound, as if they were shadows. In owls, the lower leg, or tarsus, and upper surfaces of the toes, bare in most birds, are covered with feathers, these being reduced or absent only in a few species that inhabit warm countries. The plumage colors run usually to gray, brown, and buff, with lighter markings of buff and gray. White and black are extensive in some, but brighter colors are rare or absent.

Some of the smaller owls have rounded markings on the back of the head, resembling eyes. In South America the country people told me these birds were "four eyes" and could see behind as well as ahead (see page 240).

WHY THE APPARENTLY ROTATING HEAD DOES NOT TWIST OFF

The eyes of owls are fixed so immovably in the head, where both are directed forward, that the bird must change the position of the head to alter its line of vision. They are especially large and are adapted for vision where there is little light. As a very small boy, I was told that an owl, sitting on a perch, would follow with its eyes a person moving around and around it, until eventually its neck was wrung and its head was twisted off.

Opportunity arose to test out this intriguing theory on a Florida screech owl, perched in a low pine, and I walked around it for some time with its eyes steadily on me. As its head did not fall off, I was completely mystified, but later, at a somewhat mature age, in other experiments of this kind, I detected the quick movement by which the owl snaps its head around rapidly, giving the semblance of continuous motion in one direction.

Though the majority of owls remain hidden in shaded, secluded places by day, there are a few that are abroad by day or by night indifferently. This is true of the snowy owl, which lives in summer through the long Arctic day, and of the burrowing owls of open country in the New World (see pages 229, 237). One of the latter that I had in captivity for some time delighted in resting in the sun, and in broad daylight would detect and watch hawks and other birds flying at such great heights that I could barely see them.

AN OWL'S MENU HAS A WIDE RANGE

Owls live mostly on animal food which is captured alive, except that occasionally they feed upon rabbits freshly killed by automobiles along our highways, or upon

Photograph by Ben East

THE BARN OWL MAY BE RECOGNIZED BY ITS HEART-SHAPED FACE

Naturalists have classed barn owls under one family, while all other owls are members of another. This one brooded nearly ninety days over a clutch of ten eggs that failed to hatch. Then, after pushing them from the nest, she laid others and raised a family of four.

other carcasses. Mice, rats, and other small mammals are regular prey, as are birds of various species.

The barred owl eats many crayfish and fish, while crabs and fish are staple foods of the fish owls of Africa and India, which have featherless legs and rough, horny-surfaced toes to assist in capturing such slippery prey. I have known the great horned owl to capture goldfish in ornamental pools, but this is unusual.

Owls, like hawks, tear their prey apart and swallow the pieces entire. During digestion the flesh is assimilated, while bones, fur, feathers, and other indigestible portions are formed into compact pellets, which are regurgitated to leave the stomach empty for another meal. Such pellets accumulate about roosts and, through identification of the bones contained, give a valuable index to the food of the bird concerned.

The great horned owls and snowy owls are fiercely predatory, killing rabbits, squirrels, and other creatures of good size. The former has been known to capture and eat small owls. In the Dominican Republic I once saw a burrowing owl tearing at the body of a young bird of its own kind which had been killed and thrown aside by some native. While the mind of a bird may be known only by inference, it was my impression that the owl had been attracted by the sight of bloody flesh, and that the cannibalism was involuntary, the bird being without recognition that its prey was a creature of its own kind.

Occasionally wild mice increase for various reasons until they form a veritable plague. Under such circumstances short-

Photograph by William L. and Irene Finley

ELF OWLS ARE AS ACCESSIBLE AS GNATS ON PORCUPINES

Woodpeckers drill holes in giant cacti. Oozing sap hardens. A gourd-like nest is formed. Result: a home to be appropriated by the tiny, night-foraging elf owl (see illustration, opposite page).

eared owls (page 225) gather in abundance and aid in reducing the numbers of the pests. Burrowing owls feed extensively on beetles and other large insects, and the barn owl in California destroys many Jerusalem crickets (see pages 225, 237).

BARN OWLS DWELL IN THE HEART OF THE NATION'S CAPITAL

Since the early days of the Smithsonian Institution in Washington, barn owls have inhabited the northwest tower of the Smithsonian building, a secure retreat in the midst of the city. From 1,247 of their regurgitated pellets, picked up on the tower floor, I have taken the skulls and other bones of 1,987 field mice, 656 house mice, 210 rats, 92 sparrows and blackbirds, and 4 frogs.

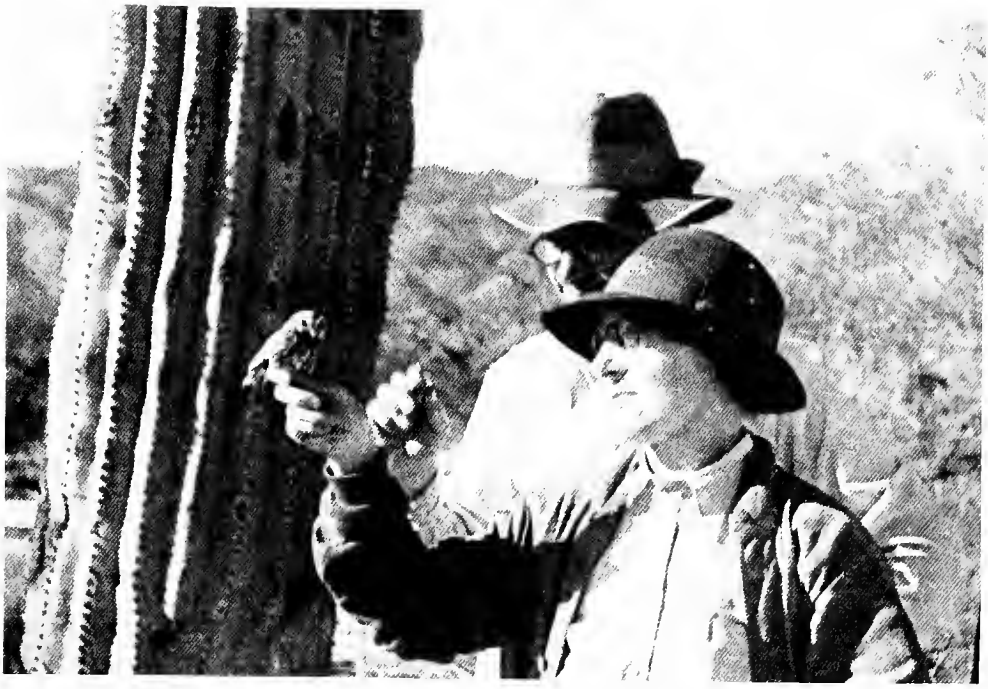
The usefulness of these birds in the destruction of injurious rodents is evident, but in spite of this all owls are considered vermin by some and are killed by hunters whenever seen. The sins of the larger species, which eat chickens and game, are visited on all their brethren, to the end that, with the hawks, owls have been included in bounties, and hundreds of useful kinds are killed under the mistaken belief that they are injurious. The majority of them should be protected at all times.

Barn Owl

(*Tyto alba pratincola*)

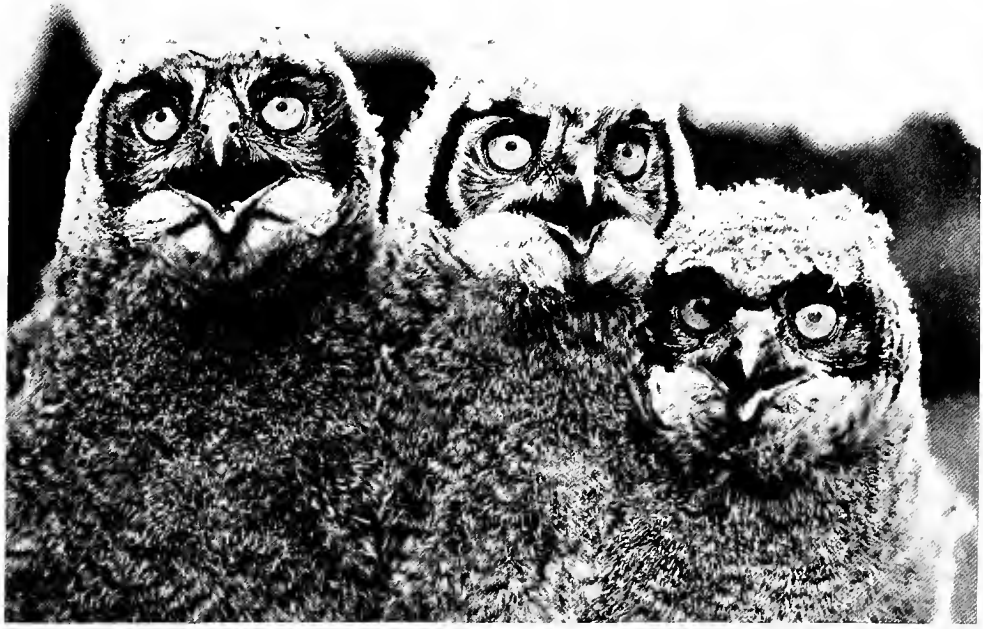
When encountered in a barn, hollow tree, or other retreat, the barn owl exhibits mannerisms so grotesque and utters calls so strange that often there is question as to whether it is bird or beast. Frequently letters come to the Smithsonian Institution asking information regarding it, and to most it is known as the "monkey-faced owl" (see page 225).

This owl remains completely secluded by day, coming out at dusk to search for food. In Arizona I have seen them abroad in early twilight, quartering back and forth over the banks of dry washes and mesas, searching for mice and kangaroo rats. After nightfall in the city of Washington I have glimpsed the white breast of one of these birds by the light of street lamps, as it flew over from the Smithsonian towers to raid the sparrow and starling roosts on Pennsylvania Avenue. In southern California as many as fifty have been found roosting together in groves of oaks.



THE LARGEST CACTUS IN THE UNITED STATES HARBORS THE SMALLEST OWL

Mr. and Mrs. William L. Finley, noted naturalists and bird-lovers, take an elf owl from its hole in a giant cactus in Arizona. These clever little birds have been known to raise one wing in front of them, possibly to disguise their identity (see illustration, opposite page).



Photograph by William L. and Irene Finley

SIX WINDOWS WIDE OPEN AND THREE FOOD DOORS AJAR

These glassy-eyed, young great horned owls seem to be a little impatient because breakfast is late. They may be served rabbit, woodchuck, duck, even a goose or turkey. Their large and ferocious parents are solicitous birds, having been known to attack even men who approached their nests.

The nest of the barn owl ordinarily is concealed in a hollow tree, cave, or building. The eggs are laid at irregular intervals, so that partly incubated eggs and young are often found together. The nesting season is somewhat variable. No nesting material is used except rubbish that may have accumulated in the cavity chosen for a home.

The young crouch, peer, and posture, with nodding heads, in attitudes most strange and unbirdlike, uttering weird calls and hisses that at times resemble the sound of escaping steam. Little wonder that they are objects of surprise to those not acquainted with them!

Barn owls are not aggressive and often do not offer to bite or scratch even when handled. In captivity they are interesting mainly for their grotesque appearance, as they sit quietly by day and are active only by night.

Beneficial everywhere, this species, like other owls, is subject to constant persecution, sad to say. The barn owls eat destructive field mice and rats in large numbers, and in the West add to this diet numerous pocket gophers, a bane to ranchers everywhere. In regurgitated pellets of this owl from California I have identified hundreds of skulls of these destructive mammals. Barn owls also consume large insects, being especially partial to the Jerusalem cricket of the West.

These owls should be protected always for the good that they accomplish in relation to the interests of man.

The barn owl regularly raids the summer roosts of the abundant starlings where these birds gather to spend the night in groves of trees. The capture of a starling or two seems to make little difference to the multitude of its companions, but when the owls remain after the meal and call and chatter, this is too much for starling nerves, and the birds rush out with a roar of wings to circle in the darkness. A few nights of this and they usually remove to other quarters. Those who suffer the annoyance of starling roosts may well wish that barn owls were more numerous.

The barn owl is found regularly from northern California, Colorado, Ohio, and Connecticut south to Nicaragua, and occurs casually north into Canada. Related forms are widely spread through the temperate portions of the world.

Long-Eared Owl

(*Asio wilsonianus*)

When the long-eared owl is flying, its broad wings and tail give a deceptive appearance of size, as in reality the body of this species is small and slight, its bulk being composed principally of long, fluffy feathers (see page 225). In general appearance it resembles the darker forms of the great horned owl (page 228), but is decidedly smaller and differs completely in temperament.

Though formerly abundant, the long-eared owl has suffered at the hands of hunters and bounty systems, so that in many sections of the East it is now rare.

This owl is found during the day hidden in heavy cover, seeking pine and spruce trees where these are available, and the shelter of dense growths of leaves or limbs elsewhere.

In the Middle West I found them in fall and winter in little groups of six or eight that rested near one another. Possibly these were family parties. I have seen them in clumps of willows and in tangled roots beneath the bank of a gully when other cover was not at hand.

Like the screech owl and other small woodland species, the long-eared owl sometimes tries to escape detection by drawing its feathers close against its body and becoming stiffly erect with partly closed eyes, simulating a broken branch or part of a tree trunk.

These birds breed in nests of sticks placed in trees, often using old abodes of crows or herons, but sometimes building their own. Rarely, they place their nests on cliffs or in holes. They have from three to seven young in a brood.

The food of this owl is mainly mice and other small mammals, with only an occasional bird. In 225 regurgitated pellets that I examined, I identified remains of 187 mice and only five small birds. The long-eared owl also eats many large beetles, must be considered beneficial, and merits constant protection.

At a camp in northern Wyoming where I was collecting small mammals as specimens for the National Museum, I was troubled by the loss of numerous traps. I was puzzled as to what had become of them until one day I found a nest of young long-eared owls in a low willow near my camp, with

Photograph by Guy A. Bailey

SILENTLY AWAITING NIGHTFALL—AND A MEAL OF MICE

Daylight finds most owls hidden from sight in dark places—hollows of trees, old woodpecker nests, and other crevices and recesses. This long-eared owl, though resting in an open nest, is sheltered from intense light by thick pine foliage.

my missing traps scattered about it. Evidently the parent owls were not averse to assistance in securing food for a large and constantly hungry family, and as fast as mice were caught they were carried away, traps included, to the nest, where the mice were eaten and the traps discarded.

The notes of the long-eared owl include a low, hooting call, peculiar whining notes, and twittering, whistling sounds. They are less commonly heard than the calls of the larger owls.

The long-eared owl nests from central British Columbia and southern Quebec to southern California and Virginia. In winter it ranges south to southern Florida and central Mexico. Closely allied forms are found in Europe, northern Asia, and North Africa.

Short-Eared Owl

(*Asio flammeus flammeus*)

While most owls are inhabitants of woodlands, the short-eared owl ranges in open country in marshes, prairies, and meadows, where it rests on the ground or on clumps of low vegetation. Walk through its haunts and it rises suddenly, often at a distance of forty or fifty yards, and flies rapidly away, turning its head back over its shoulder to see what has startled it. Sometimes it perches for a moment on a post or low bush. Then its head appears completely round, the tufts of feathers that compose the "horns" being so short as to be seen only near at hand. More often it drops back to the ground, where it is hidden from sight by grass or rushes (see page 225).

More wary than the long-eared owl, this bird has remained common in spite of the many killed by hunters.

Although this owl has excellent eyesight by day, it usually hunts by night, flying with soft wings a few feet above the ground and pouncing suddenly on any prey that appears beneath it. I have seen them in winter coursing by moonlight near the highway leading to the Key Bridge on the Virginia shore of the Potomac River at Washington, and also flying by day over small areas of waste marshlands completely surrounded by railroad tracks in the suburbs of Chicago.

The nest of this owl is placed on the ground, where from four to nine eggs are laid in a slight depression containing a small amount of nesting material. When caring for their young, the parent owls hunt constantly by day.

The short-eared owl eats mice and other small mammals mainly, with occasional birds, and it must be considered distinctly beneficial. Over open ground, the owls seize their living prey easily without stopping, and carry it to a perch to be eaten. When cover is heavy, the owls pounce quickly into the grass and may remain on the ground to eat if successful in effecting a capture. Where there is a sudden increase of mice, these owls gather in numbers and at such times may be considered gregarious, as thirty or forty may be seen together.

The call is a monotonous hoot, repeated rapidly, higher in tone than the call of the great horned owl, and the bird also has high-pitched squealing calls. When its nest or young are approached, it often evidences displeasure by loudly snapping its bill.

This species is regularly migratory and ranges widely when not nesting. It breeds from northern Alaska and Greenland to California, Kansas, and New Jersey, and in winter is found south to Guatemala. It also ranges in South America to the Falkland Islands, and in Europe, Asia, and northeastern Africa. Related forms are found throughout the world.

Great Horned Owl

(Bubo virginianus)

Fiercest and most powerful of our common owls, the great horn is the best known of those found in America. It ranges widely and is able to live under a variety of natural conditions (see page 228).

The great horned owl, except during the nesting season, is solitary and in the main inhabits unsettled areas. In the East and North it frequents dense woodlands of conifers or hardwoods, coming into the open only on its hunting expeditions at night. In arid sections in the West it is found along the cliffs of rocky canyons, or along earth-walled gulches where holes and crannies offer shelter during the day. In the mountains it ranges in open forests where there is little settlement and the birds are not frequently disturbed.

Even in the colder parts of its range this owl nests early in the year. I have taken eggs in Wisconsin the first week in March, during a blizzard, when the weather was so cold that the eggs were frozen before I arrived home. To give approximate dates, in New England they may breed in February and March, in Virginia in late January and February, and in Florida in late November and December.

The nest is usually in the deserted domicile of a hawk or crow, sometimes high above the ground, or about cliffs where holes may be occupied. Where such shelters are lacking the birds have been known to nest on the ground. The eggs usually number two or three, rarely as many as five. One family is reared each season, and both male and female incubate the eggs, which require about four weeks to hatch.

Great horned owls are solicitous parents, protecting their nests most successfully against depredation by other forest creatures, and many are the recorded occasions on which they have struck fearlessly at men who approached their homes. Driven with savage vigor, the claws of this owl can inflict wounds through heavy clothing.

The voice of the great horned owl is a low *whoó whoo whoo whoó whoo whoo*, the first four notes given rapidly and the last two somewhat slowly. One bird of a pair, supposed to be the female, has a deeper voice than the other. The notes carry for long distances, and to human ears attuned to wild Nature they are an attractive and mysterious element in life outdoors.

In choice of food the great horned owl is bold and predatory. Any bird or mammal not too large is subject to attack, this owl killing with ease rabbits, hares, woodchucks, and ducks, and occasionally even taking geese and turkeys. Domestic cats are not immune, and the bird regularly kills and eats skunks without seeming to be affected

LET RATS AND MICE BEWARE THESE OWLS' SHARP TALONS!

When the author analyzed more than a thousand disgorged pellets of a pair of barn owls (top) nesting in a tower of the Smithsonian Institution, Washington, he discovered that they had consumed 2,853 rodents. Because of its characteristic markings, this bird is known to many as the "monkey-faced owl." It and the long-eared owl (left), of catlike face, hunt chiefly at night. Inhabitant of marsh and prairie, the short-eared owl (bottom) has no fear of the sun, being abroad frequently by day. The three represent two families found throughout the United States, the range of the short-eared owl being almost world-wide.

by the odor. I have shot great horns which were so heavily impregnated with this scent that it still remained evident after days of "airing" in the open and years of seclusion in a museum case.

In the north woods great horned owls have been shot filled with the quills of a porcupine, an animal usually immune to attack. One owl was found in Massachusetts holding a large blacksnake in its talons with the snake wrapped about its body so that the bird was nearly choked. Rats, mice, crayfish, large insects, domestic poultry, and birds of all kinds figure in the diet of this species, which must be rated as destructive.

That great horned owls are not entirely savage, however, is shown by one kept as a pet; year after year it served as foster parent to broods of young chicks, hatching the eggs and caring for the unusual brood assiduously.

In the broad territory it occupies, this owl has developed a number of forms that differ in size and color. These differences are illustrated by the accompanying plate (see page 228), which shows the ordinary type with dark coloration, and the arctic horned owl of the north, which is very pale in color though retaining the darker markings.

As a species, the great horned owl ranges from Tierra del Fuego and the Strait of Magellan north through western and northern South America, Central America, and Mexico to the limit of trees in the far north. North of Mexico the geographic races are recognized.

Great Gray Owl

(*Scotiaptex nebulosa*)

Related to the barred owl, which it resembles in smooth, rounded head without feather horns, this species is easily distinguished by larger size, grayer coloration, and light-colored eyes (see pages 229 and 232). The great gray owl lives in numbers in heavy forests in the far north and more rarely in the western mountains. It is known to relatively few persons.

Though this species in actual measurements of total length is among the largest of our owls, equaling or exceeding the great horned and snowy owls in this dimension, its apparent size is due to the long wings and tail and to the length and fluffiness of its plumage in general. As compared to the others, its body is slight and its feet and legs small and delicate.

While it is in the far north, this owl must be forced to hunt at times by daylight because of the length of the day; but it prefers night, and even in its northern range it rests secluded in dense shade when not in search of food.

The great gray owl builds in a tree, making its nest of twigs and moss, lined with feathers or other soft materials. From three to five eggs, slightly smaller than those of the great horned owl, are laid, nesting taking place in the north from April to June.

The notes of this bird are described as deep in tone, but its calls do not seem to be well known.

With its wonderfully thick dress of long, soft feathers which extend clear to its toes, this owl is immune to cold. Though it comes south in winter into the northern United States, its presence there is casual except during years when its food supply in the north fails. Then numbers of the birds are forced southward.

It lives on mice, rabbits, squirrels, and birds, but, being less powerful than the great horned owl, it necessarily chooses smaller prey. Its long, slender, sharply pointed claws penetrate the thick winter fur and feathers of the creatures that comprise its food and hold them without the slightest difficulty.

The great gray owl (*Scotiaptex nebulosa nebulosa*) in America nests from the northern limit of trees south to central California, northern Montana, and central Canada. It comes south in winter as far as Wyoming, Ohio, New York, and New England. The Siberian gray owl (*Scotiaptex n. barbata*), which is paler colored, has been found in Alaska. Allied races range in northern Europe and Asia.

Snowy Owl

(*Nyctea nyctea*)

One bleak December day on the beach near Ocean City, Maryland, a large, apparently pure-white bird, of graceful flight, glided past me to perch on the summit of a low sand dune overlooking the ocean. From its size and color, I recognized it instantly as a snowy owl, a winter visitor from the north (see page 229). It faced the cold wind with gaze directed steadily out across the water, where its attention was attracted

by flocks of ducks driving steadily southward. At intervals it turned to look back over the inland dunes, a form of wild beauty against a wintry setting of gray sky, gray water, and yellow, wind-blown sand.

As I came near, partly hidden behind a ridge of sand, the owl rose and flew to the south, resting from time to time on the summits of the tallest dunes.

The male of the snowy owl is frequently so nearly pure white that careful search is necessary to discover a few dusky flecks on the concealed margins of the wing feathers. The female, considerably larger than the male, is also white, but the plumage is barred more or less heavily with dusky and slaty brown. The birds are well suited for life in regions of cold, as their feathers are long and abundant, and grow in dense, closely set filaments clear to the tips of the toes. Even the bill is almost concealed amid the feathers of the face.

The usual home of the snowy owl is in the far north, where it ranges through the circumpolar regions of both the Old and New Worlds. It lives on the open tundra, though it is found also on the barren slopes of mountains, and seldom enters regions of extensive forests except in winter.

The food of this owl in its native haunt is composed largely of lemmings, which are a kind of short-tailed mice, the arctic or varying hares, and, to a less extent, birds of various kinds, and fish.

BIG INVASIONS IN FAMINE YEARS

At irregular intervals the arctic hares, or snowshoe rabbits, that form much of the winter food of all hunting animals in the vast north, die from disease in such tremendous numbers that there are few left to satisfy the hunger of the many creatures dependent upon them. Lynxes and men are left to starve miserably in the cold of the dark winter days, but the snowy owl spreads its broad wings and glides away southward.

As the shortage of rabbits comes every eight or ten years, the big invasions of snowy owls come at such intervals, though a few may reach the northern United States each winter.

During these flights of large numbers in the New England States, hunters kill dozens of snowy owls out of curiosity as to what they may be. The birds are often found in little companies that may contain six or eight individuals. Several such flocks may be seen at one locality in a day, and in big invasions, such as that of 1926, hundreds of the birds are recorded. The snowy owl travels without fear over the ocean and has come aboard ships a thousand miles from land. Individuals have even reached the island of Bermuda.

A FLYING GHOST IS LAID

Track walkers along a lonely stretch on one of the principal railroads leading into the city of Washington some years ago were terrified at night by a moving white object that glided noiselessly through the air. It was interpreted as the ghost of a man who had been killed in the vicinity. After several weeks during which this spirit of the night had appeared at intervals, striking terror to the soul of the observer, the apparition was laid most effectively when a large snowy owl was shot from its perch in a tree by a hunter.

In the northern tundras the snowy owl places its nest on the ground on some low eminence. The eight or ten white eggs, longer and less rounded than those of most owls, are as large as small hen's eggs, and are laid in a slight depression which may be lined with a feather or two and some bits of moss, or may be bare. The eggs are not deposited at intervals of a day or so, as those of most birds are, but are laid irregularly through a considerable period, so that it is usual to find newly hatched young and fresh or partly incubated eggs in the same nest.

The young are covered with white down, which, as in the adults, extends clear to the toes. The task of incubation is said to fall to the female, but the male stands guard near by or seeks food for his mate.

The snowy owl is not nocturnal, as, in its northern haunts where the sun remains above the horizon during midsummer, it must perforce remain active by day. Even where woods are at hand these birds delight in perching on the ground, preferably on some low hillock where they can look about over open spaces. One that lived for several years in a cage in the National Zoological Park, in Washington, rested usually on the ground, though a perch was provided.

In its northern home this owl is regarded at times with dread, as it is fierce in its attacks on those who approach its nest. Some have asked if it can be really a bird. Laplanders are said to consider the flesh of the snowy owl excellent eating. This taste in food may have been shared by men of earlier periods in Europe, as bones of the snowy

A HIGHWAYMAN OF THE NIGHT AIR LOOKS DOWN ON AN ARCTIC HENCHMAN

One of the fiercest and most powerful of birds, the great horned owl, perched on a tree stump, has been called the "tiger of the air," so savage and fearless are its methods. Like the jungle beast, it strikes unheard, its talons dealing death to birds and mammals. Another form is the arctic horned owl, shown with daggerlike claws deep in the fur of a snowshoe rabbit, whose peculiar track is seen in the snow at the right. The great horned is a bird of eastern, the arctic horned owl of western, North America.

MUCH OF THEIR FORAGING IS DONE IN DAYLIGHT

Because true night is shortened or absent in the northern summer range of the great gray (top), and the snowy owl, they must perforce hunt for hares, mice, and birds during daylight. Both are known as winter residents in northern United States. Foolish crows have been seen mobbing the supposedly sun-blinded snowy owl, only to meet swift death in a rush of silent wings and unerring claws. The comparatively rare great gray, clothed in fluffy feathers, measures the largest of North American owls, though less powerful than its snowy companion.

owl have been found in numbers in the kitchen middens, or refuse heaps, near the caverns and grottoes inhabited by the strange, primitive men of the hunting tribes of Pleistocene times in France.

The snowy owl nests in the barren grounds from northern Russia to Greenland and Alaska, and in its southern flights spreads south to Japan, Turkistan, and even into northern India. It regularly occurs in the north of Europe and comes casually farther south. In the United States it is common, during its irregular occurrences, in the Northeast, particularly on the seaboard, and less abundant westward.

Barred Owl

(*Strix varia*)

In the eastern half of our country the barred owl is one of the best known of its family, its loud calls being familiar to all who are abroad at night in regions of lowland woods. The bird is large, appearing equal to the great horn, though, as in the case of the great gray owl, a good part of its bulk is due to its long feathers, its body being small and relatively slender. The head is round, without vestige of ear tufts, and the bird, unlike most of our other owls, has dark-colored eyes (see page 232). It is solitary except during the nesting season, and then is encountered only in pairs.

In the South barred owls are partial to wooded swamps, and everywhere they are found in the open mainly during their nightly hunt for food. They are loudly vociferous in their calls, these being heard to some extent throughout the year. In spring the variety of their notes is surprising, and on many occasions when sleeping outdoors I have been awakened by their noisy cries.

This owl is frequently mobbed by the small birds of the forest when discovered by day, and at such times it is much disturbed by scolding groups of jays, cardinals, titmice, sparrows, and other species that gather to peep and peer and protest its presence. Crows speedily put a barred owl to flight to more secluded quarters.

The barred owl nests in hollows in trees, or in old hawk or crow nests, laying from two to four eggs. In Florida it nests as early as December and January, while in the North the date is later, usually March and April. Eggs have been found in Connecticut, however, in February, when the ground was covered with snow and the eggs themselves lay on ice frozen in the nesting cavity. One brood is reared each season. These birds are migratory to some extent, and in fall sometimes are lost in unusual situations, so that at times they are found about tall buildings in cities.

The food of this owl is composed mainly of mice and other small mammals, and it takes comparatively few birds. Curiously enough, remains of smaller owls have been found occasionally in stomachs of this species. It also eats frogs, fish, crayfish, and large insects.

The northern barred owl (*Strix varia varia*) is found from Saskatchewan and Newfoundland to eastern Wyoming, Arkansas, and the mountains of North Carolina. The Florida barred owl (*Strix varia alleni*), which is slightly smaller and has toes nearly bare of feathers, ranges in the South Atlantic and Gulf States from the coast of North Carolina to eastern Texas. The Texas barred owl (*Strix varia helveola*), which is paler in color, occurs in south-central Texas. Another form ranges in the highlands of Mexico.

Spotted Owl

(*Strix occidentalis*)

A western cousin of the barred owl, the spotted owl is rightly considered one of our rare and unusual birds. In the Northwest it is found in heavy forests, and in the mountains hides in dense growths of quaking aspens, or in deep, dark canyons. In fall and winter the birds wander from their secluded haunts to some extent and come into other situations. Even so, they are seldom seen, and until recently have been known to few, even among naturalists.

Resembling the barred owl in smooth, round head and dark eyes, this species likewise is chiefly nocturnal, being active in daylight hours principally when it has growing young in its nest. By preference it is abroad at night, coming out by day mainly when driven by necessity to search for food. The mottled colors of the plumage of this owl harmonize completely with sunlight coming through leaves; so that, whether resting motionless on the face of a cliff or against the trunk of a tree, the bird blends with its surroundings and so escapes detection (see page 232).

The nest of the spotted owl is a structure of sticks lined with bark and other soft

materials in the fork of a tree or in a cavity in rocks. One found by Donald Dickey in southern California was located in a hole in the side of a cliff fifty feet above the bottom of a deep canyon. The parent owl, which had two young, was tame and unsuspicious and in no way resented approach, once even alighting in the nest cavity when it was being examined by a man suspended from a rope.

The note of the spotted owl is a hooting call, heard most frequently during the nesting season, when the birds may be quite noisy. They have in addition a considerable variety of other notes. Occasionally these birds may be attracted from their coverts during the day by imitating the shrieking of a wounded or frightened bird, but except for this these owls are seldom seen.

The spotted owl feeds mainly on mice and rats, occasionally taking birds. In New Mexico and California it is recorded as killing many of the abundant wood rats, and a skull of the rare red tree mouse was found in the stomach of one killed in northern California. One kept in captivity by E. S. Steele was tame and confiding and never refused to take mice, rats, or chipmunks from the hand, though even when hungry this owl would not accept birds of any kind.

Three races are recognized. The California spotted owl (*Strix o. occidentalis*) ranges from central California in the Sierras of Mariposa County to northern Baja California. The northern spotted owl (*Strix o. caurina*), somewhat darker, is found from southern British Columbia to central California, and the Mexican spotted owl (*Strix o. lucida*), lighter below, occurs from Colorado and Arizona to central Mexico.

Screech Owl

(*Otus asio*)

A tremulous, high-pitched call, quavering in ghostly cadence through the still night air, announces the screech owl, best known of the smaller American owls, as it is found through a broad range (see page 233).

To some superstitious folk of the South, the note of this bird betokens the approach of death or other trouble if uttered near a house. As a charm to counteract the evil, they turn the left shoe upside down, pull the left trousers pocket inside out, or cast a bit of iron or a handful of salt in the fire—such are the beliefs of those who follow omens.

The ill thus imagined becomes fact and not fancy to the mice and other small creatures that form the food of this rapacious bird. To them the screech owl is indeed a goblin of the night.

A bird of woodland groves and forests, it dwells indifferently in the orchards of New England, the scrub pines of the South, or the scanty cottonwoods that follow the small watercourses in the drier sections of the West. It has prominent "horns" of feathers that project above the head, distinguishing it from any of our other small owls except its cousins, the flammulated and spotted screech owls.

By day the screech owl retires to hollows in trees when these are available, and, failing these, to the densest cover accessible, where it may hide from the eyes of other birds and rest. When it is discovered, there is loud outcry, as jays, cardinals, flickers, titmice, and other small species gather to peer and scold, reviling the one responsible for the destruction of many of their number. Occasionally, when the owl is in an exposed situation, the attack becomes real, and, handicapped by daylight and by force of numbers, the owl may be put to flight to search for safer quarters.

Among the screech owls found in the eastern United States there are two distinct color phases, one gray and one reddish brown, as indicated in the two lower figures of the plate on page 233. These are merely individual variations, as both reddish birds and gray birds are found in the same family of young, regardless of sex. Curiously, the western screech owls do not exhibit these two definite styles in coloration.

Hollows in trees furnish nesting quarters for these little owls, old woodpecker holes being frequently selected. The eggs are laid in the bottom of the hollow without nesting material. Ordinarily from three to five young constitute a family, but as many as nine have been found. When the young are out of the nest the parents often swoop at the heads of passers-by, snapping their bills threateningly.

The screech owl feeds extensively on mice of various kinds and on large insects. Moths and beetles are taken in numbers and birds of various sorts are eaten. Crawfish, frogs, spiders, small snakes, snails, scorpions, earthworms, and millepedes in

THEIR EERIE HOOTING FRIGHTENS THE TIMID

The weird *whoo-oo* night serenade of the northern barred owl (top) may continue until dawn. They frequently respond to imitation of their calls. Inhabitants of dense woods and swamps, they live on mice, fish, crustaceans, insects, and sometimes small birds. Below is the rare northern spotted owl, a western cousin. With the barn and flammulated screech owls (pp. 225 and 236), these are the only dark-eyed members of owl families found north of Mexico.

HOBGOBLIN OF THE DARK IS THE POORLY NAMED SCREECH OWL

A high-pitched quavering note is its nearest approach to a screech, but the uncanny call sometimes stirs the superstitious, who go to fantastic ends to break its "evil spell." Because these small birds destroy harmful mice and insects, they bespeak man's protection. There is no satisfactory explanation as to why the eastern screech owls (lower pair) develop the two plumage phases, red and gray. Kennicott's (top with young) inhabits northwestern North America.

small amount vary the menu, and the birds on the whole are decidedly beneficial. Like other owls in recent years, these birds have become less common in many sections where they were formerly abundant.

About country estates the activities of the tree surgeon in filling cavities and removing dead limbs reduce the number of shelters available for small owls, a matter perhaps to the advantage of other birds. Where natural holes are not available, the owls will often use flicker boxes and similar artificial shelters.

