

94. WARD HERON—*Ardea herodias wardi*.

95. SNOWY EGRET—*Egretta candidissima candidissima*.

The last mentioned was here the most timid of all: in Florida and California I have found them almost stupidly tame. The Ward herons, too, were quite wild. The spoonbills were to me a decided treat, and as the saying is, I "feasted my eyes" on them. In life they are far richer in color than museum specimens would lead one to expect; specimens must evidently fade much. They were gorgeous, lovely, spectacular. We saw seventy-seven in one flock, and later saw one of about half that size, presumably, but not certainly a second bunch.

There is a happy ending to this that is not always the case. Texas has recently set this island apart as a sanctuary, so that with legal protection, good wardens on the job, few predatory birds, comparative safety from beasts of prey, and abundant food, these birds should thrive. I understand that much credit for all this belongs to Dr. Pearson of the Audubon Society, and to Mr. Camp, "patron saint" of the Brownsville birds.

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#### THE RELATION OF THE CROW TO PECAN CULTURE

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The common crow is a widely-distributed and well-known bird. Literature is replete with references to this black denizen of forest and field. It is one of the first birds for which we have critical food-habit studies, but in spite of this fact, its real economic status is still a mooted question. On first thought it might seem surprising that the bird's beneficial and injurious traits have not been listed, and a balance declared either for or against it. When, however, we consider the fact that over 650 specifically different items of food have been identified in the stomach contents of the crow, we can see wherein the solution of the problem might not be as simple as at first thought. If we find grain present in the diet, our principle concern is whether the grain was waste grain or utilizable grain. Even if at times it be other than waste grain, we still might object provided the crow's services throughout the rest of the year compensated for it. But when we come to consider the crow's destruction of the smaller mammals, batrachians, reptiles, insects, and crustaceans the question is not so simple. Our knowledge

of the exact inter-relations of each of these forms in the complex of nature is too incomplete for us to more than hazard a guess as to the ultimate effect of the destruction of any one of them. We find this same difficulty presenting itself when we consider measures for conserving the wild life of both land and water. Consequently the need is great for life-history and food-habit studies of all our animals excepting those already well known. Any careful observations which help us to understand the relation of a given animal to the other animals or to the plants of the community may be considered a contribution toward the ultimate evaluation of its economic status.

With this aim in view the writer wishes to record some of his observations on the habits of the crow. These observations were made for the most part in the northeast corner of Grant County, Oklahoma, and cover a period of several years. A monetary interest rather than an ornithological one prompted the study. When crows began to make serious inroads upon the pecan crop, the problem became an urgent one. Up to 1912 or 1913 crows were not numerous in this locality and were seldom seen during the summer. About this time, however, they became more noticeable during the summer months and an occasional nest was found. During the winter good-sized flocks of them could be seen feeding in fields and pasture lands, especially those near wooded areas. A year or so later it was learned that upstream a distance of about three miles, "as the crow flies," a roost had been established. Just when this occurred nobody seems able to say. We were aware of an upstream movement of the crows at night, and had noticed their return the following morning, but had not given the matter much thought. The crow roost is separated by perhaps a mile of wooded territory from the nearest human habitation. The nearby farmers were aware of the fact that the crows were spending their nights in a certain clump of trees, but never actually investigated the spot until after the roost was well established. The roost has accommodated more birds year after year and has accordingly increased in area.

It would be valuable to know just what factors caused the crows to establish a roost at this place, to commence breeding in greater numbers in the general vicinity, and to greatly increase in numbers during the fall and winter. Before this territory was opened up for settlement the land had been practically

deforested by people living across the line in Kansas, because they found here a convenient place to get their building material, fence posts, and fire-wood. The area had also been swept by fire. After homesteads were filed, the forest was cared for and allowed to reestablish itself. The native pecan grows slowly and does not bear early, consequently it has only been within the last few years that the nut crop has become large. It seems probable that in the gradual increase in the pecan crop, and the discovery of the nuts by the crows, we have important factors leading to the present situation.

As early as 1888 the crow was reported as doing considerable damage to the pecan crops in parts of Louisiana and Texas. In the locality under discussion, however, feeding upon pecans seems to be a habit recently acquired, because the few crows seen here in earlier years were never observed paying attention to the pecans.