As a species the screech owl ranges from New Brunswick, southern Manitoba, and Sitka, Alaska, south into Baja California and northern Mexico. In this vast area fifteen geographic races, differing in size and color, are found.

The plate (page 233) illustrates two types among these forms. Kennicott's screech owl (*Otus asio kennicotti*), a large dark form, of the northwest coast from Sitka to the State of Washington, is shown in the upper figure.

The red and the gray phases of plumage in the eastern screech owl (*Otus a. naevius*), which ranges from New Brunswick, Ontario, and southern Manitoba to the highlands of Georgia and west to eastern Oklahoma, are depicted at the bottom.

Flammulated Screech Owl

(*Otus flammeolus*)

Our curiosity was aroused by an unusual owl call heard nightly from a small gulch near a camp in the Chiricahua Mountains of Arizona. Investigating, Eugene Law and I found that it came from the little flammulated screech owl, a species as rare as the spotted owl and equally little known. As we moved slowly through the brush in our search, the owl, previously not seen, swooped suddenly at Law's head and then returned to a perch. Here we had a view of its short ear tufts and dark eyes (page 236), the latter being entirely different from the yellow eyes of ordinary screech owls (page 233).

Brief episodes of this character have given naturalists most of what little is known of the habits of this rare owl.

The flammulated screech owl is nocturnal and is seldom abroad by day. It is found in wooded areas in the western mountains, and in Colorado has been encountered as high as 10,000 feet above the sea.

The nest is usually in an old woodpecker hole, where the eggs, two to four in number, are placed on a few chips, to which there are added sometimes bits of twigs or feathers. The egg of a flicker has been found with those of the owl, indicating that the latter may sometimes preëmpt domiciles in use by other birds. However, the owls do not seem quarrelsome, as occasionally neighboring holes in the tree occupied by them may be in use by bluebirds and other hole-nesting species, all living peacefully in close proximity.

One flammulated screech owl collected by Dr. C. Hart Merriam at the Grand Canyon in Arizona had eaten a scorpion and various beetles. These birds also feed on small mammals.

This screech owl ranges from southern British Columbia and Idaho to Colorado, south through the mountains into Mexico and the highlands of Guatemala.

The spotted screech owl (*Otus trichopsis*), which is not illustrated, is somewhat like the ordinary screech owl, but has long bristly tips on the feathers of the face. Like the eastern screech owl, it has two color phases, one gray and one reddish brown. It is found from the Huachuca and Santa Catalina Mountains of Arizona south into Guatemala.

Saw-Whet Owl

(*Cryptoglaux acadica*)

This tiny owl takes its name from its curious notes, uttered constantly during the nesting season. They often resemble the sound made by filing a saw, though at times they are more softly modulated (page 236).

The saw-whet owl inhabits forests where it hunts at night. It breeds from April to June, placing its nest in an old woodpecker hole or other tree hollow, or rarely in a cavity among rocks or in the abandoned nests of birds or squirrels. There is sometimes a slight nest lining to protect the eggs, which range from three to seven in number. The birds call regularly from February to April, when some idea of their abundance may be gained. After the nesting season they become quiet and are seldom seen, as they rest quietly by day and are detected only by chance.

This owl feeds on mice and insects, occasionally taking small birds. At irregular intervals considerable numbers of saw-whet owls come south in winter beyond their

usual range, probably through shortage of their food supply. On such occasions some are thin and emaciated from lack of food, and the birds often appear in unusual localities. Even when in good condition they are frequently captured by hand, as they are so unsuspicious as to appear stupid. It is even possible at times to stroke them without causing alarm.

The saw-whet owl (*Cryptoglaux a. acadica*) nests from southern Alaska, Alberta, and Nova Scotia to California, Arizona, and Mexico, and in the East to the northern United States, coming as far as western Maryland in the mountains. In winter it goes casually as far as Louisiana and Georgia. The Queen Charlotte owl (*Cryptoglaux a. brooksi*), darker in color, is confined to the Queen Charlotte Islands, British Columbia.

Richardson's Owl

(*Cryptoglaux funerea richardsoni*)

This relative of the saw-whet owl is a northern bird that nests north of the United States, ranging widely through forested areas from eastern Canada to Alaska. Like the related species, it is rather strictly nocturnal and even in the far north, where daylight in summer is long, it appears sluggish except when it is dark. The Eskimos, according to Dr. E. W. Nelson, believe that it cannot see by day and call it *tuk-whelinguk,* "the blind one" (see page 236).

It is certain that the birds are tame to a point where they seem stupid, because, when they come in winter to more southern regions where they are in contact with man, they are often caught by hand. One New England lady, seeing a ball of feathers hanging on her clothesline, was astonished to discover that it was a Richardson's owl, alive. When captured, the birds are passive and offer no resistance.

Richardson's owl is an inhabitant of timbered areas, though where large trees are lacking, as in the Yukon Delta in Alaska, it frequents willow thickets. It nests in May and June in holes in trees, or in the deserted nests of other birds, laying from four to six eggs. Its food is mice, insects, and small birds, and it comes south in winter when a shortage of mice deprives it of this food supply. At such times it is found frequently about farm buildings, and many seem to starve, as those captured are often thin and poor.

At intervals they are very common during winter in the woods of Maine and elsewhere in New England, but as yet there is no record of their nesting within United States territory aside from Alaska. The southern invasions are governed by periodic shortages of mice in the north, as then the owls must migrate or starve.

Richardson's owl ranges from the tree line in Alaska, Yukon, and Mackenzie to northern British Columbia and Nova Scotia. In winter it is found casually to Oregon, Colorado, and New England, while its bones have been identified in ancient cave deposits in New Mexico. Tengmalm's owl (*Cryptoglaux f. magna*), a closely related form of eastern Siberia, has been taken on St. Paul Island, of the Pribilof group, Alaska.

American Hawk Owl

(*Surnia ulula caparoch*)

A long tail and slender body mark the curious hawk owl of the north from all our other species of owls, though comparatively few persons see it, as its range in the main is in the vast forests of Canada and Alaska, where human habitations are widely scattered (see page 237).

The hawk owl is much more conspicuous than any other forest owl, as it rests regularly on the top of a tall dead stub or some other commanding perch, where, in broad day, it is entirely in the open. Added to this, it has the habit of jerking its tail nervously like a sparrow hawk, a movement that aids in attracting attention to the bird. Ability to hunt by day or night is truly an advantage to a species of the north where day is long in summer and night equally extended in winter.

These owls are entirely fearless, and there is no difficulty in approaching them within gunshot. Though seen constantly in the open, they are flushed occasionally from thickets of aspen and willow.

The notes are described as a rolling trill, and when the birds are disturbed about their nests the hawk owls utter chattering calls and other sounds of protest.

Heavily feathered to the tips of its toes, this species is entirely unmindful of cold, so that it remains in the far north throughout the winter, coming south in numbers only in those years when mice, lemmings, and other small mammals are scarce. Even then the hawk owl remains as far north as possible, unlike the snowy owl and other

A BROWN-EYED WESTERNER ENTERTAINS WINTER VISITORS FROM THE NORTH

Lazy sleepyhead is the saw-whet owl, clutching a rodent. It often places its nest in an old woodpecker hole or tree hollow. At night its rasping cry sounds like a saw being filed. Eskimos call Richardson's owl (right) "the blind one," since it may often be caught by hand in daylight. Its musical cry is like water dripping from heights. Good mousers, both birds inhabit northern North America. At the moment they are guests of the little-known flammulated screech owl (bottom), whose home is in mountain regions of the West.

ONE REVEALS ITSELF IN TREE TOPS, THE OTHER HIDES IN HOLES

Perching high on an old tree stub, the American hawk owl of Alaskan and Canadian forests awaits the moment to swoop silently down on unsuspecting rodents and birds, while the western burrowing owl stays close to its ground hole, feeding on locusts, snakes, grasshoppers, or anything its sharp claws can snatch. Unlike most owls, both see well and hunt regularly in broad daylight. The burrowing owl, inhabiting unforested regions of western North America, will occupy any abandoned hole or perhaps dig its own.

species that pass southward in numbers.

Regardless always of temperature, the hawk owl begins its nesting season in April and early May, even in the high latitude of Great Slave Lake, at a season when ice and snow abound and the weather is still extreme. A nest of twigs is built in a pine or spruce, or, failing this, the eggs are placed on decayed wood on the summit of a broken stub or stump. Intruders in the home domain are attacked without hesitation, and many naturalists have had hats knocked off by parent owls when climbing to their nests. The birds' sharp claws are to be respected, as they can easily gash the skin.

The hawk owl subsists mainly on mice and lemmings. It eats insects in summer and also kills birds the size of a ptarmigan.

The American hawk owl breeds from northwestern Alaska and Hudson Strait south to southern British Columbia and the Ungava region. It winters south into the southern Canadian Provinces, casually across the border in the northern United States. The Siberian hawk owl (*Surnia u. pallasi*) has been taken twice in Alaska. Other races of this bird are found across Siberia and northern Europe.

Burrowing Owl
(*Speotyto cunicularia*)

During travel through the open plains and desert areas of the West, small owls with long legs and round heads are often seen resting on the ground, perhaps on a little mound of earth (see page 237).

Approach them and they watch attentively, bobbing their heads gravely, or crouch as if about to fly. At the last moment, instead of taking wing, they turn tail and dash precipitately into a hole in the earth, hitherto unnoticed, and disappear below ground in a most astonishing and unorthodox escape for owl or any ordinary bird. On other occasions the burrowing owl rests on posts, poles, or in low trees, and flies away to safety in usual owl fashion.

These owls regularly use old burrows of prairie dogs and other small mammals as their homes, but when these are not available they dig shelters of their own. The form found on the open prairies of Florida must regularly excavate its own homes, as do the related forms of the West Indian islands, since there are no other burrowing animals of proper size to supply them with domiciles.

According to one amusing western story, prairie dogs, burrowing owls, and prairie rattlesnakes live in amity all in the same burrow, each with its own little lateral compartment off the main tunnel leading down from the entrance. The tale is more romantic than probable, as the three are hardly compatible, both rattlesnake and owl being partial to young prairie dogs and possibly also to the flesh of one another. Should all three be found in one prairie dog burrow, this is due to necessity for haste in concealment and not to any preference for one another's company.

The burrowing owl nests in the holes that it inhabits, and its young do not venture far from the burrow opening until they are well able to fly. During the warmer weather these owls subsist largely on insects, especially grasshoppers and beetles.

In late summer, in the plains regions, grasshoppers form the bulk of their food, and in locust years, when these destructive insects abound, the owls eat little else. They also feed on mice, rats, and lizards, and on occasion eat small birds.

One that I kept as a captive was fond of garter snakes, seizing them, pinching them with the bill all along the body, and then swallowing them headfirst. Ordinarily the snake was too long for all of it to be swallowed at once, and the owl stood about for an hour with a few inches of the snake's tail drooping from the corner of its mouth until digestion made room for all inside.

In the level pampas of Uruguay the Gauchos told me that the body of this owl, if eaten by convalescent invalids, promoted appetite for other food.

The ordinary call of this little owl is a loud *boo boo boo*, and it has various chattering notes. Though active at night, it is regularly abroad by day, being able to see in bright sunlight without difficulty. My captive bird, by watching intently, often brought to my notice soaring hawks so distant that they were mere specks in the sky.

Throughout the West these interesting birds are known as "billy owls" or "prairie dog owls." The western burrowing owl (*Speotyto cunicularia hypugaea*) is found in the treeless districts of the West from British Columbia and Manitoba south to western Iowa, Louisiana, and Panama. The Florida burrowing owl (*Speotyto c. floridana*), darker in color, ranges in the prairie region of central and southern Florida. Related races are found in the Bahamas, Hispaniola and other West Indian islands, and in South America.

Pygmy Owl

(*Glaucidium gnoma*)

With the rapid fall of darkness in deep-walled Oak Creek Canyon in north-central Arizona there came a slow, whistled call, uttered in mournful cadence, from distant shelter near the cliffs. At my imitation of the notes answer followed quickly, and after two or three repetitions a little pygmy owl alighted in the tree above me to peer down balefully with distended eyes and jerking tail, searching for the intruder that had dared to invade its special territory (p. 240).

Various birds are attracted by this call. On my first experience with it in the Chiricahua Mountains near the Mexican border a screech owl came, leaving me much puzzled for a time as to whether or not this was the owl that produced the strange and unusual note. In daytime, as I stood in deeply shaded gulches, the whistled imitation of the pygmy owl call has brought about me in scolding flocks kinglets, hermit thrushes, warblers, and other small birds, ready to mob the disturber of their rest.

Pygmy owls are found in forested country, usually about gulches and canyons, where they nest in old woodpecker holes or similar cavities in trees or stumps. The family ordinarily numbers three or four.

Active to some extent by day, they often feed on grasshoppers and other insects. They also eat mice and other small mammals, lizards, frogs, and small birds, the latter including English sparrows. In California these owls have been known to kill pocket gophers, good indication of their strength and prowess, as the mammal is certainly as large and heavy as the owl. They will also strike birds as large as a robin.

This owl has two color phases, one grayish and one rufescent.

Five races of the pygmy owl are found in the region from southeastern Alaska, British Columbia, and Wyoming south to Baja California and Arizona. Another form ranges from the highlands of Mexico to Guatemala.

Ferruginous Pygmy Owl

(*Glaucidium brasilianum ridgwayi*)

This tiny owl, closely related to the ordinary pygmy owl, is widely distributed in tropical America, ranging north barely within the border of the United States. Though small, it is fierce and rapacious. It has been known to attack birds several times its size, tearing at them until they were worn out and at its mercy (p. 240).

The nest of this owl is placed in old woodpecker holes and similar hollows, where the eggs are laid without nesting material. By day the bird generally hides in thickets, but since it is often abroad to hunt, it is far from being strictly nocturnal.

The black spots on either side of the neck seem to natives in South America to resemble eyes, so owls of this type are known in Spanish as "four eyes," in the belief that they can see both before and behind.

The ferruginous pygmy owl ranges from the lower Rio Grande Valley, Texas, and southern Arizona south to Panama, with allied forms in South America.

Elf Owl

(*Micropallas whitneyi*)

Tiniest of all our owls, no larger than a sparrow, the elf owl is abroad mainly at night, so that it is far more abundant than ordinarily may be supposed. It is found in the Southwest, in the country of the saguaro, or giant cactus. Living in old woodpecker holes in the trunks of this cactus, it is secure from most enemies (pages 220, 221, 240).

When captured, elf owls often feign death, lying limp and motionless until chance offers escape, when they dart away instantly to safety. They have been seen also raising one wing and extending it in front of them, so that, hidden behind this shelter, they had no appearance whatever of being a bird. Though confined to the giant cactus belt while breeding, elf owls later may wander afield and are sometimes found in growths of willows or similar dense cover.

Eggs are laid in a woodpecker hole without nesting material. Occasionally the owls preëmpt occupied nests, as their eggs have been found mingled with those of the woodpecker, with the owl in possession.

The elf owl feeds almost entirely on insects, with occasional mice, and in captivity has been known to starve rather than eat birds. In its hunting it seems to be wholly nocturnal.

Whitney's elf owl (*Micropallas whitneyi whitneyi*) ranges from southeastern California and southwestern New Mexico into Sonora. The Texas elf owl (*Micropallas w. idoneus*), grayer above, is found from the lower Rio Grande to the Valley of Mexico. Sanford's elf owl (*Micropallas w. sanfordi*), paler gray, is confined to southern Baja California. A related species is restricted to Socorro Island, of the Revilla Gigedo group, west of Mexico.

ALTHOUGH SMALLEST OF THE OWLS, THEY ARE STOUT-HEARTED AND SHREWD

Resting on the pine bough above is the courageous Rocky Mountain pygmy, who will pounce on squirrels or other rodents twice its own size. In Latin America, natives call the ferruginous pygmy (left) "four eyes," believing the black spots on either side of its neck are eyes and that it sees both in front and behind. Little Whitney's elf, in the tangle of cactus, is the dwarf among owls, being hardly larger than an English sparrow. Wise in the ways of the possum, it feigns death when captured. Southern California to Texas is its habitat.

which won the geographic setting for an accomplished fact.

Dr. Tyrš built his dream on a drill squad of 75 Sokol members, who initiated his system of gymnastics on March 5, 1862. The First Pan-Sokol Festival in 1881, including 696 Sokols gathered from 76 different units, was considered a great success.

The Seventh Sokol Festival in Praha in 1920, involving the mobilization of 70,000 trained athletes and countless spectators, was a major factor in the consolidation of a new nation in the heart of Europe. Czech consciousness and patriotism, fostered by the Sokol organization for nearly 60 years, had proved its worth.

Shortly before the 1932 festival I flew over the great stadium on Strahov Hill. It seemed more like a village than an arena.

There were 140,000 participants in this year's meeting. From June 5 to July 6 the athletic colony was busy. Preceding the main adult festival, from July 2 to July 6, first the children, then the adolescents, displayed their skill and training. From June 29 to July 6 the streets were a riot of color in informal or formal parades of marchers in local or national dress.

THE SOKOL ATTRACTS VISITORS FROM AFAR

Delegates from neighboring lands added even greater variety to the display, which took on characteristics of a fashion show of peasant handicrafts and needlework. Although membership is limited to Slavs and a few nationals from countries which fought on the side of the Entente during the World War, Serbs, Croats, Slovenes, and Bulgars have been allied with the Czechs in the Sokol movement and recent festivals have had an international aspect.

The Stars and Stripes wave over many a colorful procession and July 4 is celebrated as the "Fourth of July."

It is hard to understand how drill teams from 3,144 widely distributed units arrive at such perfection; but the Sokol organization has its own publishing plant and the music to which the movements are set is distributed long before the show.

Special gramophone records are made and sent to all parts of the country, and on Sunday mornings the Praha broadcasting station is used by Sokol instructors, who give directions and the words of command which are employed in the final exhibitions. Nothing is left to chance. That is contrary to the entire Sokol spirit.

The festivals are distinguished not only by mass drills and colorful parades, but also by an allegorical pageant.

In 1932 this allegory related this radio-directed spectacle with the original Olympic festivals which inspired Dr. Tyrš.

From the central stage a figure impersonating the Sokol founder expressed his aspirations for a healthy State composed of healthy beings. Time turned back to Olympia, where such ideals were so notably exemplified. Greek champions, warriors, priests, and poets engaged in spirited contests, and ancient Greece lived again.

THE SPIRIT OF OLYMPIA IN A MODERN STATE

These representatives of antique glories then turned into lifeless statues. There was a pause, during which one could sense the loss the world suffered when the glory that was Greece became a memory. Then the statues came to life, cast aside the drapings of an outworn past, and appeared in the Sokol uniforms which had won new glory during the mass drills of the earlier days of the festival. The Olympic ideal, resurrected, took a place in practical, modern living.

All classes unite in this great exhibition of individual health and group efficiency. Visitors here see a unified nation in concerted action.

Many a Czechoslovak is getting an even greater thrill. Splendid as is the spectacle from the side lines, a part in the big game is even more moving. Every six years a hundred thousand players, trained away from awkwardness and self-consciousness to grace and group-consciousness during months or years of practice, win a rich reward for their efforts. Small teams of athletes cannot attain this nation-wide spirit of coördination. The Sokol Festival is the flower of an entire nation's growth.

During these golden days in Praha a highly industrialized and modern nation lives in the fairyland of beauty and dreams. Where has a dream proved more practical than that of Tyrš, who, behind trained muscles, glimpsed clear, clean, thinking minds and the free State they were to build and serve?

Photograph courtesy U. S. Biological Survey

FREE LUNCH FOR A FEATHERED FRIEND

A Florida jay at Sebring, Florida, taking food from the hand of Dr. E. W. Nelson, until recently chief of the U. S. Biological Survey and a contributor of notable natural-history articles to the NATIONAL GEOGRAPHIC MAGAZINE (see page 71).

Photograph by George Shiras, 3d

EVEN A STUFFED OWL MAKES HIM SEE RED

One of the chief delights of a group of Florida blue jays is to locate some sleepy old owl and worry him. This one is attacking a stuffed owl and is a bit puzzled because the victim shows no interest in his onslaught (see text, page 61, and illustration, page 58).

CROWS, MAGPIES, AND JAYS

Unusual Intelligence Has Earned a Unique Position For These Birds

By T. Gilbert Pearson

President of the National Association of Audubon Societies

With Paintings from Life by Maj. Allan Brooks

The Geographic presents in this issue the third of a comprehensive series of paintings descriptive of all the important families of birds of North America. The first, "Seeking the Smallest Feathered Creatures (Humming Birds)," appeared in the issue for July, 1932, and the second, "The Large Wading Birds (Herons, Ibises, and Flamingos)," in the issue for October, 1932. The fourth of the series will be published in an early number of the National Geographic Magazine.—Editor.

While driving along an unfrequented road in the semidesert country of southern Oregon, I noticed at a distance two large birds apparently engaged in some kind of game. They would fly almost together, then one would dive and quickly mount aloft. Twice he alighted on the ground, but only to rise at once. As we approached, they separated, one perching on the post of a barbed-wire fence. When we were within 80 yards, he flew to a distant post. For half a mile he thus preceded us with short flights.

This bird was carrying something in his beak. My companion fired his revolver, and the bird dropped an object which proved to be the dried leg bone of a jack rabbit. We had come upon a pair of ravens at a time when they were in one of their playful moods. Sometimes a dozen or more may be seen maneuvering about each other, nose-diving, volplaning, or tumbling about in mimic combats. For the time all dignity is forgotten and the solemn birds present a performance entirely out of keeping with what is generally regarded as their usual habits of life.

The Raven in Folklore

Tradition emphasizes the idea that the raven is a dour and somber bird. The shadow of his sable wings falling across the path of a bride foretells disaster. He is sinister and mysterious, and his coarse croakings through the centuries have been thought prophetic and portentous of evil.

His remarkable sagacity has caused many to believe that he possesses attributes of a divine nature, while others think that his uncanny shrewdness is derived directly from the Evil One. Odin, the chief god of the Norsemen, was attended by two ravens, who whispered advice in his ears. It was the raven that Noah first sent forth from the Ark. To Elijah, hiding by the brook Cherith, the ravens brought food. In Wales the legendary hero, Owein, was accompanied by an army of ravens that guarded him from harm. In Ireland, Cú Chulainn had the constant service of two magic ravens to warn him of the coming of his foes. The Greeks were not unmindful of the raven's power.

Tradition is back of the ravens kept in the Tower of London; there is meaning in the raven forms carved on the totem poles of Alaska.

The Pilgrims Warred on the Raven

In the world are many thousands of species of birds to which the people pay scant attention. But wherever the raven is found, the inhabitants are aware of his presence, and tell of his weird powers as they gather about the campfire or sit in council in the igloo, the hogan, or the mountain cabin.

Our raven is merely one of the geographical races of the ravens inhabiting many parts of the Northern Hemisphere.

The Pilgrim Fathers found him in Massachusetts, but he soon fell into evil repute, for it was discovered he would attack and

Photograph by Dr. A. A. Allen

YOUNG CROWS ARE MOSTLY APPETITE

This is the welcome home which awaits Jim Crow or his spouse when they return to the nest with dinner. They are faithful parents and work hard to keep their youngsters' voracious hunger appeased.

kill the newborn lambs and sickly sheep. So the people made war upon him, and to-day ravens do not build their nests within the boundaries of that State.

The bird is not uncommon in Maine, especially near the sea, where he is a scourge to some of the bird colonies of that rocky coast. On the island of No Mans Land, near the fishing village of Matinicus, Maine, a pair of ravens has lived for years in a nest in a sturdy evergreen tree. How long ago it was built I was not able to learn, but it is a very substantial structure. Year after year it has been repaired by the addition of a few new sticks, a little fresh wool, a few billfuls of seaweed, and small roots to help shape afresh the ample bowl for the eggs.

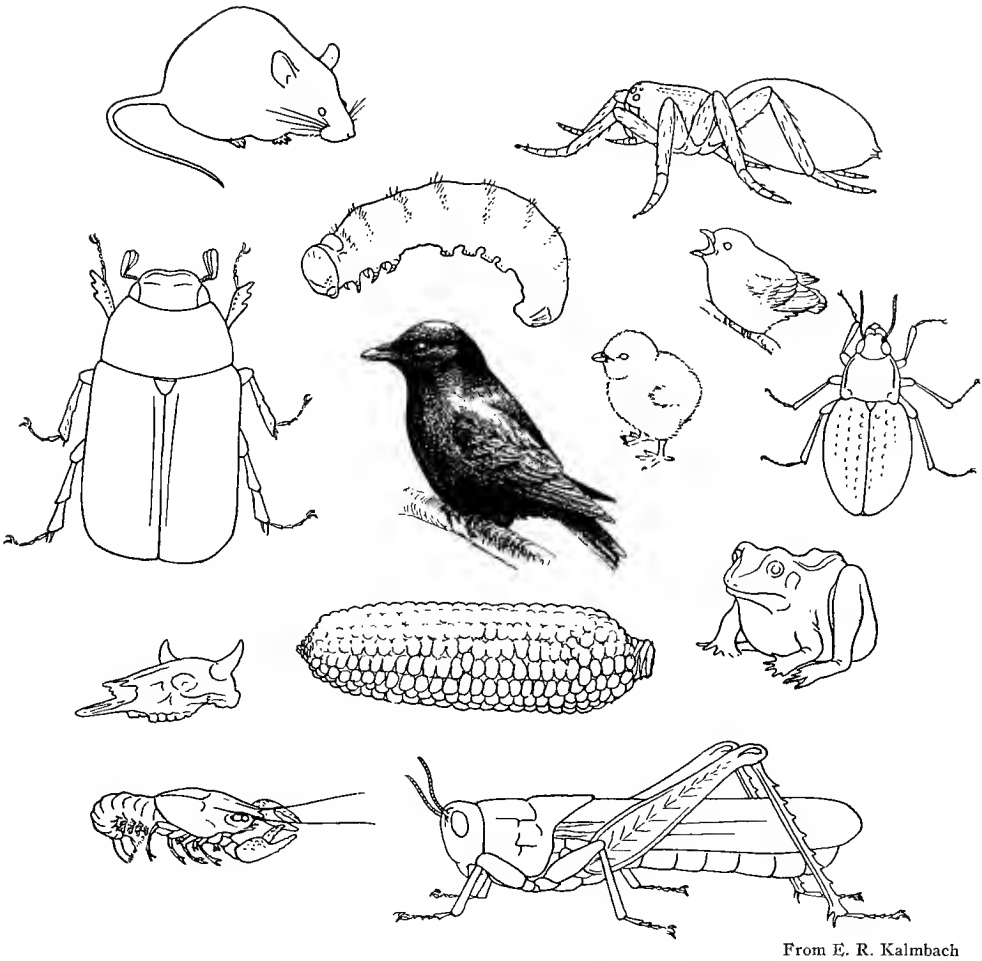
Defying the fierce gales which in winter sweep over these icy seas, the eerie stands secure, and every season has seen it occupied by young ravens, which, here at least, need not "lack and suffer hunger."

On this rocky island, safe from the ordinary enemies of birds which haunt the neighboring mainland, many thousands of herring gulls assemble in summer. Their eggs, as well as the young, are constantly eaten by the ravens, and a continuous warfare goes on between the two species.

On a sagebrush slope in northern Nevada I found a raven feeding upon a sage hen, and in a little opening in a Utah forest I came upon three ravens and a turkey vulture eating the body of a young mule deer. Probably in neither case were the ravens responsible for the death of the creatures upon which they were feasting.

It makes no difference to the raven how long an animal has been dead; he seems to relish carrion just as much as he enjoys the flesh of recently killed animals. Groups of ravens gather every day in summer about the refuse heaps back of the hotels in Yellowstone National Park and pick over the garbage in company with the bears. Often you may find one or more waiting expectantly on the posts of a certain corral in Glacier National Park.

Just north of the Grand Canyon, in northern Arizona, lies the Kaibab Plateau, with its famous deer herd attracting tourists from afar. Here, when the deer were accustomed to gather in the afternoon, I



From E. R. Kalmbach

WHAT IT TAKES TO RAISE A CROW

The nestling crow requires about 10 ounces of food per day, or about 13⅛ pounds for its nestling life of three weeks. At the end of that time it will weigh about a pound. During this period it will have eaten two and a quarter times its own weight of May beetles. The grasshoppers it has eaten would, if combined, form a mammoth insect about twice the size of the bird. Wild birds and poultry would each form a mass about a fifth of the crow's weight and corn about one and one-half times its mass. Here are pictured a fully fledged young crow and its principal food items. These include small mammals, spiders, caterpillars, May beetles, poultry, wild birds, miscellaneous beetles, carrion, corn, amphibians, crustaceans, and grasshoppers. These are all drawn to a scale that approximately represents the aggregate mass of the different items consumed during the nestling life, compared with the bird that ate them.

noticed that ravens were frequently present. In August, 1924, I counted more than 60 at one time. They would sail out from over the forest and gradually descend to the short grass, there to walk sedately about and feed upon the numerous grasshoppers of the valley.

Very rarely one sees so many ravens together. Usually they are found only in family groups, composed of the parents and their offspring. When the young have attained the necessary age and experience to shift for themselves, they wander off, but their elders remain together even until the snow begins to melt and the call comes to repair again the old nest.

RAVENS SEEK LOFTY NESTING SITES

Although sometimes ravens use trees as nesting sites, their usual selection is a high, beetling cliff. Here, often hundreds of feet above the sea, or above the floor of

Photograph by George Shiras, 3d

A CANADA JAY INVESTIGATING A HAUNCH OF VENISON

Meat is his favorite food and the sound of a hunter's gun seems to attract rather than to frighten him, for he has learned to associate that sound with meat (see text, page 76, and illustrations, pages 61, 63).

some inland valley, protected by projecting rock above, the nest is built in a niche of the wall. Such situations are exceedingly difficult to approach and the birds cannot readily be disturbed by any creature not possessing wings.

The cranny chosen for a nesting site may be of any shape, and often must be well filled in order to make a substantial structure of proper size and shape. The nests of many birds show little variety in their form or in the character of the materials used. This is not the case with the ravens, for their practical imagination permits them to adapt their nest to almost any kind of opening in the rock, and to use a wide variety of objects in its construction.

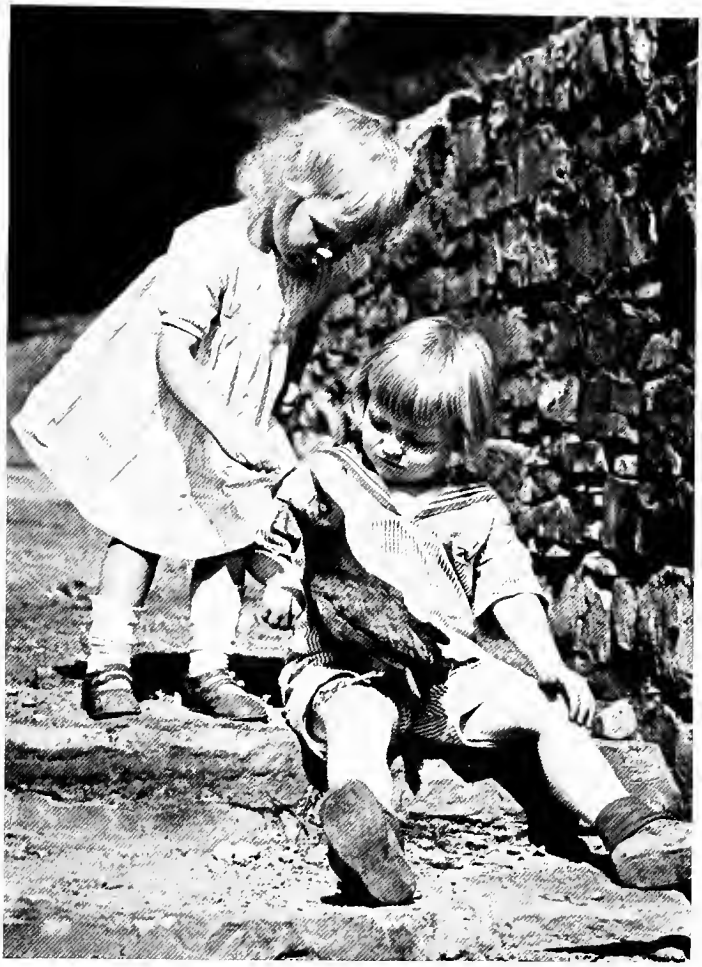
A few of the materials that have been noted as component parts of the nest are: sticks, twigs, cow-ribs, rope ends, ragged canvas, fragments of cloth of various kinds, moss, seaweed, roots of many sizes, hay, cow dung, clusters of hair from the carcasses of deer, horses, cows, and coyotes, and strips of hide and shredded bark.

That the raven's wit sometimes fails him is illustrated in an account by a California ornithologist, who for some time watched a pair carrying sticks to a certain point on a cliff. He says: "Investigation disclosed an astonishing condition of affairs. The daffy birds had been trying to lodge the foundations of a nest in a small sloping crevice where any sort of lodgment was practically impossible. As a result, every stick had fallen, in its turn, until a pile 6 feet in diameter and not less than 2 feet high lay at the bottom of the cliff—two hundred pounds' weight of wood and not a mud-sill to the good yet! And about 40 feet along, under the same cliff, was another stick pile, evidently the accumulation of the preceding season."

The raven mates for life and a pair uses the same nest season after season. These birds are extremely devoted to their young and to each other. Their domestic lives, therefore, are very regular, well ordered, and much more formal than those of the average bird.

The Family *Corvidae* in America includes two subfamilies. One is the jays and magpies; the other, ravens, crows,

piñon jays, and nutcrackers. It is represented in North America by 17 species and 22 subspecies, or varieties. If to these be added two European species, the rook (*Corvus frugilegus frugilegus*) and the hooded crow (*Corvus cornix cornix*), which have been recorded as accidental wanderers to Greenland or Iceland, we find a total of 41 kinds of the *Corvidae* which have been accredited to this continent north of Mexico.



Photograph by Dr. A. A. Allen

YOUNG CROWS TAME EASILY AND MAKE INTERESTING PETS

All three of these desperate-looking plotters are at work hatching some mischief and Jimmie Crow is probably in the thick of it (see text, page 58).

THE COMMON CROW

South America is the only continent where there are no native crows. Africa has a black-and-white species and Asia one whose black feathers are interspersed with markings of gray and brown. In Europe some of the family representatives are rooks, jackdaws, and carrion crows. The first named congregate in vast numbers to roost, and this practice has given us the name "rookery," which in the United States is applied to any numerous assemblage of birds in trees.

In the Piedmont country of North Carolina I came upon a little girl weeping beside the road. The mother, with red and toil-worn hands, was caressing her child and trying to comfort her. Dismounting, I led my horse nearer and learned that the outburst of grief was caused by a crow which had just killed and carried away the last of five newly hatched chickens, the pets of the distressed child.

It was no use telling these people that the crow is not really as black as he is painted, that he eats many grubs and beetles, and does much good about the farm. They lived with him throughout the year and found their contacts with him too intimate and disturbing. Crows had stolen their hens' eggs repeatedly and now had begun to acquire a taste for young chickens. Crows pecked holes in their melons; pulled up sprouting corn, and robbed the nests of birds which the family liked to have about the home. In fact, they were so destructive that the father had devised every means he could think of to rid the place of their presence.

The opinion which this family held about crows is entertained generally by farmers. In almost every community where the crow appears in numbers, the

Photograph from Dr. Spencer R. Atkinson

"PUCK-OF-THE-WOODS" HAS SOME FRIENDS AND MANY ENEMIES

The California jay is an impertinent creature, who seems to take conscious delight in mischief-making. Nothing could be saucier than this rascal, as, perched on a twig, he dips his head in a mocking bow, jerks his tail, and screams anathemas to the world at large. He destroys millions of other birds' eggs every year and takes keen delight in pecking cats' tails (see page 79).

Photograph by George Shiras, 3d

HE IS NOT AS NOISY AS HIS COUSIN, THE BLUE JAY

Florida jays are found only where there is a dense growth of oak and shrubby bushes or in adjacent sand-pine areas. They respond readily to human advances (see pages 50, 59).

Photograph by Dr. A. A. Allen

CROWS AT A WATER HOLE IN ITHACA, NEW YORK

The crow comes close to being the "great American bird," for it is likely that a thousand people know him personally for every one who ever saw a live eagle. He has waged a successful battle for existence, and there are probably more of his clan here now than there were when the Pilgrims came. Henry Ward Beecher once remarked that if men wore feathers and wings, very few of them would be clever enough to be crows.

inhabitants view his presence with apprehension and dislike. From the early settlement by Europeans, every man's hand has been against him. Scarecrows erected in ten thousand fields and poisoned grain scattered about have had little effect.

No town or city ordinance and no State or Federal law protects the crow. Bounties have been offered for his head. Neighborhood campaigns for destruction of crow nests and "shoots" at their roosting colonies have been organized and enthusiastically put into execution times without number.

Despite this widespread, continuous, and almost universal campaign for its destruction, the crow has steadily increased and yearly his numbers are becoming greater. In the bird world the crow is one great American success.

Personally I am very fond of the crow. He is such a shrewd fellow and so tremendously successful in the struggle of life that I cannot but admire him. His caw on a frosty morning reaches my ears from across the fields and I know there is life abroad in the land. He is the one bird I am pretty sure to see when the snow is deep and the sleet glistens on the trees. Sometimes I have seen him on an ice cake riding down the Hudson.

In summer I find him tearing rotten logs to pieces and turning over bark and sticks, and I see numbers of crows swarming in flocks over the newly plowed fields looking for grubs. I enjoy the sight of a

Photograph by Dr. A. A. Allen

A FLORIDA BLUE JAY AND PROOF OF HIS IDENTITY

This species is somewhat smaller and grayer and has narrower white tips to the feathers than the northern race. Although not a shy bird and quite at home in city streets, he does not tame as readily as his neighbor, the Florida jay (see pages 68-71).

crow, but I am a bird lover and therefore not an unbiased observer. Furthermore, I have no chickens, no melon patches, not even a cornfield, for him to raid.

YOUNG CROWS MAKE AMUSING PETS

Young crows make interesting pets. They are voracious eaters and require much food to keep them in a contented frame of mind, but they pay for their keep by performing many curious antics and by their amusing attempts to imitate the words and voices of the people about them.

They are fond of collecting and hiding bright trinkets of many kinds. A broken bit of china, a dry chicken bone, the cap from a ginger-ale bottle, a small block of painted wood, a glossy beetle, and pebbles of various hues are objects which may take their fancy. They have been known to carry away thimbles, small scissors, and pipes. Sometimes their treasures are hoarded in a hidden nook, or they may be buried here and there about the yard or in the garden. They are often forgotten, but sometimes are exhumed and transferred to some other favorite hiding place.

Crows often accumulate in large numbers. Hundreds of thousands have been known to assemble in some favorite roost. At times a flock will gather and engage in vociferous cawing. They make seemingly

Photograph by H. W. Brandt

LENDING A HAND TO A FLORIDA JAY AT SEBRING (SEE PAGE 71)

Photograph by Guy A. Bailey

MRS. BLUE JAY MAKES A DEVOTED MOTHER

Usually she and her mate build a new nest each year, using twigs and small branches broken from the trees. Although generally a noisy bird, the blue jay becomes a model of quiet and caution while the young are in the nest (see text, page 68).

Photograph by Dr. A. A. Allen

ONE OF AMERICA'S BEST-KNOWN BIRDS TAKES THE STUMP

The handsome and active northern blue jay likes to hear his own voice, and is seldom so well pleased as when making a hair-raising din and a lot of fuss and excitement about nothing. From a safe thicket of vines, he makes so bold as to hurl nasty epithets at hawks, but in the open keeps discreetly out of their way (see page 68).

useless short flights, shift their positions on the limbs, or move from one perch or tree to another, all the time keeping up a most animated series of calls pitched in various keys.

Some observers claim that crows talk. It certainly is true that their various notes are understood by their fellows, who at once react as the emergency requires. These so-called "crow conventions" are most amusing and would probably be extremely interesting if we could know what they were all about. Some observers claim that they hold trials over the conduct of some of their members. There is little evidence, however, that anything of this kind takes place.

The nearest opportunity I ever had of being a witness to any of their activities suggesting condemnation proceedings against one of their kind occurred one winter evening while I was watching scattered flocks of hundreds of crows coming to their roost.

Suddenly I became conscious of an unusual commotion among a group of eight. One evidently was in great disfavor with the others, for with angry and excited cawings they were striking at him most vigorously. The strength of the persecuted bird was all but spent when I first sighted him, and when, a moment later, the fleeing one sustained a particularly vicious onslaught, he began to fall. He did not descend gradually, like a bird injured on the wing, but plunged downward like a falling rock for 100 feet or more, into the top of a large pine tree and, bounding from limb to limb, struck the ground only a few yards from me. Upon picking him up I found him to be dead.

THE AMERICAN MAGPIE

In the western part of our country is found the black-billed magpie, very closely related to the magpies of Europe and Asia. In some of the States it is a numerous species, and because of its large size, striking contrasts of plumage, and extremely vociferous habits, it is one of the outstanding birds which cannot readily be overlooked, even by the most casual observer.

Photograph by George Shiras, 3d

A DENIZEN OF THE NORTH WOODS SHOWS SCANT FEAR OF MAN

The Canada jay lives in the coniferous forests on the fringe or beyond the limits of civilization and is remarkably tame and bold. Despite an enormous capacity for food, he sometimes gets enough, and then stores his surplus in tree crevices. This reserve supply enables him to sustain his young in early spring, before good foraging is possible (see page 76).

This is another representative of the family *Corvidae* which is unpopular with various groups of people. Cattlemen tell you that he attacks weak or injured stock, and that by pecking the scars made by the branding irons on calves or colts he prevents the wounds from healing.

All observers agree that the magpies are a scourge to many birds, and that nests are constantly raided by them. Mourning doves, meadow larks, and other birds nesting on or near the ground are especially subject to raids. The eggs and young of swallows are dainties which parent magpies delight to gather for their young. Of course, they eat crickets and grasshoppers as well. A mouse is not safe if a magpie discovers it away from cover.

Ground squirrels are killed by them, and magpies have been known to wait long and patiently for one of these rodents to emerge from its hole, when it is pounced upon and dispatched with blows from the powerful bill.

I have seen flocks of magpies in Alaska, Colorado, and elsewhere engaged in hunting systematically every bush and tree as they progressed. From the way they peeped and peered and investigated, they were unquestionably searching for eggs and young birds. At a distance I could keep track of the onward movement of the marauding band by the cries of alarm and distress raised by the smaller feathered inhabitants of the underbrush.

THE BLUE JAY

It would be difficult to find a more noisy bird than our beautiful blue jay, and when a family group takes up its habitation in the trees about a dwelling, the occupants are kept fully aware of the fact that this bird is in the neighborhood. His note at dawn has been compared to a shout.

These jays have a great variety of calls and often imitate the notes and cries of other birds. Their imitation of the call of the red-shouldered hawk is so nearly perfect as often to deceive the bird student.

Their vocal performances are at their best when an owl is discovered. Shrill screams call together all the jays of the

Photograph by William L. and Irene Finley

CLARK'S NUTCRACKER INHABITS THE HIGH MOUNTAINS OF THE WEST

This avian mountaineer has a harsh, grating voice. One note, which he seems to use when at play, closely resembles the scream of a mountain lion. He is hardy and a good fighter; he has been known to tackle a golden eagle. His powerful claws and beak also serve him well for extracting seeds from pine and other cones (see page 75).

neighborhood. With flashings of blue and white feathers, they arrive and at once plunge into the fray. Abuse is poured out on the sleepy owl, who desires nothing so much as to be left alone. Growing bolder, the jays approach within a few feet of their traditional enemy and shriek anathemas at him in the most outrageous language known to the hardiest members of a blue-jay mob. This fuss and din may continue for half an hour before the owl is driven away (see page 50).

Jays are silent, however, when about their nest during the period of its construction; also while the eggs are being incubated and when the young are being fed. I have never seen a jay go directly to its nest. Once I watched a mother perch 21 times before she reached her eggs and settled upon them. Her approach and departure are accomplished with extreme stealth and caution.

The nest is usually placed in the crotch of a limb some 10 to 30 feet from the ground. I have found nests in old pear trees at an elevation of only six feet, and again in pine trees many times that distance from the earth. The nest is composed of dead twigs, usually broken from the trees for the purpose. Rootlets for a lining are much used. The eggs are drab-colored, with brownish spots, and number from four to six. Seventeen days are usually required for them to hatch.

Like most of the members of his tribe, this jay bears the reputation of being a plunderer of the nests of other birds. Evidences of this habit I have rarely seen, although for many years I have been on the watch for them. Once I saw a hungry jay try to strike down a junco feeding on the snow, and again I saw one seize and kill a young English sparrow just out of the nest. Twice I have seen them taking eggs from a robin's nest.

Blue jays eat insects of various kinds and acorns and beech mast are staple articles of diet. When such food is scarce jays will migrate considerable distances in search of it.

Fifty years ago little settlements began to spring up in the pine-woods country of

Photograph by George Shiras, 3d

"WHISKEY JACK" NEVER FAILS TO HEED THE MESS CALL

The Canada jay has an appetite so omnivorous that he has been known to consume large quantities of soap. His nickname may have come from the Indian word "wiskedjack," or from another Indian term, "wiss-ka-chon," corrupted by white men to "Whiskey John" and then to "Whiskey Jack" (see page 76).

central Florida. Jays were not very common there at that time. The settlers planted water oaks for shade, and as these and other deciduous trees developed, the character of the bird life began to change. Crested flycatchers, chuck-will's-widows, cardinals, and wrens, hitherto but little known in that immediate neighborhood, began to come about the houses. Inland towns to-day have bountiful acorn crops, and blue jays are abundant.

Blue jays are very engaging birds. You may suspect them of taking the eggs from the robin or yellow warbler's nest which you have been watching; you may object to their cries and shouts, but the blue jay is the dashing, handsome rake of the village.

In a vast evergreen forest in the mountains of Montana I was awakened one morning by a sound that was entirely new to me. A guttural, grating, rattling note, difficult to describe, yet easy to remember, was issuing from some point near by. Cautiously raising the flap of my sleeping bag, I discovered the author of the sounds. On a low limb of a tree sat a stocky, gray bird at least a foot in length. His wings were glossy black with a dash of white. He was peering at his companion standing on the ground by the log where we had eaten our supper the evening before. This was my first acquaintance with the "big camp robber," or Clark's crow, and the meeting was just as I would have had it—a perfectly natural environment and a visit staged in a manner wholly characteristic of this little-known bird.

High up on the slopes of Pikes Peak, a Clark's nutcracker dashed from a stunted conifer in pursuit of another. Straight out from the mountain they flew. Four hundred yards or more away, they turned to the misty valley far beneath and plunged downward, volplaning, banking, flying with flapping wings, but always descending until, perhaps 2,000 feet below, they were lost to my view. Diving flights from such dizzy heights meant nothing to them. In the wilderness the Clark's nutcracker is as adventurous as was the great explorer of the Northwest who first discovered it to science and whose name it bears.

NORTHERN RAVEN (Corvus corax principalis)

The raven looks like a large crow. Although it appears to be about twice the size of its smaller relative, as a matter of fact it is not. The common crow is from 17 to 21 inches long from bill tip to tail tip. Ravens vary from twenty-one and a half to twenty-six and a half inches. The raven is always heavier, the head and beak are stouter, the feathers on the throat are pointed and not rounded, and the cry is a deep-voiced croak that is unmistakably different from any note which a crow can produce. It is a bird of the mountains, of rocky cliffs by the sea, of barren mesas, of semiarid deserts, and of the great uncut forest lands.

It has retreated before the advance of man, being still an inhabitant of the wilderness. Its food is the offal or carcasses of animals, fish, and crabs gathered by the sea, insects, eggs, and helpless young birds of any species. As it comes very little in contact with man, its economic interest is not important.

Like many species of birds, the raven feeds its young for a time by regurgitation. Its devotion to its offspring is very great, and it is said to attack the eagle, if necessary, to protect them. The parents stay with the young, feeding them, guarding them, and teaching them the ways of the raven world throughout the summer, long after they have left the nest.

The northern raven is found from the Arctic Ocean southward to the northern tier of States and in the Alleghenies to Georgia.

AMERICAN RAVEN (C. c. sinuatus). This is a subspecies occurring from British Columbia, Montana, and North Dakota southward to Nicaragua.

WHITE-NECKED RAVEN (C. cryptoleucus). The white on the neck of this bird is seen only if the neck feathers are raised, since it is found only at the base of the feathers. The bird's habitat is the desert region of western United States and Mexico, from Arizona, New Mexico, and central Texas southward. Of a size midway between the common crow and the northern raven, it is often seen perched on telephone poles in towns.

EASTERN CROW (Corvus brachyrhynchos brachyrhynchos)

This is the common crow of much of eastern North America. The northern boundary of its breeding range is along a line extending from Newfoundland and through Quebec to Manitoba. From here it spreads in a southward and southeastward direction through the States to Maryland, the northern part of the Gulf States, and northern Texas. It winters generally in the United States.

The common crow is one of the best-known birds in this country and in many regions it is extremely abundant.

In the autumn, in some sections, crows congregate in large numbers to roost in a favorite grove, and here come together nightly for many weeks. In the morning they spread out over a great area of country in search of food. Long before sundown they begin to return from all directions, continuing to arrive singly or in small groups until dark. Many thousands thus assemble in a single roost.

They are very cunning and know to a nicety the range of a gun. In the woods and fields it is only by accident, or by the exercise of careful strategy, that a man may approach this bird close enough to kill it.

A story has long been current that a crow will talk only if its tongue is split. This cruel practice is neither necessary nor desirable.

Crows make their nests in trees, usually in March, April, or May. Four to six eggs are laid. They are greenish blue, thickly covered with markings of various shades of brown.

This is one of the species which has been divided by ornithologists into various geographical races. There is extremely little difference in their appearance, and their general feeding, nesting, and roosting habits show only such variations necessarily due to natural surroundings. In addition to the widely distributed eastern crow, this group includes four other forms, as follows:

SOUTHERN CROW (C. b. paulus). Its territory is from the lower Potomac and Ohio valleys south to southern Georgia and eastern Texas.

FLORIDA CROW (C. b. pascuus). This variety breeds throughout most of the peninsula of Florida.

WESTERN CROW (C. b. hesperis). This western subspecies occurs from British Columbia and Saskatchewan to New Mexico and northern Baja California.

NORTHWESTERN CROW (C. b. caurinus). The range of the northwestern crow is limited to a narrow strip of country from Kodiak Island and Kukak Bay, Alaska, to Puget Sound, Washington.

FISH CROW (Corvus ossifragus)

While skirting a salt marsh on the Virginia coast one June day, I sought the shade of one of the scattered pines dotting the landscape. When on the point of sitting down, I noticed an eggshell on the carpet of pine needles. Near by was another, and still another—in fact, I soon found the remains of at least two dozen eggs of the clapper rail, which inhabited the neighboring marsh in large numbers. The eggs must have been carried to a certain large limb, where they had been eaten and the shells dropped to the ground. While I rested, one of the marauders of the marsh appeared. He was a fish crow and he carried an egg in his beak.

Fish crows eat principally crabs, fish, and such other animal food as they can find along the coast and neighboring rivers and lakes. They range from Massachusetts southward to Florida, and thence along the Gulf coast to eastern Texas. One may find them inland, especially at various places in the Southern States. The bird is smaller than the common crow and measures about sixteen inches in length. Its usual cry is a nasal, reedy *caw*, which resembles the note of the young of the larger species. The best way for the student to distinguish this bird in the field is by its note.

 The upper figure is approximately one-sixth natural size; the lower figures, one-fifth

NORTHERN RAVEN

Upper

EASTERN CROW

FISH CROW

Approximately one-fourth natural size

AMERICAN MAGPIE
Upper

YELLOW-BILLED MAGPIE
Lower

AMERICAN MAGPIE (Pica pica hudsonia)

In 1927, under the direction of the State authorities of Montana, 25,269 magpies were killed and 18,071 of their eggs destroyed. Nothing, perhaps, can more forcefully illustrate the popular dislike for this bird throughout the cattle- and sheep-raising districts of the Far West than the fact that ranchmen are willing to pay for its destruction.

Despite the constant warfare made on the handsome black-billed magpie, its numbers seem not to decrease, except locally, and then only for a time. When its enemies become weary of the seemingly hopeless task of exterminating it and relinquish their efforts, the birds are soon about the country in their usual numbers.

The reason for the rural westerner's dislike is that the magpie persistently destroys the eggs and young of wild birds, and hunters deplore the destruction of game birds by any wild creature which they class as "vermin." Magpies kill young chickens and eat hen's eggs when they can find them. They will gather about a sickly sheep or a cow, or the newborn young of either, and kill it by their pecking. They attack newly branded stock and freshly sheared sheep.

At times, and in some localities, these propensities render them extremely annoying. However, Mr. Kalmbach well points out: "As in most, if not all, problems of bird control, the real need for drastic action against the magpie is confined to local areas where one or another of its faults has become unduly emphasized."

Over the greater part of the magpies' range they appear only in moderate numbers. They are great scavengers, and with the ravens, and in some regions with the vultures, they help to rid the countryside of offensive carcasses. They clean up scraps of meat and offal about places where stock is butchered. They flock about Indian villages or encampments where little effort is made by men to dispose of offensive refuse. Magpies eat grasshoppers that consume the grass, which is scanty enough in many regions. They destroy countless weevils, caterpillars, and grubs and kill a certain number of noxious rodents.

The magpie, therefore, is not wholly bad. It is a comfort to one interested in the conservation of all wild life to reflect that its range is so great over vast, thinly settled sections and its fecundity so pronounced, that we may expect this striking species to live and prosper for years to come.

The magpie is a very noisy bird and is continually chattering about something. Mr. Henshaw, speaking of the flexibility and the range of its voice, said that it runs "from a guttural chuckle to the softest whistle." The bird is imitative, and here and there magpie pets learn to imitate the human voice in a highly entertaining manner.

The nest is a bulky, domed affair of twigs, built in trees. It contains a mud cup lined with rootlets. Mrs. Bailey speaks of certain old nests which "were much in demand for roof-trees by English sparrows, and to a less degree by house finches."

This species ranges from Alaska and Manitoba to New Mexico.

YELLOW-BILLED MAGPIE (Pica nuttalli)

The yellow-billed magpie is a little smaller than the American, or black-billed magpie, but the difference in size is very slight. The birds are exactly alike in appearance, except that one has a black beak and the other has a yellow one and also a bit of yellow skin back of the eye.

The difference in the distribution of these two species constitutes one of the amazing and unexplained problems in the field of ornithology. Closely related subspecies of the black-billed form are found in northern Africa, Spain, northern Europe, northern Asia, China, and western North America. The race occurs over the greater part of the Northern Hemisphere. On the other hand, the yellow-billed magpie is confined to less than half of the area of California. Why is one restricted to such a limited region and the other so widely distributed? This is a problem for evolutionists and geologists.

The yellow-billed magpie may represent a very ancient race that is dying out. Since scientific interest has been directed toward the observation of its habits and distribution, it has been discovered that its range has become more restricted. There are reports that fifty or sixty years ago it was a common bird in many places in the immediate vicinity of the coast, where the observer would now look for it in vain. It inhabits only the interior of the State west of the Sierra Nevada, from Tehama County to Ventura and Kern counties, and chiefly in the Sacramento and San Joaquin valleys.

It haunts the neighborhood of stock ranches, because food to its liking is usually plentiful in such places. When cattle and sheep are butchered, the refuse attracts magpies. They gather about any animal which accident or disease has killed. They feed also on grasshoppers, worms, and grubs to be found in certain places, and, of course, always consider the possibilities of a reasonable supply of eggs of birds or of poultry.

The nest is a bulky, roughly rounded structure consisting of a great mass of twigs. In this is built a deep cup of mud or cow dung. The lining is of rootlets, pine needles, dry grass, shreds of cottonwood bark, and sometimes horsehair. Egress is through a passageway in the side. An opening in the opposite direction admits of swift exit if danger threatens at the front.

These rude cradles for the young are often placed in oak trees from 10 to 60 feet above the ground. Sycamores, willows, and cottonwoods are some of the other trees chosen for nesting purposes. Small colonies of these magpies are sometimes seen, but more often a single pair, with its nest, is found in some secluded gulch or out-of-the-way corner of the ranch. The nest may be cunningly hidden among clumps of mistletoe or it may be placed in such an open situation that it can be seen from a considerable distance.

These birds become much attached to a locality and will return year after year to build their nests in the immediate vicinity of the domicile used the previous spring. Often a pair will make use of the same tree and at times even build the new nest on top of an old one.

The five to seven yellowish or olive eggs are covered with spots of brown or grayish olive.

NORTHERN BLUE JAY (Cyanocitta cristata cristata)

The blue jay is one of the best-known birds in central and eastern North America. Recently I examined an index covering for fifteen years a publication devoted largely to notes and brief articles by contributors writing of birds which had interested them. Of all the 1,420 kinds of birds that are listed as occurring in North America, the blue jay stood fourth among those most frequently mentioned in this magazine.

One of the most outstanding characteristics of this dashing, handsome bird is its propensity to make a noise. He shrieks singly and in chorus. He shouts at hawks, owls, cats, and snakes, or screams only for the pleasure of hearing himself make a hair-raising din. His shoutings fill the woodlands of southern Canada and of the eastern United States. There is no escape from his cries for any great length of time. Only in the nesting season, when domestic duties and the safety of his eggs and young demand a certain amount of vocal restraint, can he be considered a quiet bird.

It is an abundant species, but has its natural enemies. Scattered clusters of blue feathers here and there in the woods testify to the success of some hawk or owl in the capture of one of his tormentors. Sometimes these feathers appear later among the nesting material used by birds whose eggs and young the blue jay has been known to eat.

Blue jays are devoted to their nests and young and show unusual boldness in defending them. Sometimes one will sit on the nest until actually touched by the hand of the intruder. With its mate it will make a great outcry and will often come within a few feet of the person who has violated the sanctity of its nesting place.

After the young have left the nest and acquired strength in flight, the family groups forage about the country with great excitement and vociferation. Two or three families will often unite and in scattering flocks go trooping along from one grove to another, crossing, a few at a time, the open, intervening areas. As autumn approaches, they may move for many miles in quest of more ample supplies of beechnuts or acorns. Some of them stay throughout the winter in the North, but many travel long distances and pass the colder months in the more southern States.

FLORIDA BLUE JAY (C. c. florincola). This jay is a little smaller, the white tips of the feathers are more narrow, and the back is slightly grayer than that of the northern blue jay. It is found in the South Atlantic and Gulf States from the coast of North Carolina to northern Florida and westward to Louisiana.

SEMPLE'S BLUE JAY (C. c. semplei). This bird was described to science in 1928 from specimens taken at Coconut Grove, Florida. Its range is central and southern Florida.

STELLER'S JAY (Cyanocitta stelleri)

Principally in the mountains, but also at times at lower elevations over the vast sweep of country from Alaska to Central America, the brilliant, long-crested, blue-bodied jay is found. Scientists know it in different places by separate names, but to the casual observer little, if any, difference in habits, form, or color can be detected wherever seen.

Maj. Allan Brooks here beautifully figures the Steller's jay, one of the six of this group to be mentioned. It inhabits the Pacific coast country, from the Alaska Peninsula southward to the State of Washington, including Vancouver and most of the other coastal islands. It is usually resident throughout the year, wherever it is found.

Often the nests are built in firs, saplings being preferred to the larger, taller trees. Nests 60 feet from the ground have been found, but this is unusual. Often they are not more than 5 or 10 feet from the earth. In their construction, twigs are used for the foundation and the outer supports.

Into the basket thus constructed, 8 or 10 inches across, is sunk a deep cup, lined generally with grass or moss. Then the hollow is well plastered with mud, and this in turn is lined with rootlets or pine needles. Now and then the hair of deer or cattle is used to make a soft bed for the three to five spotted eggs which are to come. The eggs are about one and a quarter inches long and the greenish-blue ground pattern is sprinkled with dots and spots of brown and lavender. Incubation requires 16 days.

Steller's jay is common in many localities and is well known to the inhabitants of the country. Singly or in small groups, it comes to the back yard searching for something to eat. Such visits may be looked for especially in winter, when snow covers its food provided for by the forest. It eats insects, vegetables, nuts, eggs, and young birds. At times it robs the California woodpecker and its kin of their store of acorns.

In addition to Steller's jay, other varieties of this group of jays, very similar to it, but possessing sufficiently small differences to justify ornithologists in accrediting them with subspecific status, are the following, found in North America north of Mexico:

QUEEN CHARLOTTE JAY (C. s. carlottae). This bird inhabits the Queen Charlotte Islands, British Columbia.

COAST JAY (C. s. carbonacea). Its range is along the Pacific coast of Oregon to the Santa Lucia Mountains of California and certain small areas to the eastward.

BLUE-FRONTED JAY (C. s. frontalis). It inhabits the high and the medium elevations of the Sierra Nevada, from Mount Shasta southward to San Diego County, California; also, it is found on various inner coastal ranges of that State.

BLACK-HEADED JAY (C. s. annectens). Its home is in boreal and transition areas of the Rocky Mountains from British Columbia south to eastern Oregon, Idaho, and Wyoming. It has been known to wander to Utah and Nebraska.

LONG-CRESTED JAY (C. s. diademata). Here, also, is a jay of the moderate and of the high altitudes. It is found in the Rocky Mountains from Utah and Wyoming southward into the States of Sonora, Zacatecas, Jalisco, and Nayarit, Mexico.

NORTHERN BLUE JAY
Upper

Approximately one-third natural size

STELLER'S JAY
Lower

Slightly more than one-third natural size

FLORIDA JAY
Upper

WOODHOUSE'S JAY
Lower

FLORIDA JAY (Aphelocoma coerulescens)

The ornithologist rarely forgets the time and circumstances when he first made the acquaintance of a bird which he had not previously seen. Forty-three years ago a water oak stood just back of the blacksmith shop, in the village of Archer, Alachua County, Florida. Here for several hours one day a strange bird sat on its topmost twig and called in a harsh, inquiring voice. I had never seen nor heard such a bird, so the impression it made was lasting. Later I learned that it was a Florida jay, and that it was at the extreme northern limit of its range. Not one of them has ever been noted in that neighborhood since that single wanderer made its brief visit.

This jay is very local in its occurrence. It is not found in the extensive pinelands, the heavy growths of hardwood about the lakes, or in the numerous swamps, prairies, and marshes that dot the State. It dwells only where there are dense growths of scrub oak, or of other shrubby bushes, or in the pine areas immediately adjoining these places. Such favored regions are scattered here and there over about half of the Florida Peninsula.

The bird is found in many places in the immediate vicinity of the Atlantic coast, from St. Augustine to Rockdale, south of Miami. Along the Gulf coast it occurs from about the mouth of the Suwannee River southward to Naples. Inland it occupies territory northward from Naples to Palatka and the Orange Lake country.

A short distance outside of Leesburg, in Lake County, Florida, I came upon a sandy area covered with bushes from four to six feet high. This looked like Florida jay country, and although I had seen no bird of this species in all that section, I began a search and within ten minutes found four of them. They were feeding on the ground by the side of one of the overgrown cement sidewalks laid down by an optimistic real-estate company. The birds seemed rather tame. They merely flew from bush to bush and watched quietly, as though waiting for me to leave.

Where one of these slender jays is found, there is almost sure to be others, for they live in small colony groups. Among the low dunes close to the ocean, not far from New Smyrna, I once counted fourteen in a few minutes.

They are not so noisy as the blue jays, nor have I ever heard them engage in any wide variety of "songs" and calls.

Mr. A. H. Howell, who has in many places gathered notes on the Florida jay, tells of visiting Miss Werner, who, at her home near Sebring, has won the confidence of her jay neighbors. "She whistles a bright little tune and in a few minutes the jays appear from all directions, and without hesitation alight on her arm or shoulder, to take the pieces of bread she offers them. She told us she had been a year or more taming the birds, and that it was a month or more before she could get them near her. At the time of our visit, however, they had become so used to strangers that they allowed us to feed them, and even alighted on our heads or shoulders."

In low oaks these jays nest, making of twigs and rootlets the cradle for their young, and they lay three or four olive-green, black-spotted eggs.

The length of this bird is ten and three-quarters inches, this being about one inch shorter than the common blue jay of the Eastern States.

WOODHOUSE'S JAY (Aphelocoma californica woodhousei)

Adjoining the eastern line of the territory occupied by the California jay, we enter the country of the magnificent Woodhouse's jay. It dwells in the foothills and on the mountains to elevations of 5,000 to 8,000 feet, although in winter it often descends to lower altitudes.

In scrub-oak trees, junipers, and nut-producing pines common throughout most of its range, it builds its nest of twigs, weed stalks, rootlets, and horsehair. For a tree-loving bird, the situations chosen are unusually low, the nests often being not more than two or three feet from the ground. They are clamorous birds and certainly make no effort to keep their presence a secret, except in the nesting season, when stealth and caution are their habits.

They live on a wide variety of food. Insects of different kinds are taken, fruits are eaten, and nuts and acorns form a staple article of diet. This jay is detested by all the small birds of the region, for well they know that in spring he is constantly hunting for their eggs and their nestlings. A collector of scientific specimens, who placed some phœbe eggs on the ground within a few feet of his camp, complained that one of these birds purloined them all while his back was turned for a few minutes.

The Woodhouse's jay is found in locations suitable to its habits of life, from southeastern Oregon and southern Wyoming southward to southwestern Texas and westward to southeastern California. It is one of the group of species *californica,* forms of which are distributed over much of western and southwestern United States. They are all so similar in appearance that few people can distinguish between them.

Two of these, the California and the Woodhouse's jays have been mentioned. The others, as recognized by ornithologists, are as follows:

LONG-TAILED JAY (A. c. immanis). It is found in the valleys and along the mountain slopes from the Washington border southward between the Cascades and Coast Ranges, and in the Sacramento and San Joaquin valleys of California.

NICASIO JAY (A. c. oocleptica). The homeland of this member of the Jay family is the coast region of California, from San Francisco Bay northward to Humboldt Bay.

BELDING'S JAY (A. c. obscura). This is a Mexican bird found in the northwestern section of Baja California southward to latitude 30°. It occurs for the most part in the hills and mountains.

XANTUS'S JAY (A. c. hypoleuca). Here is another form inhabiting a region to the southward of our border, viz., the cape region of Baja California and from there on northward to latitude 29°.

TEXAS JAY (A. c. texana). Its range lies in the central and central-western regions of Texas, "from Kerr and Edwards counties to Davis Mountains."

GREEN JAY (Xanthoura luxuosa glaucescens)

In a region of bushy thickets in south Texas a bird suddenly appeared with a twig held in its beak and gazed intently at me. Its size, form and every movement revealed the characteristics of a jay and its colors showed that it was the little-known green jay of the lower Rio Grande Valley. When it flew, I followed, for not many bird students had seen the nest of this species and I was interested in learning what disposition the bird would make of that twig.

It led me for more than half a mile, alighting frequently and appearing to make no special effort to keep out of sight, although I am sure it was aware of my movements. At length it flew into a bushy tree, still carrying the twig. When I came close it departed, but without the twig. In the tree I discovered a nest. Cutting thorns and limbs, and pushing upward among innumerable small branches, I reached it and found it to be an old one with no signs of any repairs being in progress. I have often wondered if that jay did not deliberately deceive and outwit me.

Very little has been written about its food or general habits, but it is known to occur within the limits of the United States only in the valley of the Rio Grande below Laredo, Texas.

In Mexico it is a common bird in the States of Tamaulipas and Nuevo León. Closely allied forms are found farther south, two of these within the limits of Mexico. The natives call it *pájaro verde*—green bird.

Mr. Ludlow Griscom, who has had personal experiences with green jays, has written me as follows:

"The green jay prefers a relatively dry climate and is most abundant in thick patches of scrub or in dry open gallery forest where there is considerable bushy undergrowth. It is rare or absent in Mexico in the humid rain forests near the coast. In southern Texas it is particularly fond of the dense patches of evergreen scrub which line the *resacas,* depressions filled with standing water in the prairie which formerly served as one of the mouths of the Rio Grande.

"In spite of living in such dense and impenetrable tangles, the green jay is not a difficult bird to observe, because its habits are characteristic of practically all jays throughout the world. It is bold, impertinent, and full of curiosity, and is highly social or gregarious, except for the breeding season. The bird goes about, consequently, in small flocks of eight to fifteen individuals, and the approach of their haunts by man is almost certain to bring them out in the open to look at him.

"They have a great variety of harsh screaming notes, varied with a medley of caws, toots, and whistles, and for a few minutes noisily hover about the intruder from a discreet distance and then melt silently away into the bush and are seldom seen again unless deliberately followed up. Farther south they wander through the more open forests, and in Yucatán I would suddenly find myself surrounded by a screaming flock where a moment before the forest had seemed quite silent and empty, and after satisfying their curiosity they would disappear as mysteriously as they had arrived.

"In spite of its gorgeous coloring, the green jay is surprisingly inconspicuous in its haunts. The green upper parts are not easily seen against the background of the forest, and the golden yellow merges surprisingly well with the dapple-yellow light of the more open glades."

ARIZONA JAY (Aphelocoma sieberi arizonae)

Early in November, 1913, ascending the Santa Catalina Mountains north of Tucson, Arizona, my guide kept me in the saddle all day long except for a brief rest at noon. We had crossed many miles of arid plains with cacti on every hand. Then we had climbed upward until late in the afternoon, when by a little rill we prepared to spend the night.

A headache, induced by the long ride in a beating, bright sunlight, caused me to spread my sleeping bag in the shade of one of the scrub oaks which dotted the ridges. The guide unsaddled the horses and took them to a distant grazing ground, while I lay with eyes closed, hoping for the pain to pass. I had not been resting long when a jarring, querulous note sounded from the limbs above, and there, only a few yards distant, was a pair of Arizona jays. Three others quickly appeared, and for some time they engaged in a critical examination of our duffel and of the recumbent form under the scrub-oak tree.

The next day I saw others; so, evidently, they were common in the oak belt. After entering the pine woods covering the upper regions of the mountains, no more of them were seen.