In the past few years, however, crows have become numerous about two weeks before the ripening of the pecans (middle October) and commenced carrying away the green nuts. They arrive at the pecan groves before sunrise, while it is still too dark to see the sights on a gun, and settle on the trees. The first ones to secure pecans fly to the ground or nearby fence posts and eat them. When the flock moves those which have not finished eating carry their pecans with them. Usually there are one or two crows in the flock that do not have a pecan, and since these individuals are busy cawing, it would seem to be a part of the general plan, and not an accident. On one occasion all but two of a flock of 200 crows had pecans. In flight their paths cross and recross so many times that it is impossible to decide whether the one or two without pecans are functioning as leaders or not. After securing a pecan each the crows leave for the time being, following in a general way down Bluff Creek valley to the southeast, but return in a half to three-quarters of an hour for another round. If they are successful in this second attempt they do not return as a flock until about four-thirty in the afternoon, when they secure another helping of the nuts on their way to the roost. A few stragglers often remain in the grove, or near it, throughout the day. If when passing over in the morning the crows are frightened, they will drop their pecans, but will return as soon as the danger is apparently over, each to secure another pecan. On several oc-

casions the writer has tried frightening the birds as soon as they began circling the grove to see how long it would take to discourage them. Each time they would remain away for a longer period, but would make about a dozen return trips in the course of the forenoon. When not allowed to feed they became discouraged about noon and with much cawing flew away to the southeast. On several occasions the crows were followed in an attempt to ascertain where and how they spent their days. Care was taken to select days that seemed to be like the average, as it was thought stormy days might alter their regular routine somewhat. On such occasions they were not molested during their early morning feed, the idea being to let the day's events take a normal course. For a distance of five miles or more they remained pretty well together and flew rather rapidly. Those dropping out of the line of flight seemed to be the ones which were carrying pecans with them. Pecans have been found five miles from the grove, but the majority of those noted were at a distance of about three and a half miles.

After covering the first five miles the crows resumed cawing and circling, but to a lesser degree than when feeding at the grove. This seemed to be the signal, "as foragers" (to copy an army term), for the crows then scattered a great deal. Some retraced their flight, some went ahead, while others flew at right angles to the course of the flight. They would alight in trees to survey the territory and then descend into the fields. Here they were busy picking up food, but it was for the most part impossible to get close enough to determine its nature. Only occasionally could the writer slip up close enough to one or two crows, feeding among trees and shrubs, to observe them secure beetles from beneath fallen leaves. The major portion of the flock worked its way in a general southeasterly direction. By noon they would be some fifteen miles from the grove, or eighteen miles from the roost. At this point crows from a different locality, (perhaps a pecan grove some eight or ten miles farther on) were encountered, and the identity of the flock under observation could no longer be traced. Beginning the return trip to the grove, crows were observed along the way, in groups of two or three, feeding and flying about. By three o'clock the same afternoon at a point about twelve miles from the grove it was noted that the general direction of flight taken by the feeding crows had changed from the south east to the

northwest. The flights between stops to feed were becoming longer and less leisurely than they were in the morning. About four o'clock the first crows reached the pecan grove. Some of these were observed to secure two pecans, but the greater number of the flock secured only one before wending their way on upstream to their sleeping quarters.

The crows waste more nuts than they eat. If frightened they often drop them. Especially is this true when they are attempting to open the shell. A fence at the south edge of the grove afforded a good place for the crows to feed. They would alight on the posts, hold the pecans with their feet and peck at them until the shells split, or until they pecked a hole through them. When a hole was made they inserted the bill and beat the pecan against the post. The long, slender nuts seemed to afford better leverage and split more readily. Daily during the height of the pecan season a handful of nuts could be picked up at the base of each fence post. The predominance of the longer nuts at the posts seemed to indicate that the crows purposely selected this type. The crows seldom flew to the ground for the pecans they dropped while feeding on the posts, and never for those dropped in flight. Instead of so doing they circled the grove and secured another nut from the trees.

The fence posts were also used as look-out posts by the crows as they returned to feed in the late afternoon. They would alight on the posts and watch and listen for signs of disturbance. If nothing unusual was in sight they would fly to a tall tree at the edge of the grove for a second reconnaissance. If the advance guard thought the coast was clear and entered the wood, the main flock would follow with but little preliminary investigation.

One morning about four o'clock the writer secreted himself on the northeast edge of the grove to witness the morning invasion of crows. While it was still too dark to take aim with a gun the crows commenced to arrive. A flock of about a thousand alighted in a green wheat field, while a half dozen crows flew ahead and perched on the fence which runs along the north side of the grove at a distance of about 400 yards. During the arrival of the flock an occasional caw was heard, but while the crows on the posts were testing the advisability of entering the grove, all was quiet, save for a few low gurgling sounds made

by the crows in the field. When viewed at a distance the crows seemed to be feeding, but those nearby were apparently making false motions. Is it possible that they were trying to appear disinterested in the pecans? This observation was made after the crows had been shot at on several preceding mornings. Feigning a lack of interest would seem to indicate that the crow was pretty smart, but smart he is. When a crow will fly past its intended destination with no apparent interest, pass almost beyond sight, make a wide circle, and then fly with precision back to the object passed up a few minutes before, you will have to concede his cunning. By the time the flock had nearly reached the fence where the sentinels were stationed, the latter "declared" the territory safe for invasion, and with much cawing they entered the grove.

The following morning an attempt was made to hide at a place over which the bulk of the crows had passed the previous morning. The first crow to alight on a post made the discovery, gave a short, jerky, one might say angry caw, and flew back toward the flock. The flock as a whole took warning from this danger call and was on the wing before he reached them. They flew across the wheat field to some trees three-quarters of a mile distant. Curious to know their next move, the writer remained quiet awaiting their return. Half an hour later the crows entered the grove simultaneously from the east and west ends, the flock having divided since the first attempt. The writer remained hidden until the two parts of the flock united in the center of the grove. At this juncture he fired into the flock and it departed to the southeast.