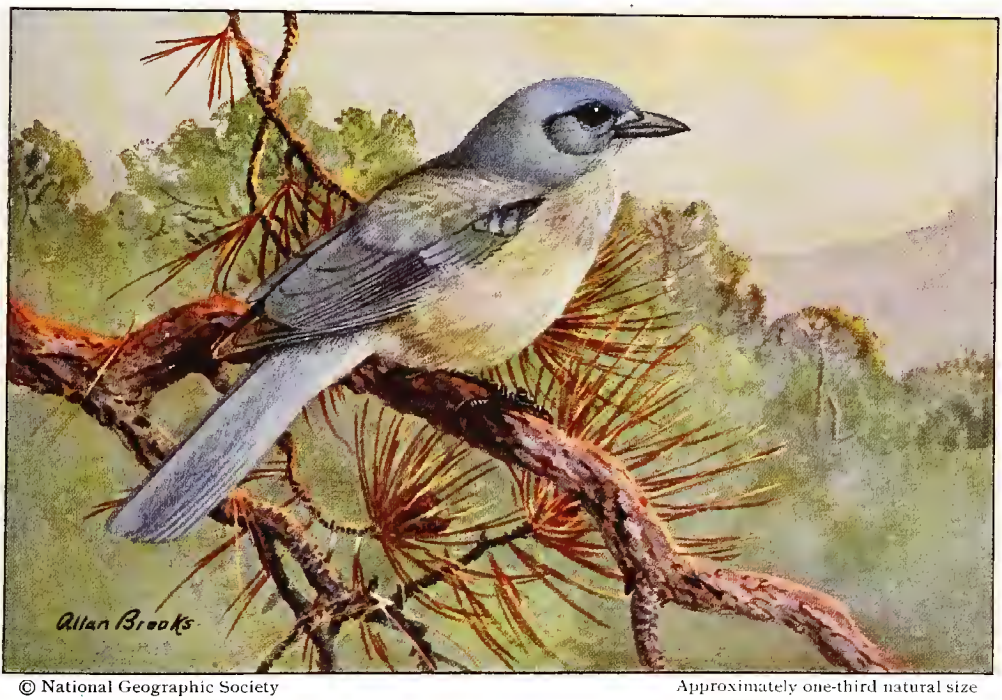
It was in December, 1873, that Robert Ridgway, writing in the Bulletin of the Essex Institute, described this bird from specimens taken in Pima County, Arizona. Its eggs were not discovered by a naturalist until 1876. It is one of the various western jays having a clearly marked and extensive range. Since Ridgway's publication concerning it the bird has been found by students in various regions. Its breeding range is believed now to cover the upper Austral Zone of southern Arizona, southern New Mexico, and parts of the neighboring Mexican States of Chihuahua and Sonora.

The nest of this jay is made usually in scrub oaks, at a height of from 10 to 15 feet from the ground. It is a rather untidy, loosely constructed affair of twigs and rootlets. When horsehair can be found, this also is employed. As a rule, the eggs are four or five in number, although six, or even seven, have been found in some nests. They are light greenish blue and are the only jay eggs in America which are not decorated with dots or spots.

Major Charles Bendire, writing of these jays in Arizona sixty years ago, said that he often saw them in spring along a near-by creek, "evidently on a raid, after eggs and the young of smaller birds, which breed in abundance here."

The food of the Arizona jay consists of insects of various kinds as well as of acorns, wild fruit, and a wide variety of seeds and nuts. They bury many acorns which later grow into trees.

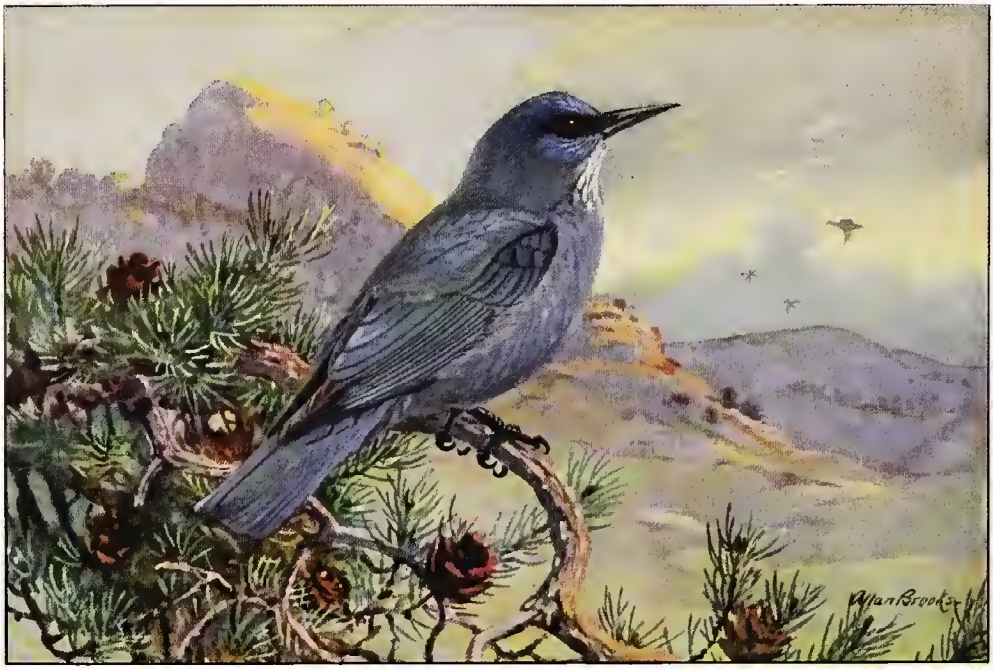
COUCH'S JAY (A. s. couchi). This form of the Arizona jay occurs in the "Chisos Mountains, central-western Texas, to southern Nuevo León and northern Coahuila."



Approximately one-third natural size

GREEN JAY
Upper

ARIZONA JAY
Lower



Approximately one-third natural size

PIÑON JAY
Upper

CLARK'S NUTCRACKER
Lower

PIÑON JAY (Cyanocephalus cyanocephalus)

When traveling in the far Western States at an altitude of from 5,000 to 8,000 feet, where the sagebrush ridges and valleys are decorated with scattering juniper and piñon, if you should chance to see a compact flock of birds wheeling about the landscape it might be interesting to stop and examine them with your binoculars. It may well be that you have come upon a foraging party of "blue crows," which the books refer to as piñon jays. They are rather short, stumpy birds, thus being somewhat different in form from the typical jay. Unquestionably they are the most noisy denizens of the regions they inhabit.

Piñon jays are sociable at all times of the year. To feed, they often gather in flocks of hundreds. When thus assembled, feeding on the ground, those in the rear continually rise and fly over their companions in front. In a kind of flattened, hooplike formation the flock goes rolling across the country. Loud chattering notes are continuous, and an advancing company may be heard long before the birds come into view. Their notes are of many kinds. About the nest they are low and soft, soothing and reassuring. There is a single harsh, guttural, rasping call frequently uttered as the birds fly about the trees. Also there are many squeaks and clucks and chatters which strongly suggest the sounds produced by the eastern blue jay.

Because of the wild, unsettled country usually inhabited by piñon jays, and of the fact that they are erratic in their movements, and more or less local in their distribution, comparatively few bird students have been privileged to witness their nesting habits. Mrs. Florence Merriam Bailey, who has had long experience with birds in the western wilderness, has given us a picture of the season, location and conditions of their nesting, as seen by others. In part she has written:

"In 1913, west of the Rio Grande, on the San Mateo and Gila River Forest Reserves, Mr. Ligon found them constant residents, wintering in flocks, nesting in colonies, roosting in thick tall pines, generally on canyons, and meriting the name of 'the most noisy bird in the southwest.' He says they nest generally from March 1 to 31, in gray live oaks among the piñons, though occasionally in piñons, even where the oaks can be had. On February 10, 1913, he noted that the birds showed 'nesting inclinations, flying two and three together.' On February 17, while the ground was still half covered with snow, on the southwest side of Black Mountain in the Datil Forest, at about 7,500 feet, he found one nest about complete and others under construction, in scattered scrub oaks on a steep grassy canyon side. There were more than 50 birds in pairs and flocks mingling and scattering and flying about noisily. On March 3, he returned to the colony and found nests in almost all the scrub oaks of sufficient size, but never more than one in a tree. One, half completed, was in a juniper. The birds, slow to leave their nests, finally did so noisily. As it had snowed many times since his first visit, the nests were damp from melted snow. Nearly all contained four eggs, but one had five. The birds were continually going and coming to their feeding grounds, where the main body stayed bunched."

Piñon jays breed chiefly in piñon and juniper belts in the mountains, from central Washington, Idaho, and central Montana south to northern Baja California, Arizona, southern New Mexico and western Texas, and from the Sierra-Cascade ranges east to the eastern base of the Rocky Mountains and northwestern Nebraska.

CLARK'S NUTCRACKER (Nucifraga columbiana)

Herders who drive their sheep to the higher grazing grounds in the Western States, guides who conduct hunting or fishing parties up to the great plateaus and about the shoulders of the towering mountains, and wandering miners, all will give you bits of conflicting information concerning the habits of the Clark's nutcracker.

From such men of the open one will hear much that, with patience, he can readily observe for himself, for these large gray and black-winged inhabitants of the wilderness will come to one's very tent door. Rarely they become so bold as the jays of the neighborhood, and they will not take as many liberties with your belongings, especially if you are at hand. However, they will come to the camp for food, and, with a little discretion, can be studied quite at leisure.

The nutcrackers make a very pretty picture, walking sedately about, much after the manner of crows. Now and then they may be seen chasing insects like a domestic hen, for they are almost as much at home on the ground as in the trees. They consume great numbers of grasshoppers and the large, wingless crickets of the mountains. At times they chase butterflies, catching them on the wing. They also cling to the sides of tree trunks and peck in the bark for grubs, as do the woodpeckers. They raid the cones of the pine trees for their seeds and feed on piñon nuts, which constitute a staple and very important article of their diet.

The nutcrackers are birds of the mountain heights and in summer delight to play along the tree line. In many places they gather in the fir belt for purposes of nesting. Wheelock says of them: "Their nests were all rather bulky, composed first of a platform of twigs, each one nearly a foot in length, so interlaced that to pull one was to disarrange the mass. Upon this, and held in place by the twigs at the sides, was the nest—a soft warm hemisphere of fine strips of bark, matted with grasses and pine needles until it was almost like felt. This is stiffened, bound, and made firmer by coarse strips of bark around the outside, these also binding it to the twigs and helping hold it to the limb. So firmly is the whole put together and fastened to the branch, that no storm can move it from its foundations."

The birds breed early in the year, when there is little travel in the heavy snows of the upper ranges, so their nests are rarely seen. Egg-laying begins in February or March. Incubation requires eighteen days. Their breeding range extends from southern Alaska, southwestern Alberta, and western South Dakota south to the high mountains of Baja California, Arizona, and New Mexico.

CANADA JAY (Perisoreus canadensis)

One winter day I followed for a time a bear trail which wandered here and there through the snow among the ridges flanking a forested mountain. This was in the Adirondacks of northern New York State. Wearied at length, I brushed the snow from a log and sat down to enjoy the sandwich I had brought from camp. The forest was very still. There was no wind, and not one living creature had I seen or heard since leaving camp that morning. My only evidence that animal life existed in the country was that bear spoor and some deer tracks I had crossed.

Then suddenly two birds appeared. Neither one was sixty feet away. They were a little less than a foot in length, were gray in color, with some white and a little black in the plumage. Quietly they looked down from the limbs upon me—or perhaps upon my fast-disappearing sandwich, which might have been of more interest to them. Now and then one changed his position to come a little nearer. They exhibited no alarm, but rather a mild curiosity, mingled with restrained eagerness. Not a sound did they utter. It was almost eerie to watch these birds in pantomime, here in the white silence of the great forest. They remained until I departed, leaving on the log some of the bread and a little meat as a token of my appreciation of their visit. I had seen at close range my first Canada jays.

In later years I was to see them in their more northern summer home. About logging camps, or wherever man tarries for a time in the wilderness, they make their appearance. I know of no bird that is so bold. He will light on a low limb and watch the kettle boil or the meat frying in the pan. He will drop down and seize a piece of bacon, raw or cooked. He will snatch a cracker from the box inside the tent. He will peck at the fresh meat hung up to cool.

It is well to be careful of the articles one leaves lying about, for "Whiskey Jack" is the famous "camp robber" of the North. He will carry off your matches, your pencil, your cigarette, or your piece of chewing tobacco, although what he wants with such things I cannot guess. He will peck to pieces your candles or soap and carry away in chunks the fish you catch. He visits the trap line and takes the bait. He is aware of the presence of hunters and comes at the sound of the gun, knowing that when a moose or a deer is killed great feasting is in store for himself and his friends. There seems to be no end to the mischief that "Jack" can make about a camp in the wilderness. However, let us remember that he does eat insects and, now and then, a mouse.

The Canada jay breeds from the limit of conifers, from Labrador to British Columbia, and southward to northern Minnesota, and to Maine. Its nests are placed in trees and are composed of twigs, plant fibers, bark, moss and other soft materials. The bird lays from three to five brownish spotted eggs.

ROCKY MOUNTAIN JAY (P. c. capitalis). This bird is very similar to *P. c. canadensis.* It breeds in the mountains from British Columbia to South Dakota and New Mexico.

ALASKA JAY (P. c. fumifrons). Inhabits the wooded parts of Alaska except the southeastern coastal district.

OREGON JAY (Perisoreus obscurus)

As will readily be seen from the accompanying drawings by Allan Brooks, the Oregon jay and the Canada jay have certain marked resemblances in figure and color. Like all the forms of the genus *Perisoreus,* their bills are short, and they remind one more of overgrown chickadees than of the jays with which most people are familiar. Also, they lack some of the sleek, smart appearance characteristic of the typical jays.

The species is an inhabitant of the coastal area from southwestern British Columbia and western Washington southward to Mendocino County, California. The species *obscurus* is now recognized as being composed of two subspecies, the Oregon jay and the gray jay (*P. o. griseus*). Since their ranges join and the two species look so much alike, the student may have difficulty in determining which bird he is observing, unless he informs himself carefully as to the exact range of each. The gray jay is found in southwestern British Columbia, south-central Washington, and Oregon through the Cascade Mountains to California. The jays of this species seen in the fir regions of the Warner Mountains and on Mt. Shasta, for example, are gray jays. Those inhabiting many of the heavy redwood forests are Oregon jays. So far as general habits and activities are concerned, they may be considered as one bird. Early ornithologists regarded them all as the Oregon jay.

Major Bendire wrote that on the summit of the Blue Mountains in Oregon he saw these birds at an altitude of 6,500 feet. He and his companion had stopped for lunch and, "While so engaged," he said, "I heard several whistles in a large pine close by, and these were answered from other directions. Shortly after I saw one of these birds in a little fir a few feet from where I was eating my lunch. I threw him some scraps of bread and meat, and he was by no means slow in accepting the invitation to help himself. A few minutes later three others made their appearance and fed among our party with the utmost unconcern and almost allowed themselves to be touched."

Many observers testify to the unusual tameness of these jays. Mr. A. W. Anthony has recorded that they are "utterly devoid of fear." As an example of this pleasing characteristic, he said: "While dressing deer in the thick timber I have been almost covered with jays flying down from the neighborhood trees. They would settle on my back, head, or shoulders, tugging and pulling at each loose sleeve of my coat, until one would think that their sole object was to help me in all ways possible. At such times their only note is a low, plaintive cry."

All campers in this country know these jays, for they constantly come about the camps looking for food. "Camp robber" and "venison bird" are names often applied to them. Although only about the size of the robin, they are also called "meat hawk" by some people.

The nests are built in evergreens. They are sufficiently substantial to stand the wear and tear of domestic occupancy, and so serve well the purpose for which they are made. The eggs are a little more than an inch in length and are spotted.

CANADA JAY
Upper

Slightly more than one-third natural size

OREGON JAY
Lower

Approximately one-third natural size

CALIFORNIA JAY
Upper

SANTA CRUZ JAY
Lower

CALIFORNIA JAY (Aphelocoma californica californica)

The "blue jay" of California is quite different in appearance from the bird of the Central and Eastern States that bears that name. The blue is a different shade, there are no conspicuous white patches on the wings, and the bird has no crest on its head. He is one of the noisiest birds in California and is thoroughly disliked by a considerable portion of the people. But he is a very vigorous character, alert, bold, prying, and at times startling in his lusty shouts. These qualities arrest the attention and many admire him. Like all characters possessing strong personalities, he is both loved and hated.

Some of his food habits have brought him into disrepute, for undoubtedly he is an agency of considerable destruction to the small birds of the country. However, this loss seems to have been balanced by a wise Providence, for when a bird's eggs or its young are taken it will invariably lay again; so California is very rich in bird life, despite the fact that by eggs and by nestlings it must help to feed the jay population.

Mr. Mailliard, California ornithologist, relates instances of this bird's destructiveness to garden products. Of one case he wrote: "I remember one spring when a patch of about an acre and a half was sown with a mixture of peas and oats, and the peas were pulled up as fast as sprouted, by the jays, so that the crop consisted of oats alone . . . I shot over forty, one afternoon on this occasion, and a good many more on succeeding days, but they soon became so wary, that it was impossible to get another shot after one was killed—and still the crop was destroyed."

It has remained for a woman, Irene Grosvenor Wheelock, to present one of the most scathing denunciations recorded of this jay. In part she says: "He is one of the greatest trials a bird-lover must encounter, and I know no reason why the law should protect him to the destruction of our beloved birds of song and beauty. Were he of benefit to the farmer or to the fruit grower, no word of dispraise would I offer; but he not only robs them, but also destroys annually hundreds of feathered creatures which, living upon harmful insects, would be of great assistance in preserving the crops. No hawk is more destructive to small birds than he is. Ruthlessly he robs every nest in his vicinity that is left unguarded long enough for him to carry off the eggs or young. Not content with this he pulls down and breaks up the nest itself. Usually he prefers the newly hatched babies to the raw albumen, and waits for the incubation to be finished. I have seen him sneaking around the nest of a pewee day after day until the eggs hatched, when he at once made a breakfast on the nestlings—in this case, calmly disregarding the cries of the poor little mother. . . . About the farms he is even a greater pest, eating the eggs and occasionally killing the newly hatched chicks."

The California jay ranges the coast region of California from San Francisco Bay to Mexico and to the eastern base of the Coast Ranges. There are other races of this species which are discussed under "Woodhouse's jay."

SANTA CRUZ JAY (Aphelocoma insularis)

There is only one of the Santa Barbara Island group on which any jay is found. This is the island of Santa Cruz, and since the jay which lives here is found nowhere else in the world, it has been very appropriately named the Santa Cruz jay.

The island home of this species lies in the Pacific Ocean 20 miles or a little more from the coast of Ventura County, California. Santa Cruz is about 22 miles in length. Although it is a rocky region, abundant soil is available, so trees, shrubs, and gardens thrive without difficulty. The jay is unquestionably its most common bird.

Few species have such a restricted range within which every individual of its tribe is confined. They have done well in their island home, and are larger than their relatives in Ventura and Santa Barbara counties, visible over the sea to the eastward. The length of the Santa Cruz jay is more than 13 inches, thus exceeding by an inch or two the measurement of its mainland cousin, the noisy and none too popular *A. californica.*

Bulky nests are built among the limbs of trees or bushes only a few yards from the ground, and the three to five lightly spotted eggs are deposited usually in March or in April.

This bird was first discovered to science in June, 1875, by the naturalist H. W. Henshaw. Since then other scientific men have visited Santa Cruz for the specific purpose of making its acquaintance. One such student was W. L. Dawson and regarding the bird and its environment, he wrote:

"This gem of the islands belongs to him by unquestioned title, and he has no need to defend his claim by frantic protest or scurrilous abuse.

"This demure quality shows itself to best advantage when his nest is threatened, for it is then, if ever, that a bird's soul is tried. Yet I have spent an hour beside a nest of jay babies with never a word of protest from the closely attendant parents, beyond a mellow and almost inaudible *choop choop*—this and the sound of pecking on tree limbs, for even this gentle bird employs the familiar corvine device for relieving surcharged feelings. But this jay is capable of vigorous expression, and the variety and suggestive affinity of its note are worth considering.

"There is first, the Aphelocomine scolding cry of common use, but this is fuller, rounder, and much less than harsh. Then there is a *djay, djay* note which distinctly recalls that of *Cyanocitta stelleri.* Lastly this note is so modified and accelerated as to strikingly simulate the *rickety rack rack* or *shack, shack, shack, shack* of the magpies. I know the magpie's voice better than the baying of a hound, but I have leaped to my feet and reached for the glasses at this *jack, jack* call before realizing that there are no magpies on Santa Cruz Island."

Little has been recorded of the feeding habits of this bird, but, in common with other jays, it is known to eat nuts, insects, and eggs.

THE GREAT WALL OF PERU, LIKE THAT OF CHINA, MAY HAVE REPELLED INVASION

Across the Santa River delta and up into the hills it twists, crossing dry river beds, climbing sharp ridges, and swooping into valleys. The author and his companions followed it for 40 miles by airplane, yet, they believe, explored only a small portion of its length. Almost certainly it was erected to stem the tide of Inca warriors who once harried the country. At intervals along its sides are sturdy forts.

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE WHITE SHEEP, GIANT MOOSE, AND SMALLER GAME OF THE KENAI PENINSULA, ALASKA

BY GEORGE SHIRAS, 3RD

AUTHOR OF "PHOTOGRAPHING WILD GAME WITH FLASHLIGHT AND CAMERA," "ONE SEASON'S GAME BAG WITH THE CAMERA," AND "A FLASHLIGHT STORY OF AN ALBINO PORCUPINE," ETC., IN THE NATIONAL GEOGRAPHIC MAGAZINE

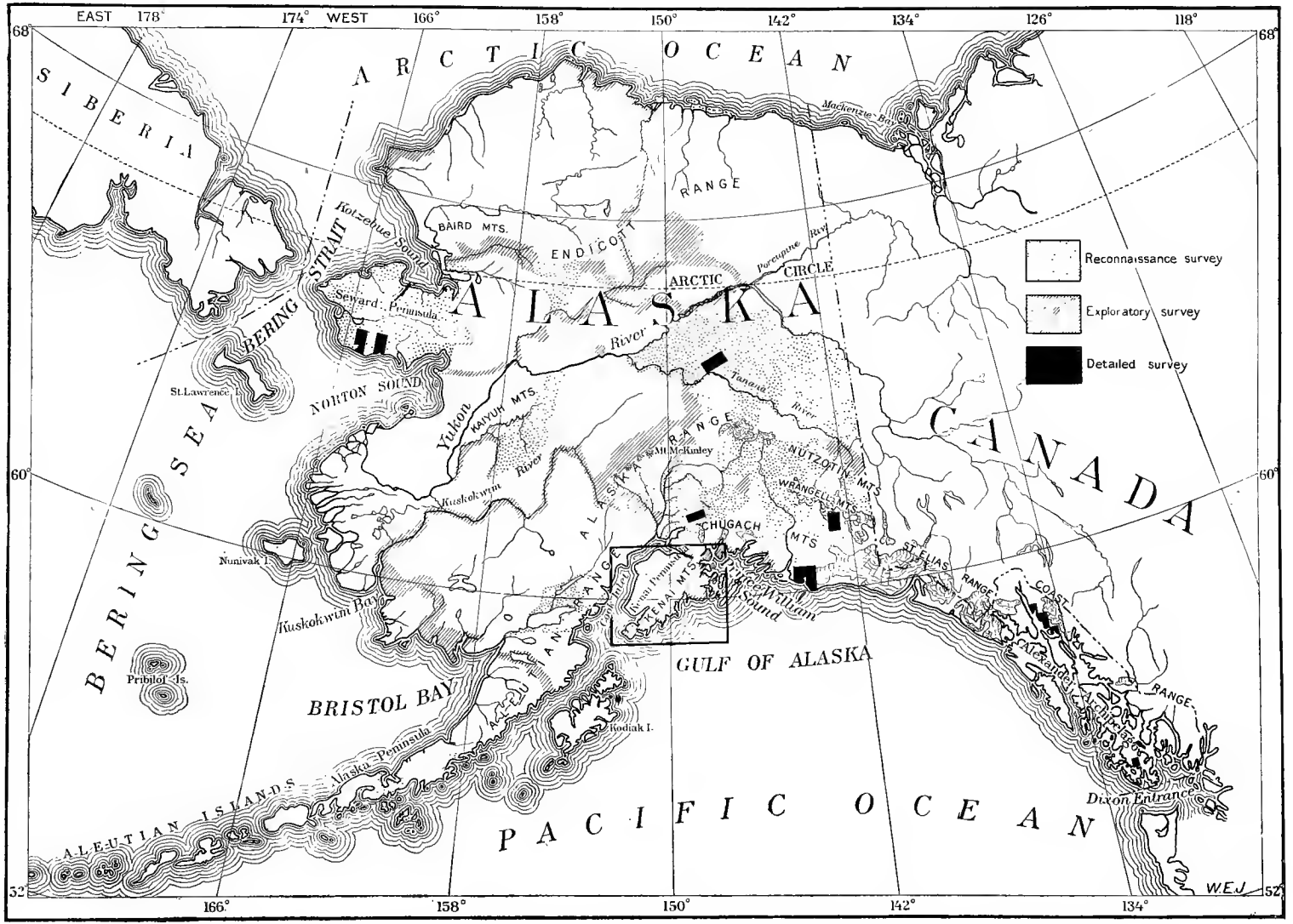
FOR a number of years the writer had in view a trip to northwestern Alaska, to study the big-game animals and certain varieties of non-migratory birds, and where the camera, rather than the rifle, was to capture the permanent trophies of the hunt.

Experience had shown, long before, that it was not how far one traveled away from home, or how extensive and primitive the country, which necessarily meant success in the pursuit of wild life. Well illustrating this are the virgin forests and the burnt-over, second-growth country immediately north of Lake Huron or Lake Superior, now largely deserted by the fur traders, the Indian trappers, and numerous camp-followers.

Here one may find a greater variety and abundance of big game in a week, and sometimes in a single day, than might be encountered during an arduous canoe journey of several months on any of the many open streams leading from the lake country to Hudson Bay. All these waterways have been traveled for centuries and the remaining game driven back into distant quarters. Because of the inhospitable winter climate, the lack of proper food conditions and shelter, most of the big game in Ontario, except caribou, is found on the southern watersheds draining into the Great Lakes.

So with Alaska. The reports of miners, trappers, government explorers, and sportsmen, covering many years of persistent research, have shown very clearly that the mere distance traversed in this vast country often meant but little in regard to big game, since it was a matter of ordinary occurrence for persons to travel a thousand or more miles on the Yukon and some of its tributaries without seeing a single specimen of the larger animals.

One might also journey for a month with a pack-train into the interior, crossing the rough and sodden tundra, the willow-tangled swamps, climbing over the rock slides of disintegrating mountains, cutting out trails along the thicket-rimmed banks of the larger streams, or wading waist deep the swirling, ice-chilled waters flowing from the melting snowbanks and glaciers of the upper valleys, and during all these long days of unremitting toil and miles of steady progress only a few grouse or an occasional porcupine might fall to the rifle of the weary and ever-hungry traveler.



OUTLINE MAP OF ALASKA, SHOWING THE SECTIONS THAT HAVE BEEN MAPPED AND SURVEYED

Compiled from maps of the United States Geological Survey

This because the caribou is a wandering and uncertain animal to find in such a limitless country; because the moose frequently remain concealed for months during the summer in thickets of alder and willow at the edge of the timber line; because the bears, besides being largely nocturnal, hide most of the time in the densest jungles or feed high up the slopes on the tender grasses and wild berries until the coming of the salmon; because the sheep and the goats habitually occupy the higher ranges beyond the valleys of the larger streams.

Thus unless a side hunt is made back and up into the game country, one might often think that interior Alaska was a barren and tenantless waste, did not the old tracks in the clay bottoms and higher sandbars faithfully register the former visits of the hoofed and clawed animals of this mysterious and little-known wilderness.

AN IMMENSE COASTLINE

To one who has not followed a portion of the Alaskan coast, with its tens of thousands of islands, deep bays, extensive promontories, and countless channels, where the main shore for miles is walled in with precipitous glaciers or by the highest mountains, and who has not also penetrated sufficiently into the interior to understand the changes wrought by the difference in climate and topography, it is difficult to present a clear and adequate outline of this great area and its diversified conditions.

The general contour of the coast is known to many and its devious channels to a lesser number of experienced navigators. Where the interior is opened up by navigable streams or where the valleys and low divides allow the use of the pack-trains or the sleds and the adjacent mountains permit an unobstructed view, sometimes exceeding a hundred miles in circumference, it naturally follows that sufficient data has been obtained to dot and trace the small scale maps with an imposing array of mountains, lakes, glaciers, well-defined river-courses and tributary streams.

But, excluding the coast survey, less than 20 per cent of the interior is mapped, and detailed surveys represent a very minor portion of this (see map, p. 424).

Until a permanently organized topographic corps is permitted to plan and pursue its work in a continuous and systematic way, instead of hurrying from one part of the country to another, as the mining camps or other interests seek assistance, the interior of Alaska can be known only in a fragmentary way from the early surveys of the War Department and the later records of the Geological Survey, which in recent years has done such splendid work in locating and appraising the mineral wealth and possibilities of the country and in suggesting the most feasible routes for its development.

One main difficulty in presenting a general geographic view of our last remaining continental Territory is not because it exceeds 600,000 square miles, or on account of its remoteness, but because Alaska is the most complex and irregularly shaped area of the size in the world. A good example is the Kenai Peninsula, which, with a total length of 170 miles, has a shore-line of more than 1,000—and a glance at the map, pages 428 and 429, will explain the reason.

Alaska lies on either side of the Arctic circle, is in both the Western and Eastern hemispheres, by reason of its westerly extension, and possesses a coast-line of 26,000 miles, exceeding the aggregate of the United States on the Atlantic, Gulf, and Pacific shores if we include in such survey the deeper indentations and the various groups of islands, one of which, the Alexander Archipelago, embraces more than 11,000 islands. The narrow chain of the Aleutian group extends, at right angles, more than 800 miles and within eyesight of Russian territory, where when the sun is setting in June it is rising on the Maine coast.

PHYSICAL AND CLIMATIC DIVISIONS

There are two comparatively distinct ocean areas on the Alaskan coast, separated by the Alaska Peninsula and its segmented extension, the Aleutian chain, which, largely intercepting the northerly flow of the Japanese current, also create marked climatic differences.

South of this barrier the warm current keeps the subarctic harbors open all the year; the humid air, coming in con-

tact with the snow-covered coastal ranges and the glacier-filled valleys, produces a most extraordinary precipitation in rain or snow according to the season.

To the north, Bering Sea remains clogged with floating ice well into summer, and when the open water finally permits navigation to the Yukon delta and beyond, the warm moist air of the Japanese current, passing freely over the Aleutian chain, comes in contact with the cooler waters beyond and creates a dense and almost perpetual summer fog. Sometimes it may take several days to find and effect a landing on the Pribilof, or fur-seal islands, and then, like as not, the islands are finally located by the cry of the seal pups or the pungent odors from the breeding rookeries.

In a similar way the land area of Alaska has two distinct divisions. To the south and the east of the Alaska Range the country is rugged and mountainous, with valleys great and small and rivers swift and numerous, as necessary incidents, while to the north and northeast it is low and rolling, the streams more sluggish and separating into many channels on approaching the Pacific and Arctic coasts. Climatically the interior cannot be divided so readily. At the same altitude and period it is warmer in summer than on the coast and much colder in winter, the local variations occurring in the mountainous country, as might be expected, where the elevations range from 2,000 to 20,000 feet.

Of the two big-game animals particularly sought on this trip, one, the moose, was to furnish, if successful, a valedictory chapter of its many years' observation, and in the most westerly and northerly of the five districts into which the writer had endeavored to divide the continental range of this animal,* and the other was the beautiful white sheep of the subarctic mountains, a variety with which I had no personal acquaintance, but now desired to cultivate in an entirely friendly way.

To stalk, study, and photograph for the last time the largest, most unique, and impressive of our antlered animals, and then when this was accomplished to seek out on the rough mountain tops the snowy descendants, or perhaps in reality the progenitors of the Big Horn sheep of the Rockies, constituted a program sufficient in itself, though plenty of sensitive plates were in reserve for any other animals or birds worthy of portraiture.

To obtain satisfactory results from a first and rather brief exploration into a new and unsettled country, I think as much depends upon the comparative accessibility of the game field as upon the comparative abundance of the game itself.

The Kenai Peninsula, lying between Cook Inlet on the west and Prince William's Sound on the east, distant 1,500 miles from Seattle, was selected as not only the most accessible in territory and in the abundance of its game, but because in this favored region the moose and mountain sheep reached their highest perfection in physical development and, what was of equal importance, were to be found with certainty in well-defined ranges in this semi-island home.

THE KENAI PENINSULA—A MINIATURE ALASKA

It is seldom that a small, semi-detached portion of a large and diversified country can satisfactorily portray the whole, not only in the romantic history of its discovery and early explorations, but in those present-day conditions, where the climate, topography, and economic resources excite attention and comparison. Were all of Alaska erased from the map except the Kenai Peninsula and its immediately adjacent waters, there would yet remain in duplicate that which constitutes the more unique and that which typifies the whole of this wonderful country.

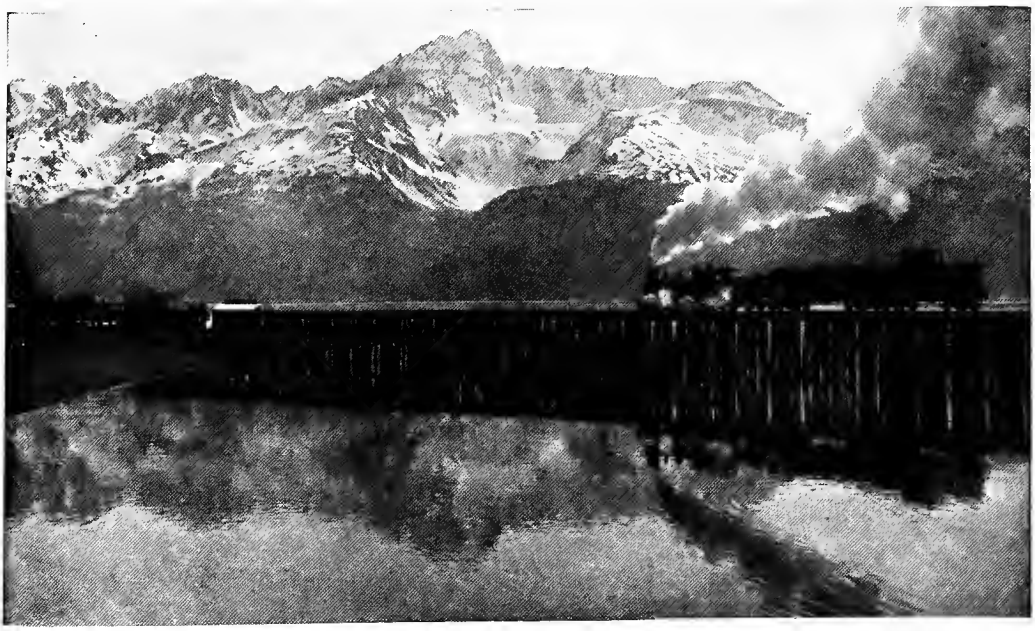
This is true of its tribal races and mixed descendants, of the hardy pioneers in well-governed settlements, where with the best of harbors, a railroad leading to the interior, steamships and cable lines to the outer world, they enjoy nearly all the advantages of modern civilization.

It is true, too, of the forests, herbage, wild fruits and flowers, the game and commercial fish, the native and migra-

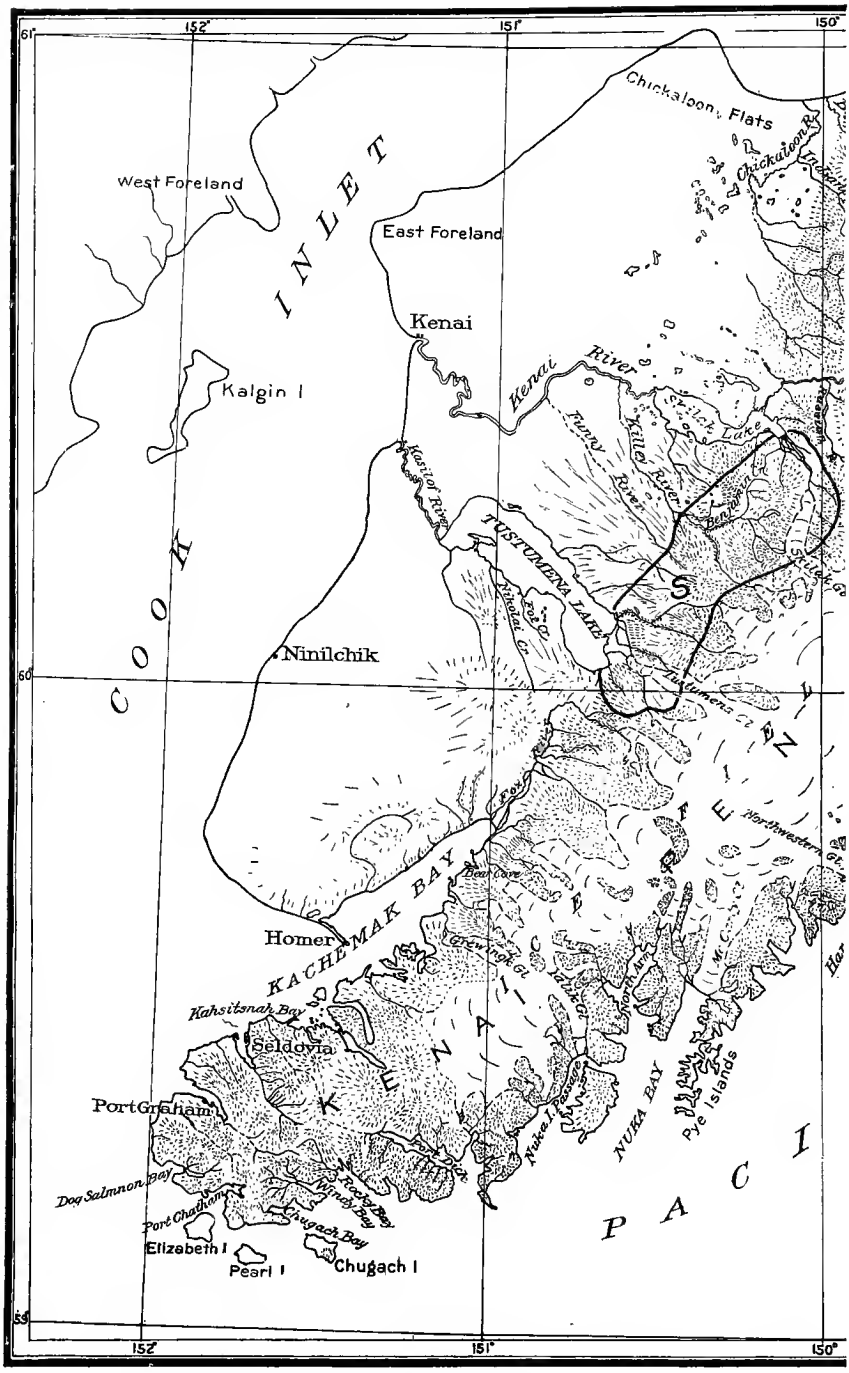
*See articles by George Shiras, 3rd, in the NATIONAL GEOGRAPHIC MAGAZINE, 1906 and 1908.

HEAD OF RESURRECTION BAY, SHOWING THE TOWN OF SEWARD

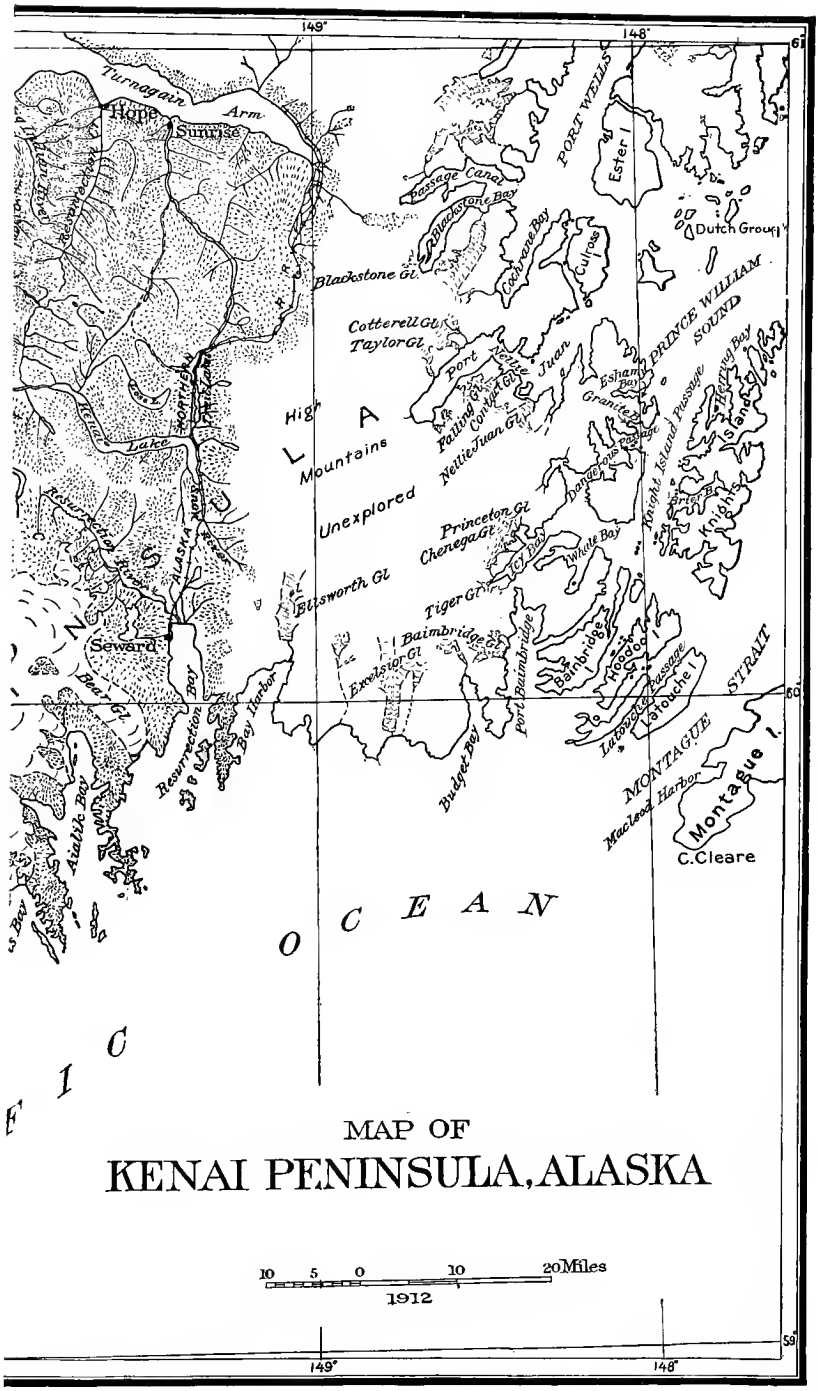
The cross to the north indicates the position of upper Kenai Lake, and 40 miles to the westward was the hunting ground of the author (see map, pages 428, 429)



RESURRECTION BAY, SEWARD PENINSULA: STEAMSHIP DOCKS OF SEWARD, WITH TRAIN LEAVING FOR KENAI LAKE AND TURNAGAIN ARM (SEE PAGE 430)



MAP OF KENAI PENINSULA, SHOWING THE BEST PORTION OF THE SHEEP COUNTRY (ENCLOSED IN A BLACK LINE AND MARKED "S")



MAP OF
KENAI PENINSULA, ALASKA

MAP OF KENAI PENINSULA, SHOWING LOCATION OF SEWARD AND RESURRECTION BAY. COMPILED BY R. H. SARGENT BY REQUEST OF GEORGE SHIRAS, 3RD

tory birds, the big-game animals and smaller fur bearers, the minerals and methods of mining, and in the magnificence and variety of the scenery, represented in well-defined mountain ranges and isolated peaks, the foaming cascades, the giant glaciers and ice fields, the rivers and intervening lakes, and the hundreds of unexplored fiords of the eastern and southern shore.

Here and there snow-capped mountains drop to plateaux, rough and shaggy in crimson coats of moss or yellow-barked willows, and further down the green coniferous forests touch the tundra, dotted with glistening ponds, the feeding place for moose and the home of the black fly and mosquito.

Here during the summer solstice are weeks of brilliant weather and periods of wet and fog, while the frequent seismic disturbances give notice how superficial are the ice fields and the blizzards in a country of great volcanic energy.

Here is a mid-year season, when the calendar days are separated by an hour of twilight, and again when the trapper, in his sheltered winter cabin, cannot see the sluggard sun above the horizon of the surrounding mountains.

Here are tidal waves and rip-raps of Turnagain Arm, like those of the Bay of Fundy, and here so rare the atmosphere that at times Mt. McKinley, distant 200 miles to the north, can be seen from the higher mountain tops.

So many accurate and graphic accounts have been written of trips along the Alaskan coast that any effort to duplicate or vary the same may be dispensed with here.

On leaving Lake Superior and at the last moment I was obliged, owing to sickness in his family, to get a substitute for my old Michigan guide, John Hammer, who for 25 years had accompanied me on various trips. Charles Anderson, who took his place, had frequently been employed by me in various capacities, and possessed a fair knowledge of the woods and waters.

On July 8 we left Seattle for Seward, and had pleasant weather throughout most of the voyage.

Toward sunset on the evening of July 14 the steamer entered Resurrection Bay, which penetrates deeply into the Kenai Peninsula, forming the most wonderful harbor on the Alaskan coast and open throughout the winter, when the Great Lakes and connecting rivers are closed for many months.

After a run of ten miles between two snow-covered ranges paralleling the bay, we reached the town of Seward, and the first responding to the shrill and echoing whistle were a hundred or more dogs, of every breed and color, who amicably ranged themselves in several compact rows along the edge of the dock, in hopes that some portion of the garbage saved by the kindly steward would fall to their lot (see page 431). In their home grounds or street fronts these shaggy beasts maintain a dead-line against all canine intruders, but at the wharf there was no distinction based upon race, size, sex, or relationship. Whenever a steamer whistled at night, or any unusual noise aroused them, the wolf-like howl, rising and falling in chorus, told plainly of the near kinship of many of these to the gaunt and ravenous creatures of the forest and rocky gulches.

On disembarking we were met by an obliging inn-keeper and soon were in earnest confab with our local guide, Thomas B. Towle, who had just come in from his mining camp, on the upper Kenai River, with the information that a launch would meet us at the lake, two days later, on the arrival of the motor train.

At Seward so varied and reasonable are the supplies needed on a camping trip that little need be brought from the outside, while the courteous and reliable character of the inhabitants, private and official, makes the entry and return to this little town a source of pleasure and kindly recollection. In fact this may be said of most Alaskans, for their trials and struggles, like placer mining, have removed the rough and undesirable from their midst.

On the morning of July 17 we boarded a gasoline car of the Alaskan Northern Railroad, en route to the upper Kenai Lake, 23 miles to the north, while the canoe and bulk of the provisions were to be forwarded by freight several days later. The railroad in question extends

Photo by George Shiras, 3rd

WINTER SLEDGE DOGS LOITERING EXPECTANTLY AROUND STEWARD'S PANTRY (SEE PAGE 430)

to the end of Turnagain Arm, half way to the Matanuska coal fields; but, lacking sufficient capital and by reason of the withdrawal of the coal lands, is now in financial straits. However, it is a most convenient highway for hunters and miners, and if either of these lack the cash to pay the tariff of 20 cents per mile or are of an economical turn of mind, the roadbed affords a fine trail to the interior.

On arriving at the lake it took but a few minutes to load our stuff on a comfortable launch, and soon we were traversing a portion of the longest watercourse of the peninsula, which from the head of Snow River to Cook Inlet is 117 miles in length. The upper lake is 23 miles long, has a maximum width of 1.5 miles, and is 460 feet above sea-level. The upper Kenai River is 16 miles long, while the lower lake, usually called Skilak, has a length of 15 miles, is four or five miles wide, and 150 feet above the sea, its waters reaching the inlet after a tortuous run of 53 miles.

At the outlet of the lake we transferred the outfit to Tom's big flat-bottom skiff, and, dropping down the river several miles, went into camp at the mouth of Cooper Creek, to await the arrival of the canoe and provisions. The maximum temperature was 80 degrees at noon, followed by 87 degrees the next day—a most unusual record.

Seeing that the half-embedded boulders were sweating vigorously along the river trail, I predicted a big thunderstorm, and was warned that they were very rare in this region. But shortly after the rain came down in torrents and thunder echoed for hours throughout the valley; so I gained that distinction which comes with a lucky hit. This proved to be the only heavy rain of the entire trip, and thereafter clear days and a high temperature pleased and astonished us all.

STERN FIRST, DOWN THE RAPID KENAI RIVER

As usual on expeditions of this kind and where the supplies could be carried by water, my outfit was varied and heavy, for it is the height of bad management, when visiting a remote and unsettled country, to economize in money, time, or labor at the expense of a proper equipment or an ample supply of provisions.

Several hours were spent in loading the boat and canoe, with just a sufficient separation in kind to leave a complete but temporary outfit in case either craft was capsized on the run to the lower lake.

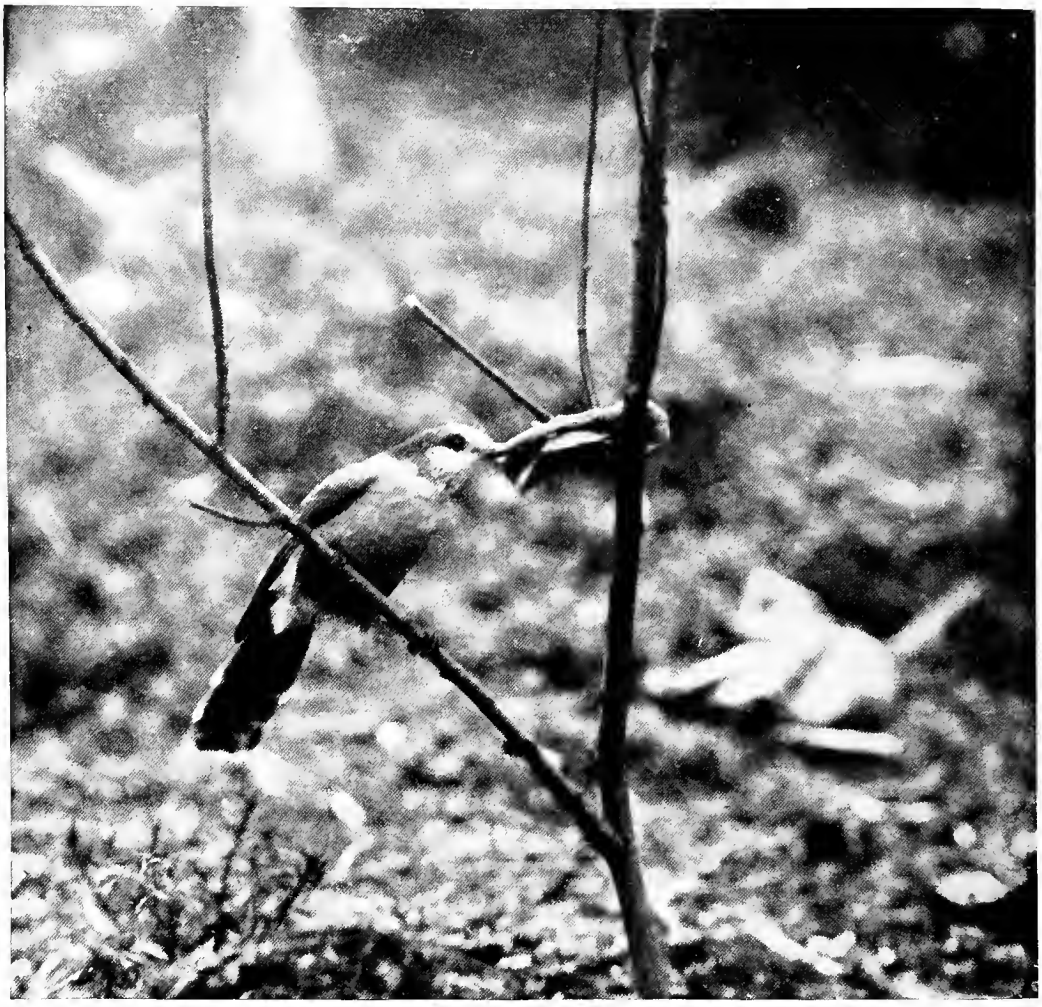


Photo by George Shiras, 3rd

THE ALASKA (?) OR CANADA JAY: THE MOST TYPICAL NON-GAME BIRD OF THE NORTHERN WILDERNESS

The above is a photograph of a non-migratory and Northern jay, taken on Skilak Lake, and which, as a species, is indigenous to the upper wilderness from Newfoundland to Bering Sea and southwardly to the lower provinces and most of the border States. While tame and fearless to a degree toward casual visitors, it dislikes and avoids permanent human habitations, single or collective. It is a bird, too, of many local names—whiskey jack, moose bird, camp robber, and meat bird. Originally classified as the Canada jay (*Perisoreus canadensis*), the effort now to differentiate the Alaska bird, on a minor if not a variable color phase, is regarded as a mistake by most lovers of the North woods. If there is any bird on the American continent of similarly extended distribution and localized environment which retains a greater and more remarkable uniformity in color, size, shape, habits, basic notes, diet, and disposition, the writer is ignorant of such. The sub-species, Labrador jay, ought to be the limit in this direction.

The clear, warm weather, with an unusual amount of winter snow remaining on the mountain ranges, had caused the river to overflow its banks. The rapid current now made it possible to cover the 16 miles to the lake in a few hours, and this condition had prevented any boat coming upstream for several weeks. It may be stated in advance that the hot weather continued until the first week in September, and so, on our return, it required four days of the hardest

Photo by George Shiras, 3rd

OTTER SWIMMING IN A BAY OF SKILAK LAKE, SEEKING SALMON: THE OTTER SWIMS WITH HEAD HIGH OUT AND BODY SUBMERGED

kind of work to line up the skiff, the canoe having been abandoned in order that the three men might devote their energies to the larger boat.

And even at that date we were the first to get up the river, due wholly to Tom's skill and the energy of all.

On the short trip from the outlet of the upper lake to our first camp, at the junction of Cooper Creek and the Kenai River, I found that it was the invariable practice for all boats, big or little, to go down this stream stern first, and to me this was a new method of navigating swift and dangerous waters. Heretofore I had boated on many such Northern streams, originally in the frail and buoyant birch-bark canoe, in dugouts, and, later, in the modern canvas-covered cedar ones, or at times in the knock-down type, as well as having occasionally used the big, strong, sharp-pointed batteaux of the Hudson Bay and Newfoundland kind, which could plunge with impunity into the roughest water; or, when sufficiently manned, could be lined up any stream, irrespective of inshore rocks and snags.

But whatever the craft or the character of the water, bow first was the rule, except when a mishap in the breaking of an oar or the slipping of a rope decreed otherwise.

Therefore, to load down a small, frail, flat-bottom, square-stern skiff with 1,000 pounds of stuff and two occupants, and then start down the river wrong-end foremost, where every 100 yards or so

Photo by George Shiras, 3rd

A HOARY MARMOT

The northern type of the American woodchuck—a good example of protective coloration. Photographed on mountain at head of Benjamin Creek

the combers in the narrower channels, or cross-currents, throw the waves a foot or two higher than the stern of the boat, seemed inviting catastrophe, had it not been proven otherwise, seconded by the fact that Tom had the reputation of being the most capable and experienced riverman in the Kenai Valley.

Grave concern was expressed, however, over the safety of our canoe, and so the feeling of distrust was mutual. Tom said that he would rather take his chances on a saw-log, "Because it never took in water, and the part above the surface was always the top, no matter how often it rolled over." So here was a chance to try out the efficiency and safety of each boat, running practically side by side.

The explanation for this method of handling such a skiff soon became plain. No ordinary boat can safely run a swift and tortuous stream when floating at the same speed as the current. It must go either faster or slower, in order to respond readily to the rudder or paddle when steering. In a canoe the occupants of course face ahead, while by letting the skiff run down stern first the oarsman, and in this particular instance the steersman, also faced down the river, the full advantages of which I learned later.

Since the river was unknown to my Michigan guide, who was to manage the canoe, it was arranged that I should sit in the stern of the skiff, facing upstream, and, with the canoe keeping 50 yards or more in the rear, I could signal the character of the water at each bend and which side the canoe should take when necessary.

The first proof that the different methods were based upon the character of the boats came a few minutes after starting. On rounding a bend we found in the middle of the stream, less than 30 yards away, an immense rock, over which the water was breaking with great force and against which we would have drifted broadside, as the current divided. Tom pulled vigorously to the left, quartering upstream, and although he could not quite stem the current the boat slowly worked inshore, with a good margin to spare when we dropped past the rock. Had the boat been going

Photo by George Shiras, 3rd

ANOTHER VIEW OF THE HOARY MARMOT, RARELY FOUND BELOW TIMBER LINE

They have a remarkable system of signals on the approach of an enemy. This marmot had just signaled our approach with an almost human whistle, which was as clear as a bell. The whistle often confuses hunters who have been separated.

faster than the current, with the oarsman's back to the danger, a smash-up would have been a certainty. Charlie, on the other hand, in the light and easier-handled canoe, took the inshore channel with a few strokes of his paddle.

Thus the lighter boat depended upon speed and ease of propulsion, while the clumsy and heavily laden skiff, with Tom facing downstream, could be kept in the middle of the river or pulled to either side in time to avoid rocks or rough water.

I must concede, however, that there were times when the skiff thus handled had the advantage over the canoe, for when entering certain rapids, where the breakers extended from bank to bank, by pulling at the oars, and thus slightly checking the descent, the great curling

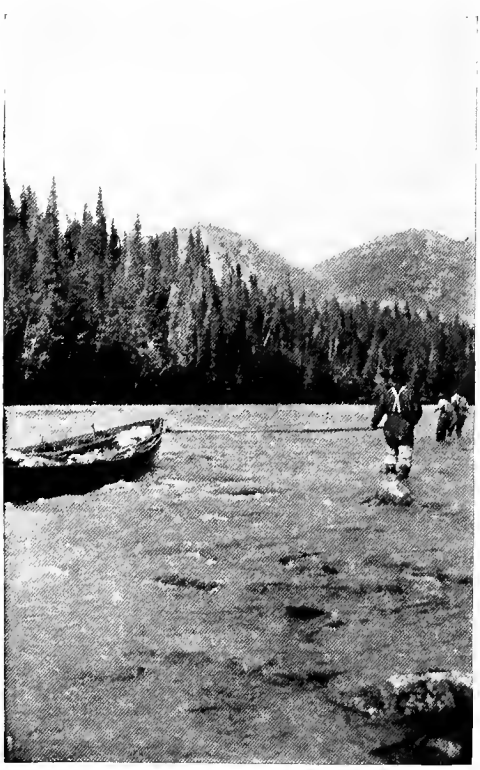


Photo by George Shiras, 3rd

TOWING OUR BOAT UP KENAI RIVER ON THE RETURN TRIP

The two men in front devote their strength to pulling on a rope, while the one in the rear, by the use of a 10-foot pole bridled to the bow, steers the craft in and out around snags and rocks in shallow water.

waves fell away harmlessly from the flat stern, because they were receding with the same speed as the current. At such times the canoe, drifting rapidly with the stream and often going much faster in order to keep its course, would be deluged with spray, and occasionally a large wave would overlap the bow.

To those who have occasion to run swift and crooked streams, where the backwoods craft is apt to be one of the easily constructed, box timbered kind, this method can be highly recommended as safe and comfortable. Were such a method in vogue on other Alaskan rivers many a miner's life would have been saved and many a valuable cargo carried safely to its destination.

At a box canyon, some three miles above the lake and where the river runs like a mill-course between high and perpendicular cliffs for nearly a quarter of a mile, we portaged over the canoe and our more valuable stuff, since I was unwilling that any risk be taken. A week before a large boat, containing government supplies, was nearly lost at this point and, half filled, floated helplessly down the stream.

When making this portage it became apparent that we had reached the first great fall and winter range of the moose, for the numerous and well-worn runways, the trees denuded of their bark and lower branches, together with an occasional shed antler, told the story.

Here we camped for the night, near one of the few sloughs connected with the river, in hopes of a moose picture or two, but the high stage of water and the fact that the most of these animals were then at the edge of the timber line or in the great swamps west of the river valley only resulted in giving the mosquitoes an unexpected but welcome meal.

Shortly after starting the next afternoon the canoe, in making a quick rush to avoid going under a log jamb, got ahead of us, and when overtaken, ten minutes later, we found Charlie clinging to a bush with one hand and bailing out with the other, having kept to the middle of the stream when rounding a sharp bend, thereby running into what the natives call "smoky water," which adventure might have been avoided had we been in advance or had he known the river better. When asked about the matter, he cheerfully remarked that it was now plain why Tom had given him all the canned goods—"because they were water-proof."

PICTURESQUE SKILAK LAKE

Finally, the boats came to the first slack water and the next turn showed the lake, higher by several feet than usual at this season, but smooth and glowing in the quiet hour preceding sunset. For the first time the oars and paddles became necessary for locomotion and, relieved from the continuous strain of watching for rocks, log jambs, rough water, and tumultuous whirl-pools, we enjoyed the placid surroundings to the utmost.

Dividing the mouth of the river was a low sandy island ablaze with a solid body

of crimson flowers, while a semi-circular shore, with a yellow ribbon of sand, was backed by a green fringe of spruce, and on either side towered snow-capped mountains, extending half way down the lake, where rounded and rolling hills sank into a great flat, extending to Cook Inlet on the west and Turnagain Arm on the north. A wide valley on the left, with a muddy floor, resembling a former river-course, and through which there trickled several small streams, Tom said was the outwash plain of a great glacier, beginning a few miles back and extending, he thought, 65 miles to the southwest, but about which little was known or at least recorded. His statement immediately aroused my interest, and during the succeeding days I learned much about the great ice field from which the Skilak glacier flowed; so that on my return to Seward, and later to Washington, I was able by dint of much inquiry to learn something further of its history, with a view of suggesting in a general way the possibilities of its origin and its probable status among the great ice fields of the northern continent.

Photo by George Shiras, 3rd

THE WORST PART OF TRACKING: REQUIRING THE MEN TO WADE IN SWIFT WATER OF UNCERTAIN DEPTH TO AVOID LOG-JAMS AND OVERHANGING TREES

Photo by George Shiras, 3rd

AN EASY HALF MILE, WHERE THE ORIGINAL FORESTS ON THE BANK WERE CUT DOWN BY RUSSIANS IN 1857

Continuing down the lake, Tom pointed out what he called a "low divide" in the southern range, saying it was the gateway to the sheep country, 10 miles or so in the interior. In the setting sun the distant patches of alders and matted forests looked like smooth greenswards on gently sloping sides and the climb appeared easy—an impression, however, which changed considerably when we came to struggle for 3,000 feet up the precipitous sides, where the feet became imprisoned in gnarled limbs and the packs were continually catching in the stiff and unbreakable branches of the dwarf hemlock.

GULLS AND CORMORANTS

On reaching the lake we had studied its general contour, and estimated the distance to our first permanent camping site to be some 10 miles to the south-

Photo by George Shiras, 3rd

BREEDING ROOKERY OF THE BLACK CORMORANT

One of two rocky islets near the eastern end of Skilak Lake, one being occupied by cormorants exclusively, and the other by gulls and terns. Note that the cormorants, on skyline or rock background, are not protected by their coloration, unlike the gulls, who are so protected (see page 444)

Photo by George Shiras, 3rd

NEST OF CORMORANTS ON A PINNACLE OF THE ISLAND: THE MAIN SHORE BEHIND SHOWS THE SNOWFIELDS CLOSE TO THE SHORE OF SKILAK LAKE

west. My desire to remain for one night at the upper end of this fine body of water was strengthened by observing two rocky islets ahead, over which gulls, terns, and cormorants were flying in considerable numbers. When passing by these, many nests were seen, and in a few minutes the boats were beached in a sheltered bay just opposite the islands.

Here, growing in the shallow waters, we collected our first wild onions and, erecting a single tent on the sandy shore in order to escape a hoard of mosquitoes buzzing in the forest behind, we spent a rather uncomfortable night, but entertained by the shrill cries of the gulls and the weird grunts and groans of the black cormorants. Shortly after sunrise the bird islands were visited, being escorted to a landing place by a great flock of protesting parents.

While the gulls and terns continued to circle just overhead, the cormorants flew a short distance on heavy wings, dropping into the lake to watch with anxiety our visit to their nursery. Some of the scenes are recorded in the accompanying pictures, with explanatory foot-notes.

THE GIANT MOOSE OF THE KENAI PENINSULA

Continuing along the high and rocky northern shore seven miles, and finding the direction of the wind favorable, though a considerable sea was running, we crossed the lake, where it was about four miles wide, to a beautiful little beach flanked by a grove of open pines, the site selected for a two weeks' camp, and situated at the end of the longest and most sheltered bay on the lake (see page 447).

The distance across the base of the western promontory was less than 75 yards, so the canoe was carried over, and during the remainder of the stay we had boats in adjoining bays, thus saving considerable time, according to the direction taken in our trips by water, besides affording a lee shore for one boat or the other, an important feature in a country where furious gales suddenly spring up in response to local conditions and seldom

Photo by George Shiras, 3rd

TWO YOUNG FEATHERLESS CORMORANTS IN NEST, ABOUT 8 DAYS OLD: THE SMOOTH AND SHINY BACKS AND THE BLUNT HEADS MAKE THEM RESEMBLE TURTLES

forecast by the barometer. For the then and future identification, we called this Double-bay camp.

The erection of the tents, the manufacture of camp furniture, and the setting up of the light sheet-iron Klondike stove took the remainder of the day.

Towards evening I ventured back into the forest to look for signs or the sight of a moose, for we were now in the home of the *Alce gigas*, and the several large runways on either side of the tents showed that we were then trespassing upon one of the main thoroughfares around the lake. But no fresh signs of any kind were found.

At dusk the guides saw, from a near-by knoll, five moose wading in the shallow waters of a pond a mile and a half distant. This sight went far to sustain the information upon which the present camp was located.

Selecting a good game country does not of itself imply individual success, though of course the main element in such. All wild animals of the larger kind have a particular range, or cover, in an extensive region, and quite often change these systematically, according to the season, or arbitrarily, according to the conditions of the weather and food supply. Therefore, before starting for Alaska, it was deemed no more important to go to a good game region than it was to go to the best part of it, for the allotted time was too limited for determining the latter by personal investigation. It is the too frequent lack of this kind of foresight which so often brings bitter disappointment to hundreds, who feel assured of success simply because of their entry into a country reputed to be swarming with game.

If my advance information were correct—and it came from several sources—it meant that I would find, to a certainty, more or less moose in an area of less than a square mile, and at a period of the year when they were hardest to locate, while the white sheep were to be

Photo by George Shiras, 3rd

HOW THE SAME TWO CORMORANTS LOOKED ONE MONTH LATER

looked for in several converging ranges, all under easy scrutiny from a single point of observation. And, in regard to the moose, this requires an explanation.

In all my journeys to the wilderness home of hoofed animals, I have only occasionally found an extensive region without animal licks, those resorts where the mineralized waters or soil attract ruminant quadrupeds. True, many of these spots are unknown, even locally; but nevertheless some hunter or explorer frequently knows of such places. And here the game photographer should locate for a while, however much a true sportsman may decry the destructive custom of killing the visiting animals at a lick, be it natural or artificial.

Some day I hope to summarize the result of an extensive investigation of hundreds of these licks, many of them thousands of miles apart, and frequented at different times by deer, caribou, elk, moose, sheep, goats, buffalo, and antelope. Just what elements attract and how each mineral affects them, physically and in their habits, presents many interesting phases (see pages 443 and 448).

It will suffice here to say that salt, soda, iron, and sulphur, in the order given, either singly or in combination, cover practically the attractive qualities of these licks. It is certainly very strange that such an interesting subject has never received any serious and comprehensive treatment by sportsmen or scientists.

An Eastern sportsman had informed me that a mile or so west of the present camp there was a good-sized lick, and, from the signs about it, he judged that a number of moose visited it, even in the summer time. As Tom had been his guide, I knew there would be no trouble finding it. However, I was told, on reaching Seattle, by a member of the party first attempting the ascent of Mt. McKinley, of a large lick less than 100 yards from the south shore of the lake, and in the same general direction as the other one. It was therefore apparent that, while neither of my informants knew of both licks, they were evidently in the same drainage basin and not more than a mile apart.

Feeling satisfied it was near the shore lick the guides had seen the five moose, and as it would be accessible by canoe and less disturbed by tramping about on

Photo by George Shiras, 3rd

ANOTHER NEST OF THREE CORMORANTS, 10 DAYS OLDER THAN THE TWO IN THE PRECEDING PICTURE

Unlike young gulls of a much younger age, they do not leave the nest when alarmed, but groan and disgorge the contents of their stomachs. The cormorants in this picture disgorged two quarts of fish from their pouches when the author appeared to photograph them.

land, I made up my mind that this would be the place where the spruce blind should be erected and my first efforts made in getting pictures.

OUR FIRST SIGHT OF THE GIANT ALASKA MOOSE

What happened the following day is described in extracts from my notebook:

"*July 21, 1911—Ther., 68-50.*

"At 9 a. m., in a bright sun and a dead calm, we started to look for the moose lick near the shore, and situated, according to directions, at the westerly base of a long point, which I took to be the one heading towards the lower end of Caribou Island. In half an hour the canoe entered the channel between the island and the point, and in a few minutes we swung around towards the bite of the bay. Tom said that the previous winter he had run 14 moose, principally bulls, off the island while crossing the ice with a dog-sled carrying provisions from Cook Inlet to a mining camp, but he did not think we would see any bulls now, as they were all hiding in the thickets well up towards the mountain-tops.

"A moment later he whispered, 'Gee! there's a bull, and a big one, too.' What I had taken for the brown soil on the roots of an overturned tree was a large moose with antlers that excited attention, but no more so than the tawny color of its coat. I had never seen such horns before nor such a color. The moose was solemnly watching the canoe, with the greater portion of the antlers shoved up into the lower branches of a spruce.

After examining him carefully through a powerful field-glass, I was about to prepare for a picture when Tom, who had been gazing about, said, 'Gee! Two more bulls! Look to the left.'

"And there, coming in file towards us, were two big brown-coated beasts with antlers that would tickle a Maine hunter, but somewhat smaller than those of the first. Sinking back into the bow of the canoe, I got the camera ready for the pair.

"But with that perversity with which providence is well supplied, the bulls turned towards the bigger one and for a moment or two rubbed noses in a friendly way—the climax of my opportunity, but missed by overcaution—when they passed to the rear and soon out of sight. They had doubtless been disturbed by us further down the shore. But the big fellow, motionless as an image, still gazed at the three heads peering over the edge of the grass."

And here it may be interpolated that no antlered animal of the earth is more obtuse and stolid than the moose, and no animal, when finally alarmed, is a greater victim of an increasing and progressive fear than this. At times it seems almost impossible to alarm them, and then, when this is accomplished, one wonders whether they ever recover from the shock.

Twenty years' association throughout their general range, with dozens of pictures by daylight and a hundred taken under the blazing, roaring flashlight—some only 20 or less feet away—make such conclusions irrevocable in the writer's case, whatever others may say regarding the supposed sagacity of the moose and the alleged skill required in accomplishing its undoing.

"Getting out of the canoe, I counted on a picture as he swung clear of the tree; and, walking slowly, got within 50 feet, when he backed a few yards and then peered under the branches from the other side. Taking a picture in this unsatisfactory position, I again advanced, when he slowly turned about and walked away with the spruce intervening.

"Somewhat disappointed, I returned to the water, and, when about stepping into the canoe, noticed the bull was coming back, and in a minute he was gazing once more through the branches of the spruce; but as it was now time for his noonday rest, and since he evidently was determined to see the thing out in a comfortable way, he unconcernedly lay down, and then for the first time I was able to see, in all their symmetry, the great horns just above the top of the high grass.

"This led to a change in my plans, and, detaching the smaller and faster lense, I got out a big telephoto for the purpose of obtaining, by a slower exposure, a picture of the great antlers. Armed in this way, I began a slight advance to where the footing would be firmer, when he got up with considerable energy, and all I could see on the focusing mirror was his slowly retreating rear—an unattractive target for the camera, however vulnerable to a ball projected by a modern rifle.

"Thus three big bulls had, in the course of ten minutes, offered easy shots to the veriest tyro, while a picture, worthless beyond its power to recall the scene, was the result of my first encounter with the giant moose.

"Pleased by the prospective and disappointed somewhat by the retrospective, a search for the lick was then begun, which I felt sure was not far away.

THE BIG MOOSE LICK OF SKILAK LAKE

"A short distance beyond the canoe, in the left-hand corner of the little bay, we found a mud-hole around which the grass had been trampled for some weeks, and the riled condition of the water showed that one or more moose had been there within a few hours. Looking beyond and through a fringe of trees, I could see a big bare field, the surface of which was plainly several feet below the surrounding marsh. Familiar with similar conditions, I felt certain that this was one of the greatest resorts of its kind I had seen in many years, for every inch of soil removed was either eaten or swallowed in the process of guzzling the mineralized water, oozing out here and there and covering a considerable part of the surface (see page 448).

"It was plain, too, on closer inspection, that the long drought had begun to affect

Photo by George Shiras, 3rd

COLONY OF GULLS ON ISLAND ADJOINING THE CORMORANTS

Here the protective coloration makes them difficult to be seen, whether on skyline or rocks. Contrast with the cormorants on page 438

Photo by George Shiras, 3rd

GULLS

As it was impossible to photograph the gulls on the foreground shown in this picture, because of their protective coloration when crouched low, the author gradually compelled them to walk to the skyline. In this respect these young gulls possess an obliterative coloration quite in contrast to the young cormorants on the adjoining island.

Photo by George Shiras, 3rd

YOUNG GULLS WHOSE LATER COLORING HARMONIZED WITH THE ROCKS AND GRAY BRUSH SO CLOSELY THAT IT REQUIRED A SKYLINE PHOTOGRAPH TO SHOW THEM

See writer's opinion on protective coloration in first part of sheep article

the surface flow, for much of the ground was hard and dry, which accounted for the moose opening up a new lick near the lake by tapping the springs at the base of the sloping shore.

"The number of fresh tracks and the variation in size finally convinced Tom that a good many bulls were regular patrons. The surrounding country had all been burnt over many years before, and this was somewhat unfavorable for daylight photography, since bull moose are largely nocturnal, unlike the caribou and elk, especially when visiting licks or exposed feeding places. The ones we had just seen were early morning visitors, and the little patch of spruce would have sheltered them until afternoon or evening but for our unexpected arrival.

"While talking over the location of the blind in reference to the position of the sun at different hours and the probably prevailing winds—the two vital elements in this kind of photography—we saw the big bull a mile away, tearing along the top of a bare ridge leading to the mountain forests. His gait showed that stolidity had at last given way to a belated but overpowering fear. We never saw that animal again in the weeks spent on the lowlands. When cutting some brush a good-sized cow moose walked up within a stone's throw, trotting away unmolested.

"Anxious to know the number and course of the runways and the character of the country immediately back of the lake before taking up the daily vigil at the blind, we went inshore half a mile to the pond where the moose were seen the evening before. Here several acres of pond lilies in shallow waters were untouched—not a leaf or root had been eaten or disturbed—in striking contrast to the moose of Maine, New Brunswick, central Canada, and Minnesota, which always considered such aquatic plants the choicest of summer food. Yet I noticed the same lack of appreciation in the moose of higher altitudes in Wyoming and elsewhere. Going a mile further, Tom recognized a high mound as the lookout for the other lick, and this was examined with great care. While used to some extent, it was only a brief stopping place for the moose en route to the shore lick—indicated by the runways, but more particularly by the condition of the soil."

Whenever the wind was favorable and the weather clear I went to the blind, but usually between 9 and 4 the breeze came from the lake, cutting off the principal runways, so that in a few days a number of moose suspected, though unjustly, that a foe was in ambush near the lick.

Altogether I saw some 30 moose in the immediate neighborhood, many of them the same animals, returning on different days. One big moose came within easy rifle shot, got the scent and retired,

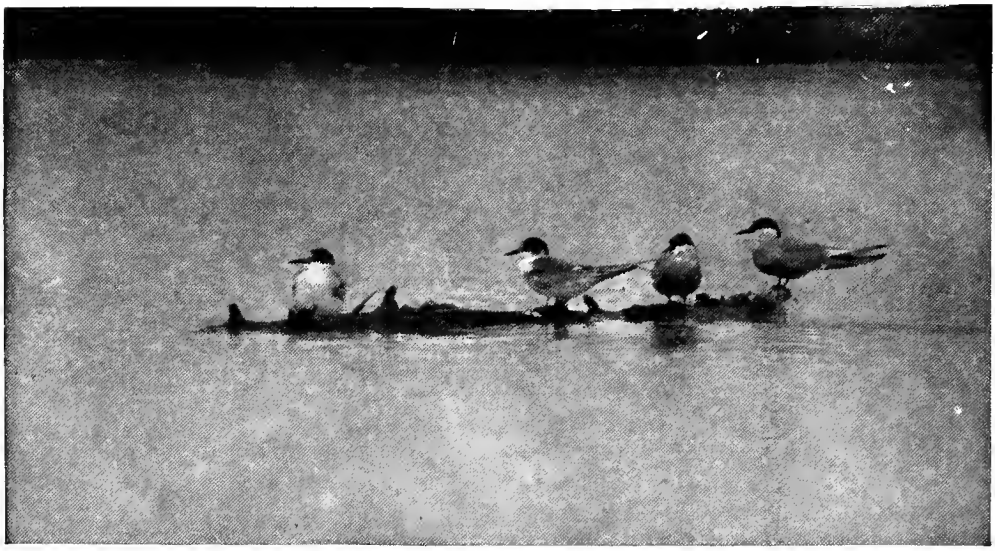


Photo by George Shiras, 3rd

ARCTIC TERN ENJOYING A RIDE ON A DEAD LIME FLOATING IN THE CENTER OF SKILAK LAKE: THE BIRDS ARE LOATH TO LEAVE WHEN PHOTOGRAPHED AT SIX FEET

and two others, equally big, were at the lick one morning on arrival, but could not be photographed from the water. All the others, with one exception, were cows or bulls ranging from one to five years of age. The exception noted was an enormous bull that came down wind on an unused runway to the rear of the blind just when I was eating lunch. He gave a loud grunt behind my back and I nearly choked with surprise. In the excitement he got away, leaving only a mental picture of a frightened moose and a flustered photographer.

I saw no calves and only their tracks in some of the heavily forested valleys about the lake. Occasionally large moose could be seen a mile or two away feeding in and out of the willows near the summit of the mountains.

The light-brown color, noticeable the first day, was repeated in the case of all the other moose, the shade approaching very closely that of the great brown bear of the inland. Judging from the shreds of the spring-shed hair and that of several abandoned hides near hunting camps, the winter pelage must be a light buff-brown in color. In the extreme southern range most moose are dark-colored in summer, looking almost black at a distance, with a somewhat lighter shading on the legs and flanks.

Some of the pelts examined show that all the hair of the narrow abdominal strip was glossy black, while that of the side and back had buff-brown tips, with a pure white body to the root, so that, with the darker tips clipped, the animal would appear to be white from the ventral strip upwards.

The present classification of the giant moose depends chiefly upon skull characters and colors of the male, as shown by Mr. G. S. Miller, Jr., in the original description of the species, but it will doubtless prove that a careful examination of the pelage colors, superficial or otherwise, as in the case of *Ovis dalli* and *Ovis stonei*, will afford even better grounds than were originally supposed for recognizing the Alaska moose as a distinct form. The greater average size of the horns should also form a distinct character.

Several encounters with regular patrons permitted observations somewhat out of the ordinary and may be quoted in part:

Photo by George Shiras, 3rd

VIEW OF SKILAK LAKE FROM OUR CAMP (SEE PAGE 439)

A COW MOOSE THAT BECAME SELF-EDUCATED

"Caribou Island Camp,
"August 17—Ther., 74-38.

"Just before noon the wind veered to the south, coming well offshore. Charlie paddled me across the bay to the blind and then went after a mess of partridges.

"I was hardly in ambush before the old cow moose was at a mud hole opposite, drinking a gallon or two of the muddy mixture. So active was the effect upon the salivary glands that long strings of saliva drooled to the ground (see also pages 443 and 448).

"Determined to try for a close picture and to test her disposition when thus interrupted, I boldly walked in view, crossing the bare and much-trampled field to within 50 feet. She stood broadside, head up, and unquestionably looking at me out of one eye, but to all appearances utterly indifferent to my approach (see page 451). Taking a picture, I went a little closer, when she turned away without looking, and again the camera recorded the scene.

"While changing plate-holders, I was surprised to see the moose turn about and come toward me on a slow trot. To the uninitiated this would probably have meant a bold charge, and to the nature faker sufficient grounds for an exciting story. The animal was now so close that I could notice the nostrils working convulsively, and could see that if let alone she would pass to my leeward about five feet—the first position in which she could get the scent without coming at me directly (see page 453).

"Wishing to avoid alarming her so soon, I backed across the field to the edge of the marsh, but she still followed. Turning my back to the animal, I walked ahead, and upon reaching a place where the ground was almost impassable with fallen timber, I stopped. By this time I noticed that she had crossed my tracks, and thinking perhaps I was mistaken about her wishing to get the scent I awaited developments. The cow immediately came up, circled almost within reach, and then was struck by the scent.

"The effect was instantaneous and remarkable. Sinking back on her haunches, I noticed that the shoulders trembled violently, just as though a rifle ball had penetrated her through and through, and then, with a quick awkward plunge, she made off at her fastest gait. And thus this innocent and impassive animal suddenly revealed its inherited dread of human scent."

Photo by George Shiras, 3rd

THE MOOSE LICK OF SKILAK LAKE (SEE PAGES 441 AND 443)

The impregnated soil has been eaten several feet below the surrounding marsh, exposing rocks and uncovering many small mineral springs. The view shows the lower half of the lick, looking toward and across the western end of the lake. The water brought back by the author shows the following analysis: "When the container was opened and air came in contact with the water, the clear water became, after some hours, opalescent, as if sulphur had separated out. Qualitative analysis showed in the water: sodium, strong; chlorine, strong; iron, marked: aluminum, marked; calcium, decided; magnesium, certain; sulphuric acid, present; phosphoric acid, present; sulphides, present. Quantitative analysis of clear water gave 175 grains of total solids present in one U. S. gallon of water. From the determination of chlorine and calculation of this as sodium chloride, there was found 113.9 grains of common salt to one U. S. gallon of the water. The taste of the water was strongly salt, with a bitterish after-taste. In its behavior on evaporation it resembled the saline waters of Ohio. It is positively a saline water and not an alkaline water."—Analysis by Dr. Charles E. Munroe.

A LITTLE BULL MOOSE THAT WAS FORCIBLY EDUCATED

A few days later there occurred another scene in the same locality and with a somewhat amusing sequel:

"August 27—Ther., 58-34.

"One of my favorite visitors was a little bull moose. At first he always came in company with a five-year-old, but the latter got too much scent once and ran off, with the smaller one trailing wonderingly behind. On this occasion he was alone. The way he kept eyeing the blind rather indicated that a visit had been made there during my absence.

"Today he came from the long point, where the flies were scarce, and after filling up nearly to the bursting point, laid down in the middle of the lick for a nap. As this was to be the next to my last day in the blind, I concluded to try some more experiments. Coming out of the blind, he saw me at once, but did not get up—simply turning his ears my way and expressing great astonishment in his big, round eyes.

"When I got very close he arose and walked to the edge of the marsh, when, getting the sun behind me, I took his picture (see pages 455-458). And later I tried to force him down toward the lake in order to get a more effective background. This he objected to, but ran about playfully, showing no concern whatever over the scent.

"After taking a few more pictures, I concluded that I would be doing a very poor service to leave him in this unsophisticated state of mind. It was plain he now no longer feared the sight or scent of man, and would doubtless soon fall a victim to a party of hunters camping half a mile down the shore.

"Selecting a good-sized club, I got as close as possible, partly accomplished by grunting like a bull.

"Throwing the missile with all my force at his well-covered ribs, I gave a piercing yell at the same time. The marksmanship was poor, for the stick struck the ground just this side and one end flying up hit him in the pit of the stomach. This probably had greater effect than a drubbing on the ribs—however much it violated the ethics of striking below the belt—for he jumped up into the air with his back arched like a scared cat. When he came down there was no doubt about his intention or ability to get out of that part of the country. Before I could pick up the camera he had vaulted over and beyond the fallen timber."

Only once, when I blew up a huge grizzly bear with a flashlight machine, have I known an animal that got its education quicker, and never, as later events proved, to better purpose.

The following day I came to the blind at an early hour, hopeful that one of the big bulls from the hills would come within photographic range. Just what occurred becomes a necessary part of the diary entry of the previous day.

"August 28—Ther., 72-38.

. . "From the start the wind was variable and so light that the mosquitoes became annoying for the first time. Twice I saw a cow moose wandering about, but she was wary. As the hours passed I was satisfied that the little bull had made his valedictory appearance and was not disappointed by the thought.

"Precisely at 2 I heard the sound of a heavy animal running, then a splash down toward the lake, where I could see the little bull struggling out of a mud hole, his feet working like the blades of a water-wheel, and then out he got, rushing on without a stop or a glance to the rear. Evidently something was after him—possibly a grizzly bear that looked now almost as big as a locomotive.

"Getting out the field glass I covered what was likely his back track for a long distance, finally noticing the figures of two men coming down a hillside, and as each was armed with a rifle I knew they were not my guides. On their approach I arose, and after a greeting found that the larger and heavier of the two was Jim Jeffries, the ex-heavyweight champion of the world. He explained in substance that they were out after a supply of fresh and tender meat, preparatory to hunting big bulls for their heads; that

they had seen in a dense cover the flanks of a small moose, and to make sure it was not a cow, the killing of which was prohibited by law, they crept up very close, when, making a slight noise to bring the head in view, the animal gave a quick glance out of the corner of one eye and then put down the hill as though the devil was after him. Not till he was beyond favorable rifle shot did the glass disclose the small horns. They were now pursuing it in hopes of a shot. The man of muscle trusted that they had not interfered with my getting a photograph of the little bull. Assuming a slight disappointment, I indicated that it was fully overcome by the opportunity thus presented of getting a photograph of a *homo gigas* and snapped him instanter."

That this latter picture does not appear herewith is due to the conservative attitude of the Editor, who "was uncertain whether some of the readers of this Magazine would stand for that kind of wild game." Hence the omission.

A month later I heard that the little bull had apparently gone through the hunting season unscathed. This year he is proudly growing a pair of Y-shaped horns, and who knows but what in the course of time he will be seen stalking across the ruddy tundra or standing like a sentinel on a granite ridge wearing a polished and serrated crown, so remarkable in size and symmetry that the *Alce gigas* of the Kenai shall have in him that type which will represent in the future as in the past the largest of the antlered race since the days of the prehistoric Irish elk.

A NEW SPORT FOR OLD SPORTSMEN: HUNTING FOR SHED ANTLERS

When a sportsman visits the distant wilderness and shoots a big bull elk, moose, or caribou, especially in the rutting season, when they are most easily found and killed, it is seldom that any of the rank flesh is used at all, and the horns afford the only trophy, while the great carcass, weighing from 400 to 1,200 pounds, according to the species, is left for the ravens and the coyotes to feed upon. And even though such big beasts are killed at a time when the meat is untainted, its toughness or the great distance from civilization prevents much of it being used.

On one of my photographic hunting trips to Newfoundland, I met, far in the interior, three Eastern sportsmen who had just killed nine big caribou stags, the three apiece allowed by law. Only the heads were removed, for the 3,500 pounds of meat was then unfit for food. As fully 100 non-resident sportsmen were there on the island, the abandoned carcasses might better be estimated in tons than pounds. With the smaller varieties of deer, killed usually in the neighborhood of settlements and generally free from a seasonal taint, such wastefulness seldom occurs.

To a sportsman controlled by the most ordinary sense of propriety, it must necessarily follow that after getting a fine head or two of the larger game, he ought then to discontinue their pursuit with a deadly weapon. To one who uses from the start, or later supplants the rifle with the camera, there exists every corresponding incentive in this more harmless method and a much better opportunity of studying the life of wild animals.

Yet it is easy to see how there may be those who desire, in addition to pictures or lantern slides, some more tangible evidence of their visit to the remote homes of our antlered monarchs, and this is to suggest a way of getting such trophies without shedding blood or wasting mountains of flesh.

Between November 1 and March 1 the larger bull caribou, moose, and elk shed their horns, and in the order given. Unlike the white-tail deer, which usually drop their antlers each fall in the dense coniferous forests and swamps, where porcupines, rabbits, red squirrels, and mice soon destroy or disfigure the same, the caribou, when feeding in the winter time on the moss of the wind-swept barrens, the elk upon the dry grass in the open parks and rolling hillsides, and the more northerly moose upon the bark in the willow thickets or second-growth hardwood forests, usually cast their antlers in places harboring few if any form

Photo by George Shiras, 3rd

THE LARGE COW MOOSE THAT EDUCATED HERSELF (SEE PAGE 447)

She stood broadside, head up, and unquestionably looking at me out of one eye, but to all appearances utterly indifferent to my approach

of rodent life, and hence in such localities one may find many horns and most of them in perfect condition.

Such as have become bleached from long exposure can be stained to their natural color, and, when mounted on a wooden base the fac-simile of a frontal bone, resemble in all respects those of a freshly killed animal. While it has long been the custom in this country to mount the head and neck, in time the shrinking skin, the twisted ears, and the ravages of the moths greatly impair the work of the ordinary taxidermist, so that the old English method of simply using the horns and part of the skull has much to recommend it; for such ancient specimens after untold centuries are often superior to those in this country after a lapse of a few years.

Of course, in the mounting of shed antlers, only the largest and most symmetrical should be used, in contrast to the habit of mounting many inferior heads; but a great deal of pleasure can be had and much information obtained by collecting in the wilderness all sizes and shapes of horns, and it is immaterial that in many cases only a single antler can be found.

During explorations covering three seasons in the Rocky Mountains, I discovered along the upper Yellowstone River, partly in the park and partly in Wyoming, a very large number of moose occupying a valley four miles wide and thirty miles long, at an elevation of 8,000 feet, where, isolated in the wildest and least frequented portion of the country, they had thrived unknown to the public. My notes and photographs, covering observations of more than 500 moose and in a country where they were then supposed to be practically extinct, was most

Photo by George Shiras, 3rd

ANOTHER VIEW OF THE COW MOOSE THAT EDUCATED HERSELF

"I went a little closer, when she turned toward me, and again the camera recorded the scene"
(see page 447)

impressively corroborated by the fine collection of moose horns, found along the river bottom in willow thickets, where the absence of pine forests and the annual overflow each contributed to the scarcity of rodent life. These horns were later presented to the Biological Survey and constitute its only collection of the mountain type of this animal.

During the several weeks spent in studying and photographing moose near Skilak Lake, the network of runways throughout the poplar and birch thickets showed very plainly that this was one of the great winter feeding ranges of these animals, and that a systematic search would doubtless reveal many fine antlers. In this we were successful from the start, and nearly every afternoon, on taking the canoe for camp, one or two big or oddly shaped horns were a part of our cargo. And if the camera failed in its quest on such occasions, here were the discarded crowns of the giant moose, many of them worthy of portraiture and many of permanent preservation.

By carefully noting the course of our rambles, in less than a week a square mile was pretty well covered and brought to view 26 nearly perfect antlers, aside

Photo by George Shiras, 3rd

THE SAME COW MOOSE COMING TOWARD THE AUTHOR

"While changing plate-holders, I was surprised to see the moose turn about and come toward me on a slow trot. To the uninitiated this would probably have meant a bold charge, and, to the nature-faker, sufficient grounds for an exciting story. The animal was now so close that I could notice the nostrils working convulsively, and could see that if let alone she would pass to my leeward about five feet—the first position in which she could get the scent without coming at me directly" (see page 447).

from nearly an equal number found in the bordering spruce forests, which the porcupines had, with few exceptions, badly gnawed (see pages 460-461).

The members of two hunting parties who visited our camp were surprised and pleased at this collection, and could not understand why they had only seen a few worthless horns in their long journeys afoot. This was because the more open country was usually watched from a knoll with the aid of field-glasses, or they failed, when moving about, to detect the prong or two of some great horn nearly hidden in the soft moss, or did not know the meaning of the great white slabs here and there on many an exposed hillside. In one case I located the best antler of the trip at the distance of over a mile, the glass showing that the serrated edges could not be other than the outer rim of a fine horn.

Three distinct types of horns were found: First, the so-called normal, or broadly palmated kind; second, one of great length and narrow beam, and third, a small fan-shaped variety (see picture, page 465).

The first type was represented at times by two rather unusual modifications: (*a*) great thickness of the lower beams with a second set of brow antlers beneath, and (*b*) broadly palmated horns with no divisional separation of the so-called brow antlers (see page 464).

In no other range of the moose have I found such a variety except in the highest mountain valleys of the Rockies, and it suggests the conclusion that the northern latitudes affect and vary the

horn growth as do the higher altitudes further south.

The writer earnestly contends that it is a false pride which always leads a sportsman to pass by a beautiful antler and a false standard which always requires their removal from the head of a personally slaughtered animal. To the public, for the use of museums and in the comparison and differentiation of the various types of horns, shed antlers are just as valuable and just as interesting as many having a narrative of blood and wastefulness in their taking.

Photographing wild animals requires all the skill and endurance demanded by the most ardent and experienced sportsman, and the finding of the discarded antlers of a giant moose adds a zest to the photographic hunt and a valuable trophy for the trip, and surely not less sportsmanlike because its former owner is still permitted to roam the wilderness as the largest antlered animal of modern times.

Fortunately for this branch of sport, it requires patience, persistence, a fair knowledge of the animal's habits and range, and when the best horns only are selected the collection will represent quite as much skill and value as when secured by killing the unfortunate owner thereof.

THE ALASKA PTARMIGAN AND HOW CLEVERLY THEY PROTECT THEIR YOUNG

To the mountain climber of the northland there are no birds more interesting than the ptarmigan. One species, the willow grouse, or willow ptarmigan, occupies the thickets bordering the tree limits, and a hardier and more humbly plumed kind, the rock ptarmigan, lives on the rocky slopes and snow-clad summits of the higher ranges. This interest is largely due to the ease of observation, for the birds are tame and numerous, and again because they can be counted upon to supply the larder with a portable and well-flavored article of food.

For several weeks we were in the midst of these birds, and when making daily rounds to the grassy plateaux, where the sheep were apt to be found, I spent a good deal of time following up the smaller streams in order to study and photograph the birds in their natural surroundings.

Familiar with many other species of grouse, I was particularly impressed by one characteristic of the cock willow ptarmigan, which differed so from the conduct of male grouse of the forest and prairie, in that he almost invariably remained with or accompanied the female during the entire breeding season and, moreover, was the most aggressive parent of the two in times of peril.

One's proximity to the family was usually foretold by the sudden fluttering out of the cock, which, with a limp and trailing wing, employed the usual devices of most ground-breeding birds in the effort to coax in futile pursuit any known or suspected enemy, and then, if successful in leading such away from the spot where the young crouched by the side of their silent mother, the cock would take wing, uttering loud and raucous notes, finding concealment in a near-by thicket.

But if one persisted in trying to locate the young, then the female would renew the effort to distract attention, and if this did not succeed she would utter a peculiar note signaling the male to return, and then between the two of them some plan would be devised to prevent the discovery or injury of the young birds.

In a hundred or more observations the cock was apparently absent only half dozen times, which might be accounted for by his untimely death in defense of his family or by a temporary absence in search of a particular kind of food.

Two instances of this strategic cooperation of the parents may be quoted from my notebook:

"August 9.

"Following the creek bottom for nearly a mile, we found the ptarmigan unusually abundant, for the day was warm and quiet and the birds were sunning themselves on the gravel bars or dusting their feathers in basins hollowed out in the sloping banks. One brilliantly colored cock rushed out at us from a patch of dried grass and I followed him down the stream a few rods with the

Photo by George Shiras, 3rd

THE YOUNG BULL MOOSE THAT WAS FORCIBLY EDUCATED (SEE PAGES 449-450)

camera, but his gait increased until he took wing, so I returned to the spot where the rest of the family were doubtless concealed and could faintly see the hen outlined in the thin grass, while the five or six young, almost at my feet, were not noticed until the old bird took flight, when they, too, popped up into the air, and with their short wings managed to fly out of the creek bottom and tumble into a willow thicket a few yards away.

"Going to the lower end I had one of the guides walk through the willows, but before the family were driven out the cock returned in response to the call of the hen, and I finally got a picture of him standing boldly on a rock in the middle of the stream. The parents then led the young into a blue bed of flowering peas, and when the two returned to guard the retreat I got a portrait of the pair" (see pictures, page 466).

Again, under date of August 27:

"While sitting in the spruce blind waiting for moose, I noticed a large hawk circling the marsh in search of prey. As it passed behind me there was a roar of wings, and turning I saw a brood of willow grouse in the air with the hawk poised above, apparently uncertain which victim to swoop down upon, but before this was determined the cock shot up straight as an arrow in front of the hawk and then the race was on. For the first 50 yards the two were separated by only a few feet, but the way the cock suddenly increased its speed showed very plainly that flight was under check until the hawk was lured away far enough to give the surprised family a chance to find some sort of concealment.

"In a minute or so the hawk returned and carefully circled over the hummocks of moss, looking intently for the slightest trace of one of the covey. Down it suddenly dropped for a distance of 20 feet—undoubtedly seeing the brown feathers of a partly concealed bird—but with equal speed the hen darted up, apparently hitting the body of the hawk just below the tail, and either because the talons could not clutch it in such a position or because unable to strike with

Photo by George Shiras, 3rd

ANOTHER VIEW OF THE YOUNG BULL MOOSE WHO WAS FORCIBLY EDUCATED (SEE PAGES 449 AND 450)

accuracy, the daring mother escaped with the hawk in fierce pursuit. Here, again, the slow speed enticed the hawk some 50 yards away, when the hen dropped like a plummet into a bunch of alders, while the hawk seated himself on a near-by limb to plan anew his breakfast.

"But the defeated aviator knew very well that two from eight left a substantial balance, however deficient the mathematical process, and once more he returned for a survey of the tangled moss. This time he was met by a shout and a waiving hat from the spruce blind, and, much disgruntled, soared away, doubtless wondering at the intervention of a third party, a wonderment that would have been still greater had it known the deadly relation between man and every bird and every animal possessing toothsome qualities, or whose plumes, pelage, or antlers had a monetary or trophy value."

In such efforts to save the young it was clear that the parent birds possessed the same bravery and the same cunning methods in misleading an aërial enemy that they did a terrestrial one.

In the Kenai Peninsula the timber line is about 2,000 feet, and only twice were willow ptarmigan noticed below it, where they were feeding in an open glade upon the earlier growth of swamp huckleberries. The usual abodes of this bird are the tablelands along upland streams terminating in ravines, where the willows and small bushes succeed the limit of arboreal growth. The rock ptarmigan either stays at the very crest of the mountains or on the sloping sides, where the lichens and patches of grass denote the limit of all vegetation. On the other hand the spruce partridge remains well within the forested area and is usually to be found in river bottoms or in the second-growth, burnt-over portions of the lowlands (see pages 467 and 469).

Thus these three species of Northern grouse, while occupying adjoining ground, are largely if not wholly controlled by the distribution of plant life rather than that of any given altitude.

One afternoon I saw a small and apparently young red fox coming rapidly

Photo by George Shiras, 3rd

THE SAME BULL MOOSE

"After taking a few more pictures, I concluded that I would be doing a very poor service to leave him in this unsophisticated state of mind. It was plain he now no longer feared the sight or scent of man, and would doubtless soon fall a victim to a party of hunters camping half a mile down the shore" (see page 449).

down a rock slide, evidently trailing but not seeing his quarry. With a field-glass I could make out a brood of rock ptarmigan scurrying ahead. When the birds reached the bank of a small ravine, filled nearly to the surface with snow, the hen flew up about ten feet, alighting on the snow, and the little ones with an effort did likewise; and, thus concealed from the immediate vision of the fox, they ran a short distance and squatted, resembling very much the detached rocks and soil dotting the edges of the snow.

When the fox reached the bank he looked intently about and, seeing nothing, descended, sniffing along the surface of the snow below where the birds alighted. Evidently thinking that they had flown across or gone further down, he climbed up the opposite bank. Here a large fat marmot, extracting a root only a short distance away, attracted his attention, and although they were about the same size, the sudden flight of the latter induced pursuit, which ended unsuccessfully a few yards away, at the opening of the burrow.

So little time was spent on the mountain summits that I had small chance to observe the habits of the rock ptarmigan. In no case did the cock accompany the brood, and it seemed as though these birds had no fear whatever of the larger forms of animal life. The hen had two warning notes for the young, one causing them to remain stock still or crouch wherever they happened to be—and so faithful was the obedience that I could pick the young up—and another note, which caused the young to immediately seek an overhead protection, either beneath the broken rocks or under the rims of snow or ice.

Once I saw seven small ptarmigan run beneath the edge of a block of ice, and all I could see was the projecting row of small black bills; and in another case the young bird, alarmed by the mother's note, squeezed in between my shoes and remained there until relieved by a reassuring call. Hawks and foxes are the principal enemies, while moose, caribou, sheep, or man seem to be regarded in the light of friends.

THE ALASKA SALMON AND THE TRAGEDY OF THE SPAWNING GROUNDS

Many know that the salmon industry

Photo by George Shiras, 3rd

"Throwing the missile with all my force at his well-covered ribs, I gave a piercing yell at the same time. The marksmanship was poor, for the stick struck the ground just this side and, one end flying up, hit him in the pit of the stomach. This probably had greater effect than a drubbing on the ribs, however much it violated the ethics of striking below the belt, for he jumped up into the air with his back arched like a scared cat. Only once, when I blew up a huge grizzly bear with a flashlight machine, have I known an animal that got its education quicker, and never, as later events proved, to better purpose" (see page 449).

of Alaska is one of its best and certainly its most reliable producer of wealth, but few in the eastern portion of our country realize that, unlike the Atlantic species, the salmon of the northwest coast, male and female, always die following the spawning season in the fresh waters of the interior.

Of course this means that the salmon, of which there are five species, spawn but once, on reaching maturity, and therefore their perpetuation depends upon a reasonable protection for the brooding fish.

From the middle of July into October the swift rivers are carrying towards the sea millions of dead and dying fish. As practically all of these lodge on sandbars or sink to the bottom of the ice-chilled streams, the air becomes polluted and the waters defiled to such a degree that a good many who witness these repulsive scenes acquire an unconquerable distaste for salmon thereafter, be they fresh or

Photo by George Shiras, 3rd

A FAIR-SIZED BULL AT EDGE OF LICK

Note the long, remarkable "bell," which dangled for 18 inches from its neck and looked exactly like a broken halter end, swinging freely as the animal walked

canned. This should excite no prejudice elsewhere, since all the fish for commercial purposes are taken before or shortly after entering the fresh-water rivers, when they are in fine condition.

Comment has been made upon the mutilated bodies of the stranded fish, and many seem to think that this was entirely due to battling upstream amid jagged rocks, whirlpools, and rapids. The writer saw no indication of this, but did find there existed a strange and fierce enmity between the fish, under conditions now described, which surpassed any contest between kindred species that he had ever witnessed.

This impulse to seek the uppermost waters of a particular stream, be it a mile or a thousand miles in length, apparently continues after the spawning period, and so each salmon, weakened from spawning and the refusal or inability to eat on leaving salt water, still instinctively struggles against the swift waters, gradually drifting back, tail first, until a pool behind a log-jamb, the entrance to a slough, or the slower waters of a side channel afford a temporary

Photo by George Shiras, 3rd

A NEW SPORT FOR OLD SPORTSMEN: SOME OF THE FINEST MOOSE HORNS FOUND DURING THE TEN DAYS AT DOUBLE-BAY CAMP, THE COLLECTION BEING ADDED TO LATER (SEE PAGES 450-454)

Photo by George Shiras, 3rd

A NEW SPORT FOR OLD SPORTSMEN: A BOAT LOAD OF ANTLERS GATHERED ON THE OPEN MARSHES ON A SINGLE AFTERNOON (SEE PAGES 450-454)

harbor, and here they collect by hundreds before making another effort to ascend the stream, only to be carried further down each time, until the death paroxysm seizes each, when, after a few mad dashes with the head out of water gasping for air, they die with surprising suddenness.

The salmon most abundant in the interior streams of northwestern Alaska is the sockeye, or red salmon.

Investigations by the Bureau of Fisheries have shown that "this species is peculiar in that it rarely or never ascends a stream that has not one or more lakes at its headwaters, and the spawning grounds are usually in small streams tributary to such lakes or rarely in the lakes themselves." The average weight is about seven pounds, varying according to sex or condition. While dead, king salmon were occasionally seen floating down the Kenai River, some of which must have weighed 60 pounds, the kind coming under the writer's particular observation, were the red salmon, the most graceful and active of the western salmon.

When these fish first come from the sea they are plump and vigorous and their silvery forms often gleam high above the surface of the waters in the slow advance to the spawning ground. Gradually the colors change to a light pink and then by degrees to a deep, blood red, splotched with yellow, when they resemble gigantic gold fish. At a later period the body becomes gaunt, the head narrow and dark green, exhibiting gleaming rows of shark-like teeth, and then this once beautiful salmon of the high seas becomes reptilian in form and disposition.

It was in the quiet, shallow pools of the inside channels of the upper Kenai River, between long islands and the shore, where the milky glacial silt was precipitated to the bottom and the waters became clarified that the writer was able to observe and study for a number of days the action of the imprisoned fish.

One hardly realizes in traveling on or along a glacial stream how beclouded are such waters. At the junction of the Kenai and Russian rivers this becomes strikingly apparent, where the latter, fed by the springs from the lower hills, is unusually clear, even though hundreds of dead salmon covered its bottom when we saw it. The photograph on page 470 gives a fairly good idea of this contrast.

Between August 29 and September 3

Photo by George Shiras, 3rd

A SPLENDID PAIR OF ANTLERS, WITH THE SKULL ATTACHED: FOUND ON THE BANKS OF THE UPPER KENAI RIVER

It is impossible to tell whether the animal died of old age or from wounds. Spread, 5½ feet. Note extraordinary brow antlers, which have a spread almost equal to the main branches (see page 453).

the gradually falling river had in many cases separated these pools by intervening bars, so that the fish, varying from two to a dozen, could be watched and the individual relations of each easily determined. While it was at once seen that the salmon were carrying on a continual warfare, it was not until the close of the first day that I found that the fish were paired apparently by hate and not by any ties of affection.

Whether this was a sexual antipathy I could not then determine, although as a rule only one fish was the aggressor, the other spending its time trying to elude the attack. Continuously and relentlessly they struggled in couples, rending and tearing the fins and tails, scoring with their sharp teeth the somewhat smoother sides, and occasionally seizing, with wide-open mouth, the nose or lower jaw of their victim.

On the four days spent returning up the river, and while the men toiled at the tracking line, I walked slowly along the banks, carrying a pack containing the more valuable part of our outfit, and so there was plenty of time to observe the salmon. From my notebook the following extracts depict what was happening much of the day:

"In one pool, separated by shallow water from the others, there were ten salmon and all in a state of fierce con-

Photo by George Shiras, 3rd

YELLOW-HAIRED OR NORTHWESTERN PORCUPINE, WHICH HAD COME TO GNAW ONE OF OUR SHED ANTLERS

It became necessary finally to suspend these horns on wires from trees to escape porcupine and squirrels. "During the several weeks spent in studying and photographing moose near Skilak Lake, the network of runways throughout the popiar and birch thickets showed very plainly that this was one of the great winter feeding ranges of these animals, and that a systematic search would doubtless reveal many fine antlers. In this we were successful from the start, and nearly every afternoon, on taking the canoe for camp, one or two big or oddly shaped horns were a part of our cargo. And if the camera failed in its quest on such occasions, here were the discarded crowns of the giant moose, many of them worthy of portraiture and many of permanent preservation. By carefully noting the course of our rambles, in less than a week a square mile was pretty well covered and brought to view 26 nearly perfect antlers, aside from nearly an equal number found in the bordering spruce forests, which the porcupines had, with few exceptions, badly gnawed."

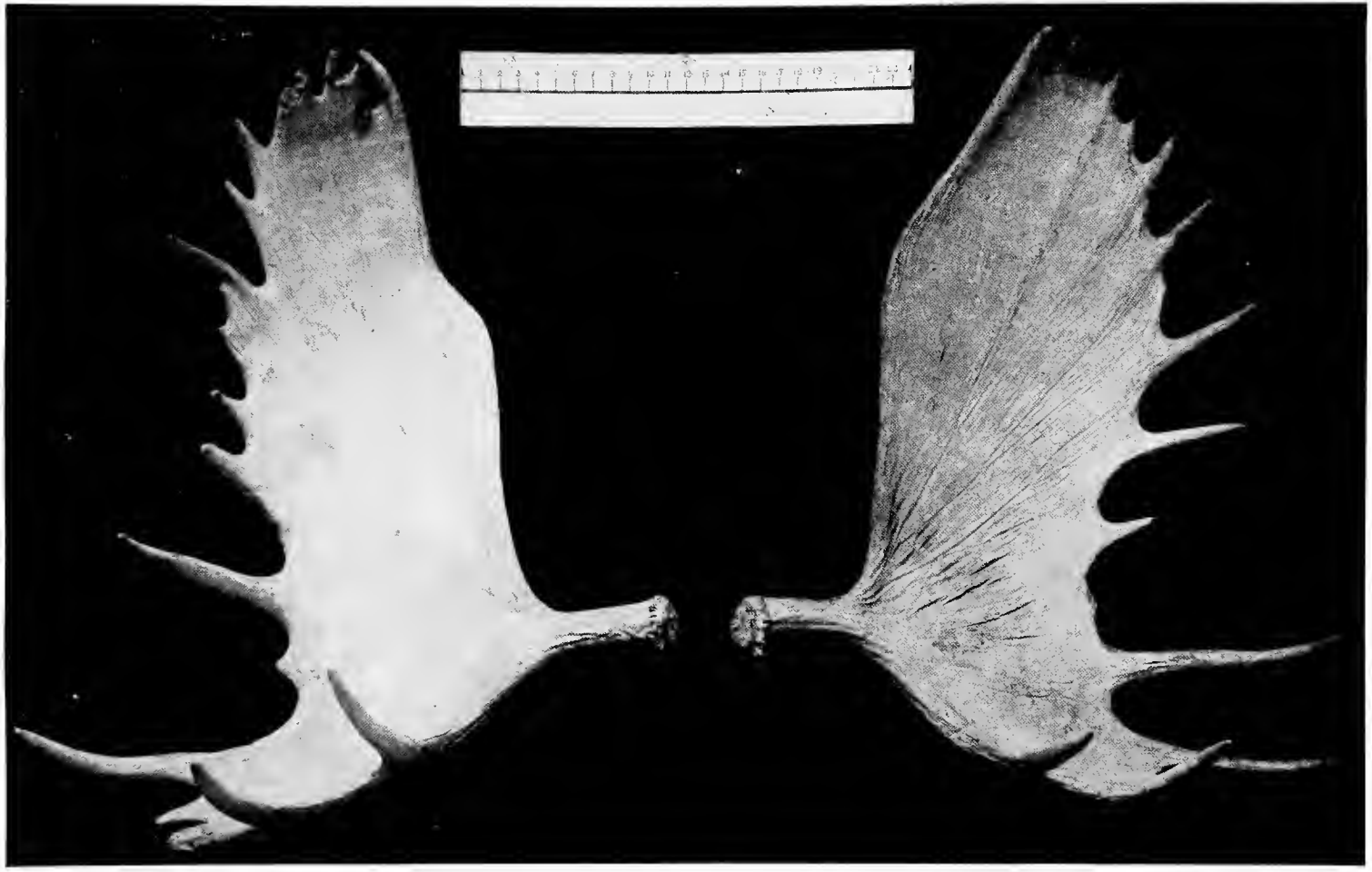


Photo by George Shiras, 3rd

A VERY LARGE PAIR OF SYMMETRICAL HORNS AND NOTICEABLE FOR THE ABSENCE OF ANY DIVISIONAL SEPARATION OF THE BROW ANTLERS, THE PALMATION BEING CONTINUOUS IN EACH ANTLER

Contrast these with the large and distinctive brow antlers shown on page 462. The spread of these antlers doubtless exceeded six feet. A two-foot scale is shown at top of picture

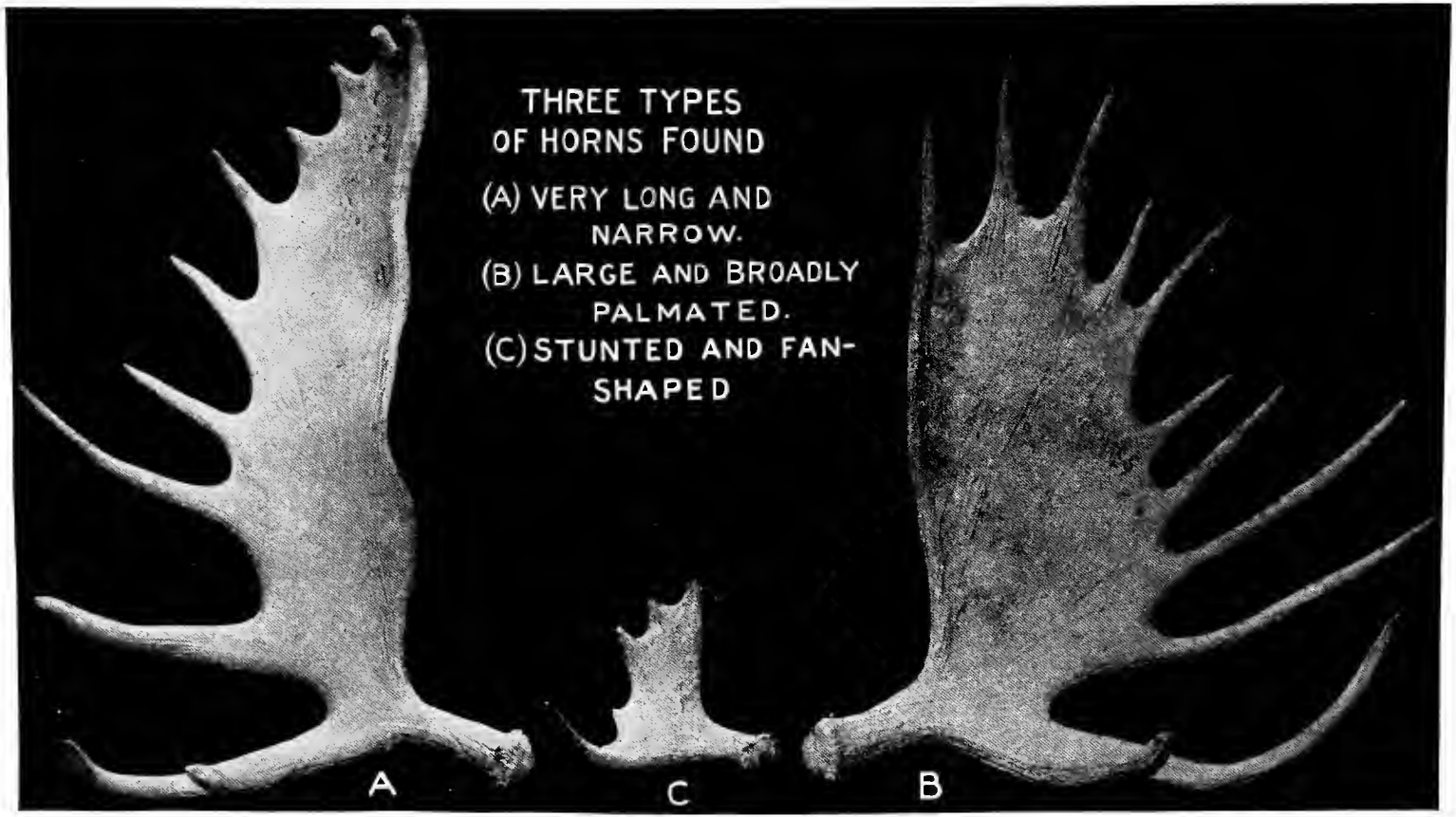


Photo by George Shiras, 3rd

THESE HORNS REPRESENT THREE DIVERGENT TYPES OF ANTLERS FOUND DURING OUR EXPEDITION: PHOTOGRAPHIC SCALE IS THE SAME AS IN THE PRECEDING PICTURE (SEE PAGE 453)

MALE OF WILLOW PTARMIGAN ON ROCK IN ROARING STREAM

Photos by George Shiras, 3rd

PARENT BIRDS OF WILLOW PTARMIGAN GUARDING RETREAT OF THEIR YOUNG

The birds show remarkable cunning in enticing enemies away from their young. For the story of these pictures see pages 454 and 455

tention. Two of these pairs were so uniformly persistent in their movements that I noted the same carefully.

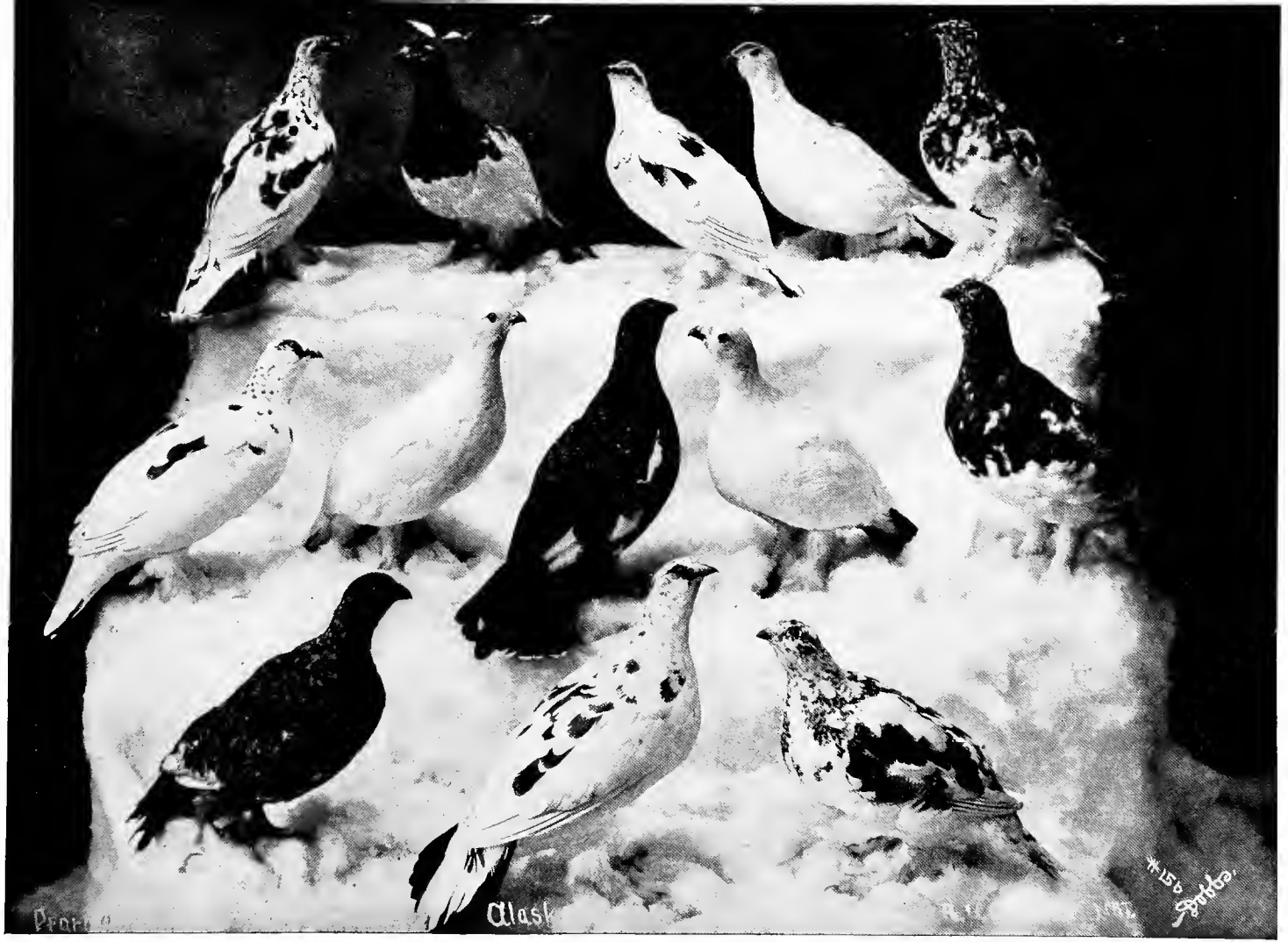
"In one case the attacking fish would drive its unresisting companion half out of the water on the lower bar by biting vigorously at the tail, and then leaving it stranded in the scorching sun would return to the upper end of the pool until the other fish, after slowly wriggling its body around, would re-enter the pool, when the attack would be renewed in precisely the same manner. This continued during two hours' observa-

Photo by George Shiras, 3rd

FEMALE OF WILLOW PTARMIGAN STANDING ERECT, AND WITH THE YOUNG STANDING IN INSTINCTIVE IMITATION

Photo by George Shiras, 3rd

FEMALE OF SPRUCE PARTRIDGE



A MOUNTED GROUP OF WILLOW AND ROCK PTARMIGAN, SHOWING THE WINTER (WHITE) AND SUMMER (DARK) PLUMAGE, WITH THE INTERMEDIATE SPRING AND FALL DRESS. PHOTO BY BEVERLY B. DOBBS, OF NOME

FEMALE AND THREE YOUNG OF THE ROCK PTARMIGAN

The subdued and grayish-brown plumage make a photograph of the four birds difficult without a background of white

Photos by George Shiras, 3rd

FEMALE ROCK PTARMIGAN, PHOTOGRAPHED AT FIVE FEET

"The hen had two warning notes for the young, one causing them to remain stock still or crouch wherever they happened to be—and so faithful was the obedience that I could pick the young up—and another note, which caused the young to immediately seek an overhead protection, either beneath the broken rocks or under the rims of snow or ice. Once I saw seven small ptarmigan run beneath the edge of a block of ice, and all I could see was the projecting row of small black bills; and in another case the young bird, alarmed by the mother's note, squeezed in between my shoes and remained there until relieved by a reassuring call" (see pages 456, 457).

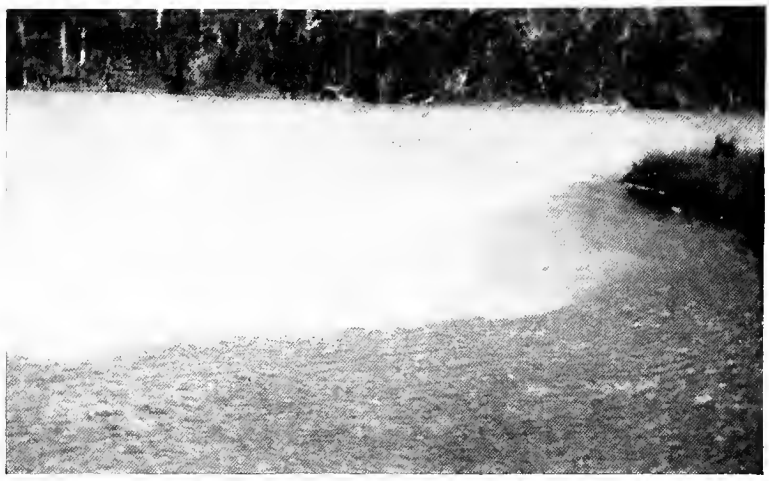


Photo by George Shiras, 3rd

JUNCTION OF THE KENAI AND RUSSIAN RIVERS, SHOWING THE MILKY, GLACIAL WATERS OF THE FORMER COMMINGLING WITH THE CLEAR, SPRING-FED WATERS OF THE OTHER (SEE PAGE 461)

tion, and in that time the victim of this relentless pursuit was driven on the bar about one hundred times.

"In the second case the pair swam side by side in a circle and seemed amicable enough until the inner salmon gradually crowded the other on to a shoal, when it would drop back and seize the tail of its helpless mate and, after rending it for a moment or so, the two would begin circling again.

"The remaining salmon in the pool were carrying on contests more or less similar. In no case did they interfere with another fish except when it got in the way or tried to occupy a position reserved by the others."

The possible explanation for this strange conduct—and the subsequent suggestions come largely from those better informed upon the habits of these fish than the writer—is this: (1) That the imprisoned fish had not yet spawned (corroborated by the fact that I saw no dead or dying ones in these pools); (2) that the female, restrained by the instinct from depositing her eggs except in small streams tributary to lakes, refused to spawn, even though the period was about over; and (3), that the male fish, mated from the time of leaving the sea, had not only become infuriated at the conduct of the female, but likewise angered by confinement, was venting his rage upon a mate in no wise responsible for the situation—a trait not always confined to the male of the fish tribe.

I found it difficult, if not impossible, to get satisfactory photographs of these battles, for the lens loses its power to penetrate the water whenever the surface is broken or ruffled from any cause. The pictures accompanying the text illustrate this, where a slowly moving salmon is plainly to be seen below the surface; while where the two pair were fighting, only the portion out of water is visible (see picture, page 471).

In the main channel of the river and its tributaries, where there was plenty of water for the fish to move about freely, I saw only an occasional fight, possibly near the spawning beds, and the nervous energy of certain fish seemed directed against the swift current, with which they struggled desperately until repeated inhalations of air above the surface produced a delirium and death apparently by drowning; and that this was confined to those which had already spawned now seems likely. At tidewater, where swift and short mountain streams often bore many of the weaker fish into the bays, I saw one salmon tear to pieces seaweed, and in the final dash its teeth locked on an upturned strand of vegetation and thus it died. The next day I could see it, head down and tail up, swinging in

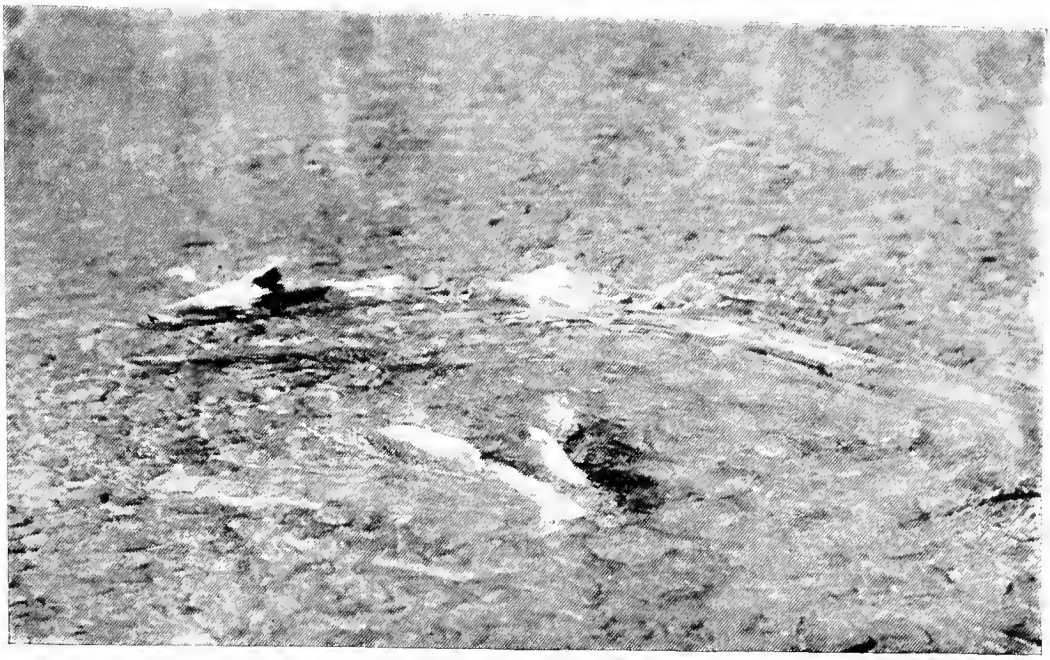


Photo by George Shiras, 3rd

SALMON FIGHTING IN KENAI RIVER

In the upper pair the rear fish is rending the tail of the other; in the lower couple the fish to the right has just bitten a piece out of the dorsal fin of the other (see page 462). "Continuously and relentlessly they struggled in couples, rending and tearing the fins and tails, scoring with their sharp teeth the somewhat smoother sides, and occasionally seizing, with wide-open mouth, the nose or lower jaw of their victim. In one pool, separated by shallow water from the others, there were ten salmon, and all in a state of fierce contention."

Photo by George Shiras, 3rd

THE IMPRISONED SALMON OF THE UPPER KENAI

A gaunt and fierce male, the under portion of the body deep red and that above the surface of the water a dirty and festering yellow (see pages 457-466)

the tide. Thus even the brine of the ocean had no restorative effect.

In such bays, owing to the higher temperature and the greater buoyancy of the salt water, the dead and dying salmon usually floated on the surface, and it was a gruesome sight to see hundreds of gulls, poised on wing, awaiting the moment when they could alight safely upon the body of a fish and pluck out both its eyes, as it rolled over and over in the final struggle.

That death should be the penalty of parentage for all the salmon of the Pacific is generally regarded as one of nature's mysteries, and deepened by the safe return of the North Atlantic salmon to the sea.

But in this number of this Magazine appears an article by one of the leading fish experts of the country, Dr. Hugh M. Smith, Deputy Commissioner U. S. Bureau of Fisheries, and therein is explained why the salmon of adjoining oceans meet a different fate in the rivers of the North.

THE WHITE SHEEP OF KENAI PENINSULA

Before taking up the narrative of the happenings in the sheep country, it may be well to state the plans arranged in advance.

On examining game pictures from Alaska, I was struck by the scarcity of those representing the white sheep, either singly or in flocks. As hundreds of the most experienced sportsmen, from nearly all countries, had pursued these animals, I had considerable doubt of success, even though having a marked advantage in a better equipment and in making my main object what in the case of the others was largely incidental.

Therefore I decided to locate and study the animals first, with the purpose of securing information about their habits and then, if possible, making use of the knowledge thus acquired to get within photographic range. Otherwise it might happen that were I to immediately begin harassing the sheep with the camera at close range I would get neither pictures nor information.

Ten days were spent in the mountains, four of which were entirely used in going and coming; and, while the six days devoted to sheep, and incidentally to ptarmigan, resulted in a fair collection of pictures, the results, I think, fully justified the procedure laid out in advance and mentioned now specifically with the view of aiding those who, in days to come, may wish to visit the scene of these brief but strenuous efforts.

Several days before starting for the interior, my old Michigan guide, John Hammer, joined us. His long-continued trips into the wilderness, and in this instance reinforced by his Norwegian blood, made the call of the North irresistible. The addition of a third man, just as we were about to undertake the hardest part of the journey, proved fortunate, and greater still when the swift waters of the Kenai River had to be overcome on our return to Seward.

At 6 o'clock on the morning of August 5 we were ready to leave Double-bay camp for a ten days' trip to the sheep country; and, with Tom and John in the heavy skiff and Charlie and the author in the canoe, the start was made for the southeast corner of the lake, just opposite the bird islands. The weather was bright and the barometer still predicted a continuation of the fine weather, so exceptional in weeks past.

On rounding the point we saw, in the morning light, the black and frowning features of volcanic Redoubt, and, a little further seaward, Iliamna's snowy peaks, 100 miles distant and on the other side of Cook Inlet. Our immediate destination, Cottonwood Creek, was reached in less than two hours, where, after placing our surplus outfit on a porcupine and bear-proof platform, made by Tom the previous season, a start was made up the mountain creek. This stream originates in a big snow field just beyond the divide, over which we had to pass on the way to Benjamin Creek, the location of Tom's cabin, where he lived during a long and vain search for gold. Though no valuable metals were found, the locality is memorialized on the map by calling the creek Benjamin, the Christian name of his eldest brother.

The ascent was a hard one, for the day was hot, the underbrush a nuisance, and

A TYPICAL HEAD OF WHITE RAM

In 1884 E. W. Nelson first described a pure white species of mountain sheep inhabiting Alaska and northwestern Canada, naming it *Ovis dalli*, in honor of Prof. Wm. H. Dall, the well-known scientist and Alaskan explorer. While the horns of this species are not as massive as those of the Rocky Mountain Big Horn, or the base circumference equal to that of the Big Horns or to those of the southern California species, the extensive spread and graceful symmetry, in connection with the beauty of the head, makes it the most-prized trophy of its race.

the packs heavy. Gradually I shed all extra clothing and then lightened my pack, the guides good-naturedly picking up the discards as they fell by the wayside. At noon the tree-limit was reached, half a mile this side of the divide, and there on a rounded knoll, with plenty of stunted hemlock for firewood, a small tent was erected for me to spend the night in, while the three men returned to the lake to bring up another load in the morning (see picture, page 474).

On their departure I lay on a cushion of moss and for many hours swung the field-glass, now into the valleys, then upon the foothills and peaks, then down upon Skilak Lake and across the great untrodden tundra, with its many glistening ponds—the summer nursery of the moose. Most interesting of all this limitless scenery was Cook Inlet, looking like a giant river and banked on the western side by the mountains of the Alaska Range, the great cordillera of the Territory, with Mount McKinley as the keystone in the semicircular swing of this great upheaval.

But later my interest became centered

Photo by George Shiras, 3rd

ENTRANCE TO THE SHEEP COUNTRY: LOW DIVIDE 3,000 FEET ABOVE SKILAK LAKE, WHERE THE AUTHOR CAMPED ALONE THE FIRST NIGHT (SEE PAGE 473)

in the animals and birds which, in the shadows of the declining sun, came out of thickets of evergreen and willow. At one time I could see a dozen porcupine—black-haired and of the Canadian species—feeding stolidly as sloths on the fresh vegetation bordering the receding snowbanks.

A cock spruce partridge came within five feet of the tent, evidently mistaking it for snow; a brood of willow ptarmigan were seen in the willows just above, while higher up a fox brought to view a covey of rock ptarmigan, heretofore described (see page 457). Moose signs were plentiful, but no moose were seen. The air about resounded with clear notes of the hoary marmot, the mountain woodchuck of the North (see pages 434, 435). Then came the mosquitoes, the post-season crop of the higher altitudes, when the insect-proof tent became a place of refuge for the night.

On the following morning I had hardly finished breakfast when along came the men, red-faced and tired in the fight against gravity and the worst of mountain trails. An hour later we were climbing over the broken rocks littering the floor of the divide, and thence entering a great plateau sloping southerly to Benjamin Creek. For the rest of the day we struggled through bushes, stumbling into grass-covered cracks, leaping from tussock to tussock, and circling about swamps and mud-holes.

In the midst of all this turmoil Tom pointed out round dots of white on a distant ridge which looked like weathered boulders or snowballs from the frozen fields above. These were the white mountain sheep of which we were in search.

When I asked Tom, somewhat hopefully, whether it would not be wise to begin the camera hunt at once, since it made no difference whether we frightened these sheep or not, he politely concealed a negative answer by saying that if I would circle two miles to the left, ascend the mountain top from the rear, he would drive the sheep toward me before dark. This didn't seem like getting to Benjamin Creek on schedule time; but as Tom assured me, in a sympathetic tone, that I would see four or five sheep

Photo by George Shiras, 3rd

THE MOUNTAIN SLOPES OF THE SHEEP COUNTRY

"Big Pond camp" in the foreground, situated midway between the cabin on Benjamin Creek on the west and the great ice cap on the east. The author camped alone here several nights while photographing the white sheep. Two Alaska bear visited the tent one night (see page 477).

near his cabin to one here, the march was continued, and at six in the evening the cabin came suddenly in sight, 200 feet below a terrace bordering the valley of the creek. John and I were quite used up, the former still suffering from the after-results of typhoid fever, contracted on our trip the previous year to Mexico, and I on general principles.

But soon the restorative effect of a hearty meal and the inspiration of the surroundings gave me sufficient energy to climb a hill behind the cabin, and there, at 8 p. m., I could see, at the headwaters of Benjamin Creek, three different bands of sheep, all preparing to spend the night on little open benches not much above the meadows. Such a sight told the story of a country seldom visited by man and where these aboriginal pastoral flocks felt secure by night and day.

BIG POND CAMP

At 8 o'clock the next morning we were ready to start after sheep, leaving John in charge of the commissary department. Following the creek east half a mile, we then went up over a series of sloping meadows for a distance of three miles.

A little above the cabin three small streams come together and, in combination, form Benjamin Creek. One flows in a zigzag course from the snow fields just this side of the low divide above Skilak Lake, where the melting snow is likewise the source of Cottonwood Creek; another carries the overflow waters of a big pond, in the highest meadow to the east, and the third drains several large valleys in the southeast.

The two latter streams, lying between the highest and steepest mountains in the neighborhood, cut deeply into upland

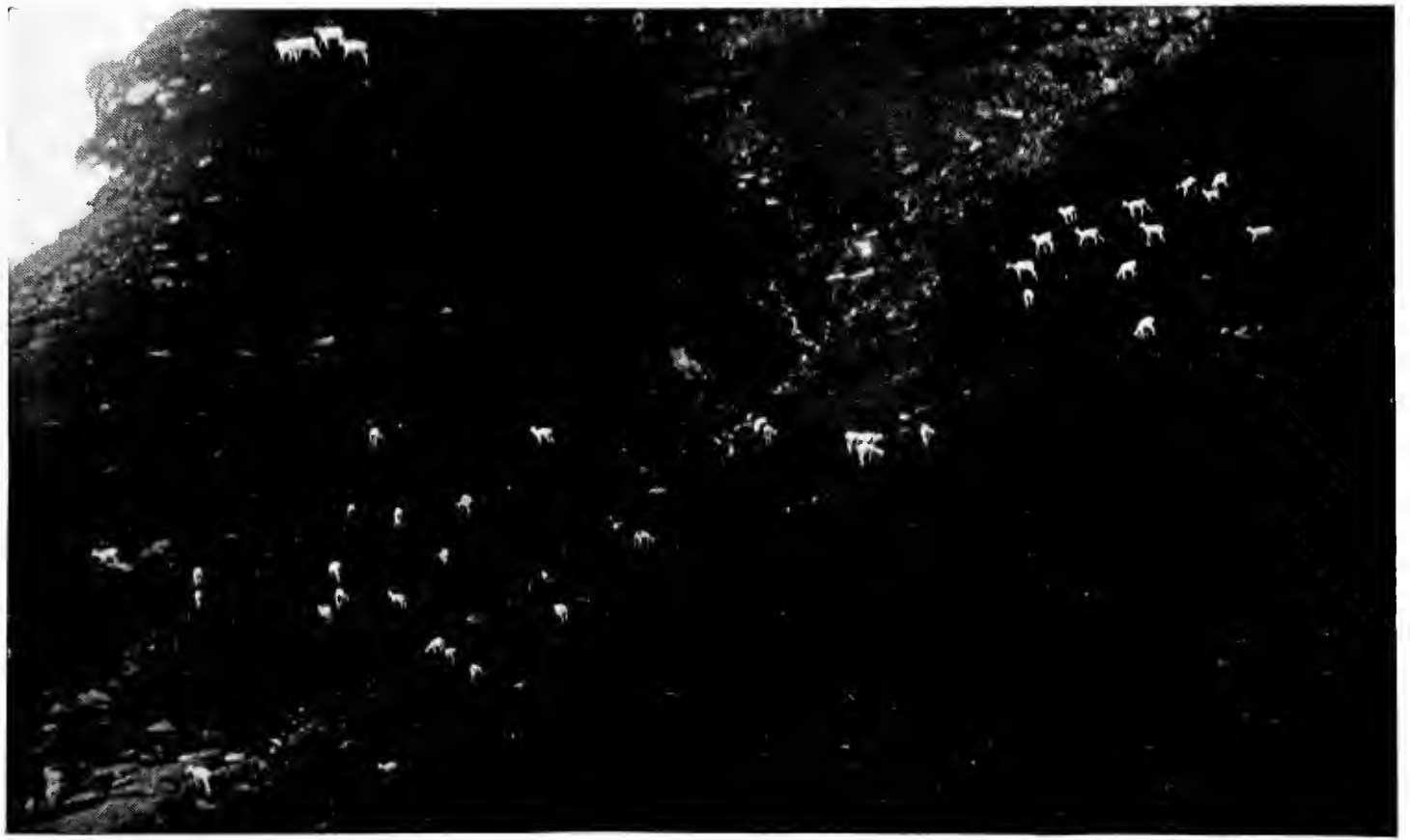


Photo by George Shiras, 3rd

TYPICAL VIEW OF SHEEP ON HIGH SLOPES BORDERING THE SNOW FIELDS, WHERE CONSIDERABLE FRESH VEGETATION IS FOUND FOR A SHORT PERIOD ON SPOTS RECENTLY COVERED WITH SNOW

The writer is not a believer in the theory of protective coloration when applying to the larger animals of this country, whatever may have been the effect of laws of nature regulating survival in prehistoric times, when the pelage colors first became constant and characteristic. Some of the smaller animals and certain birds, fish, reptiles, and insects, whose enemies are largely the same today as in the past, are undoubtedly preserved by obliterative or deceptive colors, as well as by concealing shapes. Confirming the first conclusion are the white sheep of Alaska, conspicuous for miles, and which never through apparent design sought the protection of adjoining snowbanks, however great their anxiety to escape detection or pursuit. Keenness of vision, or occupancy of a favorable lookout, and wonderful aptitude in inferring danger from the action or the absence of other sheep, constitute their main reliance.

meadows, which harbored not only the band of sheep I had seen the night before, but many others.

On the way up the valley we came to the last timber, consisting of spruce, mountain ash, and a considerable number of cottonwood trees, intermixed with willows and alders. At this terminus of the forest growth there were many moose trails and numerous fresh beds made by these animals in patches of grass between the willows. It was plain that the head of this high valley and the smaller ones containing willows were the summer resorts of the bull moose. Only two shed antlers were found in our extensive wanderings, one many years old, confirming my view that all the moose at such elevations returned to the shores of the lake and adjoining lowlands during the late fall and midwinter months.

On the few occasions that Tom had hunted sheep here he had always returned to the cabin at night; but, as this meant a waste of time and energy, it was deemed best for my purpose to erect a tent in the midst of the sheep range, so that I could have a chance to watch them almost continuously during the 18 hours of daylight.

An hour after starting we came to the pond, which seemed to be the best and most convenient location, commanding as it did three of the best sheep valleys, and yet not too close to interrupt the movement of sheep from one district to another.

The tent was placed on a little knoll, close to a fine spring, and where a great black mountain rising from the opposite shore of the pond afforded a striking background (see picture, page 475). Numerous adjoining knolls covered with glacial rocks were the homes of many marmots, who viewed my canvas home with surprise and protestation (see pages 434, 435).

After lunch we made a reconnaissance, locating an unusually large flock of sheep up a valley to the north which drained into the pond, and there we spent the remainder of the afternoon, with the sheep brought within easy inspection by the use of a powerful field-glass.

The wind was blowing straight up the valley toward the flock, but there was no indication that any of the sheep suspected our presence. Not only before coming north, but later, I knew of the conflicting views held by sportsmen and guides in reference to the alleged inability of sheep to detect the near-by presence of man through scent, and it was one of my purposes to make every possible experiment in this direction.

Late in the afternoon Tom and Charlie returned to the cabin, leaving me to spend the night in the tent. Before dark I watched scattered bands of sheep leave the meadows for the higher slopes, where gradually they gathered into several good-sized bunches.

At 9:30, when distant objects became obscure, I went into the tent, and while slipping into the sleeping-bag I happened to look out the wire ventilator in the rear canvas wall, noticing two large animals coming down a ridge a hundred yards back of the tent.

My first impression was that they were sheep, or possibly caribou, but when one rose on its hind legs and looked about, I could only conclude that a pair of the big brown bear of Alaska had come to the meadow for the purpose of digging out marmots or ground squirrels.

These animals have a bad reputation among miners and explorers, due I think to their immense size and their near relationship to the grizzly, around which many of the blood-curdling tales of this country have been woven. Based upon my own experience and the carefully sifted experience of others, I had long ago come to the conclusion that there are no dangerous wild animals whatever in the northern hemisphere, except the grizzly, and this only occasionally when molested.

Having no intention of interfering with these visitors, I felt little concern, although quite appreciating that it might be a dearly paid experience if I neglected taking such precautions as were then possible. So the little automatic revolver was placed by my side, the opening of the tent closed, and, when too dark to see anything further, I crawled into the canvas sleeping-bag. Once there seemed to be something sniffing behind the tent,

Photo by George Shiras, 3rd

THIS REPRESENTS A SMALL BAND OF SHEEP THAT HAS JUST COME FROM THE MOUNTAIN TOP TO A LOW MEADOW COVERED WITH FRESH GRASS AND SMALL PLANTS: SEVERAL LAMBS ARE PLAYFULLY JUMPING OVER THEIR MOTHERS (SEE PAGE 479)

but there was no way of determining the question without going outside. Gradually my nerves quieted down and the next thing I knew was the buzzing of the mosquitoes in the morning, brought into activity by the early rising sun.

Several hours later Tom arrived with cooked food sufficient for three meals, and, after sampling some of this, we returned again to the valley where the sheep were seen the afternoon before. The big band had broken up again into small flocks and were feeding on the same meadows, some of them working down our way. The wind still continued to blow up the valley, but as I now wished to get some views of the sheep grazing here and there on the meadows and at the same time determine with preciseness just how close one could get before the scent created alarm, we cautiously approached.

MANY FLOCKS OF SNOW-WHITE SHEEP

When 400 yards away from the nearest flock, a little blind was made by cutting out brush in the edge of a thicket on the top of a mound, and there we went into concealment for a number of hours. All the sheep were gradually working down wind, and the prospects for pictures and of determining their scenting power became excellent.

The nearest flock, when 300 yards away, began showing some uneasiness. The old ewe in front, and which had charge of this particular flock, several times raised her head, sniffing the air suspiciously. At 200 yards the leading ewe stopped, looked directly our way, and I felt sure the limit of the approach had been reached, so several pictures were taken of the band.

And none too soon, for the leader then turned back, and in a stiff-legged and peculiar way strode through the flock, with her little lamb following obediently in the rear.

All the other sheep, some of which were grazing and some lying down, seemed to take immediate notice of what was going on, for when the old ewe reached the end of the flock and began ascending the steep slope instead of continuing up the valley meadow, the rest fell in behind and in a few minutes a great long file was zigzagging up the side of the mountain.

And here occurred another striking result. Four large rams that had been reclining on the top of a flat rock 200 yards beyond the rest of the sheep all stood up and began looking about, first at the line of sheep ascending the mountain and then down the valley. Whether their restlessness was wholly due to the flock of sheep leaving the valley at that hour or to the manner or peculiar actions of the ewe or whether they had gotten a trace of scent was hard to tell.

Soon the other sheep began working away from us, finally dropping into a meadow walled in by a stone ridge running across the head of the valley except where broken by a narrow opening, through which a little stream dashed in a series of cascades.

During this and all successive days we saw none of the sheep drink water either from the streams along which they grazed or from any of the pools of water in the green meadows. Whenever the sheep became thirsty they always went to a snow field, and so noticeable was this that I spent a part of one day getting into a position where photographs could be taken of sheep coming to the snow banks for that purpose (see pages 484 and 487).

A little later I saw a band of about 20 sheep coming down the side of a distant mountain toward the meadow and on the dead run, jumping rocks, slipping and sliding down the steep sides of the bare mountain, hurrying across little terraces, over which they leaped and continued their rapid and downward course.

So striking was this sight and so certain was I that these sheep were badly alarmed that I aroused Tom, who was dozing in the sun a few feet away, and pointed to the sheep. Looking at them for a moment he said, "Why, those fellows are just coming to the meadow for their afternoon meal, and seeing all the others at work are losing no time in doing it."

"Just watch them," he continued, "and you will see that on reaching the bottom of the hill they will begin butting one

another and cutting up all kinds of capers" (see picture, page 478).

And that is exactly what happened, for on coming to the edge of the little creek butting matches began, while some of the lambs jumped entirely over their mothers. At the creek it was a pretty sight to see them leap from bank to mid-stream, where rocks amid swirling waters gave a footing, and thence again to the opposite shore.

But the bunch of sheep which had come down the mountain in such haste either saw or smelled me when I photographed them, and immediately departed by the same route they had come. Also every sheep in the meadow behind the stone ridge left immediately for the mountain top.

I was curious now to know just how this little meadow looked, so we walked up and crossed over the top, looking down into a beautiful spot. Below was a circular meadow, containing a small but beautifully clear pond, and the trampled condition showed that every day the sheep came there for grass, which was unusually green and abundant. Whether at one corner of the pond a good-sized mud hole indicated the presence of a lick I could not tell at the time and was sorry not to have investigated it later.

This seemed an ideal place for close-range pictures, so we immediately began the construction of a blind on the face of the cliff, looking down upon the meadow. A narrow ledge allowed the piling up of flat stones until there was room for three of us to squeeze in behind and point the camera downward. We then left, but returned the following day. The experiences of our day in the blind are given in the following extracts from my notebook:

A MORNING IN THE SHEEP-BLIND

"August 12—Ther., 75-52.

"Today was selected for a visit to the stone blind above the little basin meadow, regardless of wind or weather. The three of us had spent a rather uncomfortable night in the small tent, and at an early hour I heard the men breaking the stunted willows for a fire and a cup of hot coffee. But the fog for the first time had descended into the valley and no object could be seen more than 50 yards away. This resulted in a later start and in the end proved a mistake.

"When half a mile below the blind, the fog lifted suddenly and the warm, bright sunlight illuminated the valley and the mountain sides in a way to accentuate the heretofore restricted vision of man or beast.

"Above us on the left, near the summit of the mountain, was a band of about 40 ewes and lambs, all lying down, but evidently looking at us. Two hundred yards above the blind, and on the same side as the others, were two big rams a little distance apart. One was watching us most intently, and in a moment began the ascent, while the other, apparently alarmed at his companion going up instead of down at the feeding hour, began to scan the bottom, where he soon saw us, though standing motionless. Instead of retreating he walked to the edge of a cliff and, standing like a marble image, gazed in our direction.

"Soon our positions became irksome and we started for the blind, while the ram immediately trailed after his more cautious companion and disappeared over the mountain top. Had we arrived an hour sooner none of these sheep would have been disturbed and, in addition to getting their pictures in the little meadow, probably others would have been attracted from more distant points. Entering the blind, everything was soon ready for an instant or continuous bombardment. But an hour passed and nothing came down any of the many runways, radiating like gray ribbons from the green meadow.

"Finally Tom, who thought that the big flock of ewes was past due, climbed cautiously to the top of the cliff behind the blind, and on his return said that not a single sheep was in sight. Among this flock were many that had seen us slipping up the valley, besides having additional warning in the hasty departure of the rams. This inferential power of sheep is remarkable.

"The 'sure thing' counted upon, like most predetermined results, had missed a cog somewhere, and when noon ap-

Photo by George Shiras, 3rd

A LARGE BAND OF SHEEP, NEAR THE MOUNTAIN TOP, CROSSING A SNOW FIELD FOR THE PURPOSE OF CLIMBING THE ADJOINING CLIFFS FOR THE NIGHT

proached the principal object of interest was the lunch-box. Finally, four sheep were seen on the skyline two miles away, and down they started on one of the big runways leading to the valley. They came rapidly and were soon standing on a bare plateau a quarter of a mile above the meadow. Here they stopped and looked below, but in a few minutes began grazing on the sparse grass. After remaining half an hour they took a trail toward the head of the valley, where there were doubtless a good many other sheep.

"It was then that the idea suggested itself of a light and portable set of life-sized profile decoys, made of white cloth, which could be set at any angle and where they could be seen broadside at a long distance. The day before, as al-

Photo by George Shiras, 3rd

A HIGH MEADOW STILL COVERED WITH MUCH SNOW: THE TWO EWES ON THE LEFT ARE HAVING A DISAGREEMENT OVER FOUR OR FIVE LAMBS THAT ARE PLAYING TOGETHER

ready stated, we noticed how quickly and unsuspiciously small and scattered bands of sheep descended and joined flocks already feeding in the valley.

HOW THE BIG RAM WAS PHOTOGRAPHED

"At noon the lunch-box was opened, but before we had fairly made a start I saw a big ram approaching along a ridge from the direction of our camp. He came rapidly, with head up and mincing steps, looking very much like a small and sturdy caribou stag. When in sight of the meadow he stopped and looked down for fully five minutes, occasionally scanning the mountains on our side.

"We feared that, like the others, he would turn away at the sight of the deserted meadow. Tom, however, thought that the ram was most anxious to join a band of his fellows and might cross to our side in order to look for such beyond. At any rate he soon started down toward the creek and we were in doubt as to his final destination. At the edge of the bank he disappeared, and we then felt sure he would come along our ridge, but on which side was the question.

"Several moments passed, and I feared he was then passing behind the blind, cut off by a wall of rock against which our backs were resting. Slipping the strap over my neck, which supported the heavy camera, I was just in the act of climbing over the top of the blind when Tom seized my arm, whispering: 'Good Lord, here he comes right at us.'

"And there, stalking along most unconcernedly, was the ram, not 40 yards away, and, if not interrupted, would soon be gazing down into the blind.

"The several portholes made for the camera all faced the meadow, for an invasion from any other quarter had not been looked for. When he got within 75 feet I was in a quandary. To rise up nearly full length above the low wall of the blind meant his instant alarm, with no time to obtain the sharp focus necessary with such a big lens.

"Holding my fire, I trusted to fate. At 50 feet he stopped, turned broadside, and nibbled at a sprig of vegetation. Silently and quickly, in one steady motion, I arose, with my eyes fixed on the focusing mirror instead of looking at the ram directly. On the ground glass I saw his head raised suddenly and turned my way. Quickly the milled head of the focusing screw brought him in focus and the focal-plane shutter clanged harshly.

"But his white form had vanished when I raised my head, and, to Tom's and Charlie's inquiring glances, I could only say that the effort was successful, provided the ram was not in air when the shutter revolved."

It was two days before I went to Tom's cabin, and when darkness begrudgingly came at 10 p. m. I dropped the negative into the developer and in a few minutes saw on the plate the big ram, broadside, head up, gazing at the camera (see page 492).

PECULIARITIES OF THE SHEEP

The next and final day at the head of Benjamin Creek was reserved for studying and photographing a large flock of sheep, heretofore occupying the end of a ridge west of our tent and which always fed on a large circular meadow, nearly surrounded by small canyons.

At no time did the daily program vary. By 7 o'clock the entire flock of about 50 descended the mountain, crossed a little creek, and then in bunches of six to a dozen scattered out over the meadow, feeding not only on grass, but small bushes. Quite often some of these bands, containing many lambs, would work their way out to the edge of the meadow, fully three-quarters of a mile from the base of the mountains, so that their retreat could readily be cut off by the intervention of a man with a rifle or by any fleet-footed predaceous animal. This, of course, meant an entire absence of molestation during the season and probably for years.

In the daily movement of the sheep on the steeper mountains I noticed that in coming down they usually took an earth trail, however loose the soil or treacherous the shaly rocks. On their return the steepest cliffs, if affording a good foothold, were ascended in preference to the near-by trails used on their descent.

The probable reasons, if my brief observations warrant an opinion, were

Photo by George Shiras, 3rd

SHEEP THAT HAVE SPENT THE ENTIRE AFTERNOON ON A MEADOW WELL SUPPLIED WITH WATER, WHICH THEY REFUSED TO DRINK, NOW QUENCHING THEIR THIRST ON SNOW

Life on the high mountains, where most of the year there is no water, and what there is in the summer swiftly cascades from the snow fields, seems to have made them dependent on snow instead of water

these: (*a*) On the descent the loose soil and tumbling rocks accelerated instead of retarded the progress of these sure-footed animals, while returning such conditions had the opposite effect, and (*b*) in the jumping down from ledge to ledge of animals weighing from 100 to 250 pounds, a slip or the breaking of the ledge was much more likely than when ascending a cliff, because each upward jump was made with the lightness and accuracy of a bird.

I had noticed, moreover, that at noon some of the sheep often returned for a rest on a lower slope of the ridge. There was no way of making a blind on the meadow without alarming them all, except during the night, and this would have been a difficult undertaking, so I planned getting on the ridge during the morning and after all the sheep had gone to the meadow, when there would be a chance for pictures in case any returned at noon and, with a greater certainty, as they assembled toward night in the vicinity of the blind.

After breaking camp in the morning, Charlie continued on down the valley with his pack to the cabin, while Tom and I left ours near the pond, where we intended wading the outlet stream, so as to reach the base of the ridge at a point where nothing could see us from the meadow. This stream proved much deeper and swifter than it looked at a distance. While not objecting to a wetting, we feared being carried off our feet, with the resultant injury or loss of the photographic outfit. It is in just such cases that a rifle will stand much more ill-usage than a camera. Nearly an hour was spent gathering and throwing flat stones into the swift water until a secure footing was obtained.

On reaching the edge of the ridge, at a point about 200 feet above the meadow, we could see many scattered bands of sheep; but, to our disappointment, a dozen sheep were now coming along in single file toward the ridge, and were then too close for us to pass around and get in a position to meet them on their ascent, so there was nothing to do but to await developments.

In a few minutes they had jumped the creek, one lamb falling over backward into the water, much to the indignation of its mother, who stamped her feet vigorously as her bedraggled offspring endeavored to climb the steep bank. With a single and later exception, this was the only time any sheep, big or little, proved awkward or careless.

PHOTOGRAPHING THE SENTINEL EWE

When the band finally came up the slope they were soon lost to sight and we waited until they had time to reach a resting place. On climbing to the rim I saw the flock about 200 yards to the left and on the same level. All were lying down but one, evidently the sentinel.

After carefully studying the approach and figuring on the possibilities of remaining concealed, Tom assured me "that with ordinary crawling agility one could get within 50 feet." But as Tom could crawl like a serpent, climb like a squirrel, and had the equipoise and jumping ability of an ibex, his encouragement was of a doubtful character.

Experience had taught me, however, that while it was important not to be seen approaching, it was equally important, when armed with a camera, to know the exact position of the animals in relation to the last cover sought.

Having determined this I started on all fours, a mode of travel rendered more difficult by being compelled to push the heavy camera ahead. When the final rock was reached, I very slowly pushed a piece of small brush to the top of the rock and then raising my head looked through it. This method, if observed by animals near at hand, might excite a puzzled interest, but even so is safer than the appearance of a human head a few yards away.

The sheep were lying in a row, less than 20 yards off, and the sentinel ewe was standing, with a little lamb at her feet, while to the right was a large ewe lying down and the rest near by. I could see that it was impossible for the plate to cover them all and be in proper focus. Then came the idea of getting the sentinel ewe and lamb, thus supplementing the picture of the big ram and completing the family group. In a moment the

camera was arranged and at a focus probably requiring no further change when brought to bear upon the sheep.

Lowering my eyes into the hood surrounding the focusing mirror, I slowly arose, and when the camera cleared the top of the rock I found the sentinel looking directly at me and in sharp focus; so, without a moment's hesitation, the button was pressed and the shutter revolved. What the camera saw is now reproduced on page 490.

Before the frightened sheep had a chance to gather their wits I had reversed the plate-holder and caught the band as they struggled in a disordered way over the broken rocks above me (see photograph, page 491).

We then set about constructing a comfortable blind between rocks concealing us from animals coming from below or above, and where we could remain the rest of the day watching the scattered bands of sheep on the meadow below. It seemed that practically every such band had a leader, and in moving from one locality to another or when feeding, one could readily pick it out. And this, today, is the surviving and predominating characteristic of domestic sheep. A dread, growing out of their exposed position and distance from the mountain, was noticeable, too, and manifested by the way the sentinel sheep continuously surveyed the country (see page 489).

And here there may be interposed some general observations on the above subject. Mr. Charles Sheldon, who is accepted, and properly so, as the leading authority on northern sheep, inclines strongly to the belief that such bands of sheep have no sentinel in a strict sense, but rather that the more alert or experienced of the members at times give the appearance of prearrangement for guard duty. Such a conclusion is undoubtedly true of caribou and elk, but in the case of sheep, where gregarious ties are very strong, it seems to me that the assumption or selection of a leader, covering days and perhaps seasons, means the necessary assumption of lookout duties, unless such a leader is thoroughly satisfied that every condition is favorable to the security of the flock (see pictures, pages 489, 490).

During my observations Tom was devoting himself to watching the mountains above, where he finally discovered a ewe coming down towards us, and which he thought was one of the sheep that might not have seen us clearly when the stampede took place and was anxious now to join the other sheep feeding in the meadows. Its course would bring it some 20 yards to the left and well out of way of the quartering wind blowing up the side of the mountain.

At 75 feet the sheep turned to the right, and, as we knew that the wind would bring it across the line of our scent, I was most anxious to note the results, even if I lost the picture. When between two rocks, with only the head and shoulders showing, the scent struck it suddenly. The animal winced as if shot and dashed upward again with the speed of a deer.

This showed pretty conclusively that a sheep at close range had a good nose, at least when previously alarmed.

Finally the animals on the meadow turned toward us, and we thought that the time had now come for a series of pictures, as band after band came up our side of the hill.

The leader of the first flock began watching the side of the mountain, coming 10 or 15 feet and then stopping for a minute or two, during which intervals the rest of the band continued to graze and often laid down. On reaching the creek the leader had apparently become very suspicious for some reason, and stood eyeing the entire side of the mountain, but finally lay down with the others, but with head turned toward the mountain side. Unquestionably the absence of sheep where they were accustomed to gather in the afternoon, and possibly the ascent of the first flock, had something to do with the uncertainty of the leader.

Meanwhile another band had come within 50 yards of the others, also led by a ewe, which acted very much like the first. In a few minutes the two bunches commingled, and, to our regret, soon began retreating towards the meadow, where they stood in an uncertain kind of way for a long time. Then the two bands separated, one continuing up the little creek. The manner of the leader, look-

Photo by George Shiras, 3rd

THE SAME BAND OF SHEEP AS SHOWN IN THE PRECEDING PICTURE, STILL EATING SNOW: PHOTOGRAPHED IN THEIR OWN SHADOWS, THEY APPEAR UNUSUALLY CONSPICUOUS ON THE SNOW

ing steadily at a distant point on the side of the mountain, led me to turn the glass in that direction, where I saw four sheep on the edge of a cliff, and towards which the band was evidently going. Soon the others were on the move across the meadows, all headed, with the exception of one distant flock, for the same spot, and we saw our chances fading away. In a short time these flocks had joined the four at the other end of the ridge, a portion doubtless of the flock which we had previously photographed, and which had sought out a new place for the night.

At 4 o'clock the little band of sheep that had been fading at the extreme western end of the meadow came trotting back on a well-defined trail bordering a canyon, and I felt almost certain that none of these sheep would come to our blind, although on five previous days all the sheep had gathered every afternoon just above it. Now, more than ever, I was convinced that a set of sheep decoys, as suggested previously, would have brought most of these sheep within photographing range. Tom even thought that a white linen night-shirt would have answered if he could have been permitted to trot about in it in front of the blind.

As the last flock continued to approach it seemed best to slip down the side of the slope as close to the creek as possible and try for a picture as they went by. When a third of the way down I found they were coming more rapidly than expected, and, in an effort to pass an exposed place between two rocks—and which should have been done by crawling very slowly—I carelessly jumped across, and in landing behind the sheltering rock I heard Tom's warning whistle.

Looking down on the meadow, I saw that all the sheep had reversed ends and were rushing back again. Since these animals were more than a quarter of a mile

Photo by George Shiras, 3rd

SHEEP TRAVELING TOWARD THE LARGEST SNOW FIELD IN THE VICINITY

Note the four big rams on the upper edge, and how inconspicuous when compared with the smaller sheep on the dark soil. The curved and bulky horns of the four rams can be clearly seen. The rams spend most of the summer on the extreme mountain tops, rarely accompanying the ewes at this season.

Photo by George Shiras, 3rd

THESE SHEEP FED FOR HOURS WITHOUT LOOKING ABOUT, EXCEPT THE SENTINEL ABOVE, ON THE LEFT (SEE PAGE 486)

The keen vision of these sheep is practically their sole reliance for detecting danger. They always feed or rest on open ridges or hillsides devoid of bushes, from which they can have an unhampered view in every direction. They also possess unusual power of inference, detecting danger from the actions of other sheep, however distant the latter may be.

away, it was a good illustration of their acuteness of sight and their quickness in realizing the character of the danger. Not knowing how these sheep could escape in the direction they were going, I called to Tom for advice. He yelled that they were now headed for an ice-bridge across the canyon (which I did not know of), and, after crossing this, he thought they would swing around our way again for the purpose of ascending the mountain slope just behind, and that if I hurried there would be a chance for a picture.

But after exercising all the energy at my command the sheep won, and I could see them 200 yards below quartering up the mountain. In a few minutes they reached a ledge of rock within a hundred feet of the crest of the great black cliff opposite the site of our former camp.

This was our last view of the white mountain sheep until two days later, when we entered the pass of the low divide above Skilak Lake.

Our visit had made the sheep considerably wilder, and the flocks which formerly rested each night on the lower benches now whitened the ledges of many a high cliff; but no red had dyed the white and woolly sides and no flock noticed an absent one within its ranks.

The next morning we left for Skilak Lake, camping a half mile this side of the low divide and giving the men a chance to make a second trip to the cabin that day.

OUR LAST VIEW OF THE WHITE SHEEP

At an early hour the next morning the little tent was taken down and cached with other articles, to be called for the following day, and then with heavy packs we began trudging along the slight rise to the low divide, through which

Photo by George Shiras, 3rd

THE SENTINEL EWE

After a long stalk on all fours the author got within 50 feet. Note the extremely long legs of the ewe. The short black horns and white body have led many of the Alaskan miners from the Rocky Mountain States to mistake the ewes of these sheep for white mountain goats (see pages 485 and 486).

Cottonwood Creek ran on its short and rapid career to Skilak Lake, 3,000 feet below.

It was here that I got my last photographs of rock ptarmigan, and as we climbed up on the broken mass of rock, littering the pass between the cliffs of the divide, I put away the lenses and boxed the camera in case of a fall through such insecure footing. Half way through the pass some one noticed seven or eight sheep, almost overhead, lying on a narrow ledge, with a perpendicular drop of nearly 300 feet below them. To those who have seen large, white gannets, nesting here and there upon the face of a maritime cliff, the resemblance was a striking one. Before I could get the camera out and arranged, the sheep, noticing that we had stopped and were gazing upward, became alarmed, and in a series of awe-inspiring leaps took ledge after ledge until the top was reached, when, getting in line, they all looked over. And that constituted my last but still lingering picture of these graceful creatures, poised on the highest summit above Skilak Lake.

Impressed once more with the agility and self-confidence of these nomads of the skies, I asked Tom whether he had ever seen the remains of any indicating that sometimes life paid the forfeit of a careless gambol or in the desperate effort to avoid pursuit. He replied that during nearly 16 years in the sheep ranges of Alaska he had never seen a single case of the kind, though several times having found carcasses at the foot of a snow avalanche.

And then occurred within a few short hours and at the same spot a tragedy constituting a most remarkable sequel to my inquiry.

After returning to the lake and remaining over night, Tom and Charlie started back in the morning for the tent and the remainder of our outfit. In passing through the same divide Tom saw, hanging partly over a ledge and midway between top and bottom, the crumpled body of a large, fine ewe, while running about below was a little lamb, which, whimpering and bleating, continued to look up toward the spot no feet could scale.

Photo by George Shiras, 3rd

BUNCH OF SHEEP, WHICH WERE BADLY FRIGHTENED WHEN PHOTOGRAPHED, RUNNING UP A ROUGH MOUNTAIN (SEE PAGE 486)

How this accident happened is, of course, a matter of surmise; but not unlikely the mother had rushed in between her young and the edge of the great cliff as it gamboled recklessly near, and slipping over left her offspring wondering at the audacity of the leap. But be this as it may, we know that when time passed and the mother failed to return the little fellow by a circuitous trail reached the bottom of the pass, to be no nearer than before to the only one it loved.

Let us trust that before the long hours of the summer day had passed the little lamb saw a white line zigzagging into the valley, which he dimly knew was the pastoral range of his mother's clan, and approaching found a welcome within the ranks, and no less so because he came alone.

SUMMARY OF GAME CONDITIONS ON THE PENINSULA

On our return from the mountain country the camp was located at the further end of Caribou Island, a few miles west of Double-bay camp, and opposite the moose lick.

This island is about three-quarters of a mile long, with a maximum width of a third, and, excepting a few acres of pine, is covered with a vigorous second growth and some swamp land, the result, probably, of the same fire which cleared so much of the shore opposite.

And here it may be remarked that, however wasteful in a commercial sense may have been many of the forest fires in the wilder portions of our continent, they nevertheless have often been of corresponding benefit to the game and range stock. The replacement of dense and often stunted and useless conifers with poplar, birch, cherry, oak, beech, maple, and the subsequent appearance, also, of meadows and glades covered with grass, moss, bushes, and small herbage, has done much in the way of supplying an abundant and nutritious variety of winter and summer food, valuable alike to the larger game animals, domestic stock, pack horses, many game birds, and small quadrupeds, few of which resort to or can thrive throughout the year in the dense, dark evergreens of the North.

In recent years hundreds of thousands of acres of such second growth have sprung up in Alaska, and nowhere has it been of greater advantage to game and

Photo by George Shiras, 3rd

A BIG RAM PHOTOGRAPHED AT 50 FEET FROM AMBUSH

He jumped the instant after the shutter revolved, but left his picture behind him (see page 483). Note the fine and graceful horns

the pack trains than throughout the interior of the Kenai Peninsula. Caribou Island, subjected to easy examination, showed that on the coming of the ice it was visited by many moose, while the abundance of spruce partridges indicated their appreciation of the berries and swelling buds, just as the rabbits thrived on the tender bark and great variety of smaller plants.

In its isolation the Kenai Peninsula is a great Presque Isle, allowing a marked segregation of northern game, favorable alike to their previous existence and now much improved by physical changes, the ease with which the game laws can be enforced, the concentration of Indian settlements near the canneries, and the practical extermination of the wolf.

Reports of those best acquainted with present conditions show that the moose have been increasing steadily in recent years, that the white sheep are thriving, and all other game animals except the small fur-bearers and the caribou are holding their own. Just why the caribou has approached extinction no one seems to know, but I am glad to report that a good-sized stag was seen south of Benjamin Creek by a party of surveyors during last July. As much of the peninsula is well adapted for caribou or their near relatives, the Siberian reindeer, an effort should be made for their introduction, since the interior will readily support a herd of many thousands. As they feed upon a form of ground vegetation now going largely to waste, their presence will not prove a detriment to the other game animals, but on the contrary will afford

an additional supply of meat for visitors and natives, besides largely decreasing the drain upon the moose and sheep.

On several occasions it has been suggested that the peninsula was just the place to establish a national park, but its remoteness and the need of developing such resorts nearer home make such a plan impracticable at the present time. Neither should this country be set aside as a permanent game refuge, because the narrow base connecting it with the main shore is traversed by a great glacier, practically cutting off the egress of the animals, and it thus lacks the essential prerequisite of every such refuge, where the surplus animals should have a chance to populate the surrounding territory.

The district, defined on the map facing page 428, is the most accessible and probably the most populated sheep range on the continent. Here on a few of the more northerly mountains I saw some 500 sheep, and here, too, is the summer range of many moose and the home of the great brown bear. In many other localities big game is plentiful, and it may prove on investigation that in the great stretch of unexplored mountains facing Prince William Sound there are white mountain goats and some specimens of the glacier bears.

THE GREAT ICE-CAP

The sheep country, between Skilak and Tustumena lakes, is walled in on the east by an immense ice field, the history of which has never been written, and only of late has its true character been determined. Marked on the older maps as the Kenai Glacier, it is in reality a great ice-cap, probably unsurpassed on the northern continent except by that of Greenland and the well-known Malaspina ice field at the base of Mount Saint Elias.

Unlike a true glacier—created by ice streams flowing from the higher lateral valleys—this great ridge of ice, towering 4,000 feet above the sea, fills the lower valleys with hundreds of glaciers, some of which are active and still topple great masses of ice into Resurrection Bay, while others are stationary, or receding, but contributing to the flow of nearly all the streams originating south of Skilak Lake.

No one has ever crossed it at the widest point, and no one has ever traveled its entire length. Computations from various sources show this ice field to be 70 miles in length with a maximum width of 20 miles.

Whether originally formed by local precipitation, now insufficient to maintain its present bulk, or whether this ice ridge is a great keel of a mighty ice field which once bore down upon the peninsula, is a problem for the geologist rather than the casual visitor.

The first week in August Skilak Lake suddenly rose a foot in a single night, and the only explanation was that the ice stream below the cap had become clogged for days and, when the pressure became too great, burst its bonds. The milky and turbid condition of the lake corroborated this view.

The weather conditions during the trip were most favorable for game, although we were undoubtedly fortunate in being there during an unusual season.

In 55 days rain fell during 19 hours—practically a drouth. We were windbound three days and experienced a number of violent squalls lasting an hour or so. There were three entirely cloudy days and half a dozen partly so. This resulted in unusually high water in all the mountain streams—an anomaly during dry weather further south, where rain and not melting snowbanks maintained the streams. As a secondary result the mosquitoes were scarce, with the swamps dry; but the black flies, beginning in September, were the worst I ever saw, nearly devouring the men alive as they toiled at the tracking line on the return up the Kenai River.

The maximum heat the last two weeks in July was 87°, on the 19th instant, and the minimum 40°, on the night of the 21st. The average maximum for that period was 70° and the average minimum 45°.5. In August the maximum was 83°, on the 7th instant, and the minimum 32°, on the night of the 10th. The average maximum for the month was 69°.2, and the average minimum 46°.5. The first

week in September the maximum was 67°, on the 1st, and the minimum 28°, on the night of the 2d. Part of this time we were in the mountains, but the weather continued so warm that the altitude did not materially affect the average.

Undoubtedly we were in the most favored portion of the peninsula, and there during an unusual season besides. Often rain and fog encompassed the higher mountains, and frequently we could see storms moving up and down Cook Inlet. Moreover, the great mountain range on the east undoubtedly cleared the wind of moisture before reaching us.

Hunting parties coming out later reported bad weather during the last of September and in October, so the above data must be taken rather as an evidence of what the weather can be than what it is apt to be.

In the winter months the snow is not deep in this region, and for causes already suggested. Last winter, when the middle and easterly States were experiencing the severest weather in 40 years, it was unusually mild on the Kenai Peninsula, because during the fall and winter a continuance of southeasterly winds held the Japanese current close against the Alaskan shore, and at a time when the Arctic cold waves were sweeping over the central and Atlantic coast States. Whether these counter-currents were correlated or whether they were coincidental and of no significance is a matter for the expert meteorologist to investigate.

In conclusion, let us hope that those interested in the permanent prosperity of the Kenai Peninsula appreciate the value of an abundant and available supply of game-food animals and fish, and understand how much the presence of this game has contributed to its fame throughout the world.

The shipment each fall of thousands of pounds of moose and sheep meat from the Kenai Peninsula to the mining towns of Valdez and Cordova is only of a temporary and trifling benefit to a few market hunters, and will some day prove a costly loss.

Long after the last flake of gold has been panned from the sands and the last blast has fractured the veins of quartz, the Kenai Peninsula should continue to be the home of the giant moose and the place where the sheep, the grouse, and the salmon are worth more in dollars and more in life than all the visionary or fleeting fortunes beneath the soil.

AMERICA'S MOST VALUABLE FISHES

By Hugh M. Smith

United States Deputy Commissioner of Fisheries

THE answer to the question, What are the most important fishes in American waters? is likely to vary with the geographical distribution of the persons addressed.

The average citizen who lives within the sphere of influence of the sacred fish effigy hanging in the Massachusetts State-house will undoubtedly name the cod and its allies that frequent the inshore waters and the great submerged "banks" lying off the coasts of New England, the British maritime provinces, and Newfoundland.

From the Hudson to the St. Johns, a primary vote would probably favor the shad and herrings among river fishes, and the bluefish and squeteague among marine species.

Along the 1,700 miles of low-lying coast that extends from Key West to the Rio Grande, the fishermen and the fish-eating public can hardly conceive of anything more important in the way of food fish than the mullets and snappers.

Throughout the Great Lakes the whitefishes, trouts, and pike perches are so abundant and support such extensive fisheries that they would undoubtedly be awarded front rank by millions of people in the States abutting on these waters.

In the vast region drained by the Mis-