At the beginning of the season it was not difficult to get within shooting range of the crows. Soon after they were shot at they would return, each time a little more cautiously. One day a crippled crow was tied to a bush with a five-foot string, to serve as a decoy. By hiding in a clump of walnut trees the writer was able to shoot a good many crows during the day. The crow was taken home over night, given food and water and used as a decoy the second day. After waiting an hour or so it became evident that the crows would not again come within shooting distance. They would circle high above the decoy or alight in trees at a safe distance. Lone crows flying high and much to one side would occasionally fly directly to the decoy. This to my mind pointed out two facts, first that the crow has

very keen vision, and second that these individual crows were not members of the main flock. The decoy was then moved to a new location. This time a second string was fastened around a wing and at intervals the string would be pulled with the result that the crow would give out a very distressed caw, caw. This call of a member in distress seemed too much for the crows to resist and several flew to the ground nearby. The new device, however, worked only two or three times. After that all the pitiful caws that could be obtained from the captive would not induce the crows to come within gun-shot. They did not leave the field but alighted on trees beyond the reach of lead.

There is every reason to believe that crows soon learn the range of a gun. The writer has repeatedly had crows encircle him just a little beyond the effective range of a shotgun. Then after being fired at a few times with a rifle widen the circle described accordingly.

Crows also exhibit a remarkable amount of cunning in their reaction to scarecrows. Almost any scarecrow will work for a time, some functioning much longer than others, but eventually even the most clever will fail to frighten them away. The writer was very proud of a "stuffed man" holding a wooden gun to his shoulder, but his pride fell at the end of a week when the crows began to alight upon it, and use it for a lookout. Scarecrows which moved, which had shiny surfaces, or which made a noise were most effective. A lid from a syrup pail was converted into a very successful frightening device. Parallel incisions were made in the tin and connected at one end, the resulting squares were pushed out so the wind would catch them and make the lid to revolve on the bolt used as a spindle or shaft. A large shaft hole caused the contrivance to squeak with each revolution. As the various devices became useless, they were moved to new locations, where they again became effective.

In order to save the pecan crop it is necessary to commence patrolling the grove about two weeks before the pecans are ready to harvest. Shooting at this time does not cause them to leave the grove, but only to move to another part of it. It takes about an hour of walking and shooting to get them to abandon the pecans. Later they will attempt to come back, and another shot or so is necessary. As the season advances they are more easily discouraged and a few shots early in the morning will drive them out for the day. In the evening when they return a few shots at

the first crows will cause the main flock to detour, or go higher, flying across the grove without attempting to pilfer the nuts. At the beginning of the season the crows pay very little attention to the report of a rifle, but as the season advances it becomes as effective as that of a shotgun. At this time a few shots fired early in the morning from the house at the edge of the grove will send the crows on their southeastward journey. During those seasons when the pecan crop is not sufficient to warrant the time and expense of fighting the crows, and they are accordingly unmolested, they soon learn to spend the entire day in the pecan grove. On such occasions the crows are in all their glory, and remind one of an old-fashioned, last-day-of-school basket dinner.

The pecan crop on the farm in question varies in annual worth from nothing to \$4,000, with the average well above \$1,000. When unmolested the crows soon destroy the entire crop. Even when the time and expense is taken to combat them, they eat a good many nuts. Formerly leisure time could be utilized during the winter in gathering stray pecans which could not be profitably picked up at harvest time. The value of this supplement to the regular harvest often amounted to more than a hundred dollars. At present the crows get this portion of the crop, for after the pecans are no longer available on the trees, they search on the ground among the leaves for them.

Counting the actual reduction of the crop and the time and ammunition necessary for fighting the crows it becomes evident that they present a serious economic problem in this locality. Further than this, the crow menace caused the abandonment of plans to introduce the much more valuable, cultivated, or paper-shelled pecan, because it was evident that these would be even more readily plundered by the crows. Chestnuts, almonds and other nuts are also destroyed by them.

As at first suggested, the fact that the crows have become more numerous in recent years as the pecan trees have become large enough to produce good crops makes it appear as though the pecans are the chief cause for the concentration of crows in this locality. In addition to the roost thus far alluded to, a second one has more recently been started only three miles from the original site. Since the first mentioned roost is yearly increasing in size, one may well conclude that the new location is being established to accommodate additional crow visitors, rather than the old being abandoned for a new one.



The old roost is in a mixed growth of trees including pecan, walnut, elm, cottonwood, oak, and perhaps others. It is situated near a stream at quite a distance from houses and roads. The new roost, across the state line in Sumner County, Kansas, is even more ideally located. It is along the banks of a river, and except for one house, far removed from habitations. Here to some extent the crows roost in the old and very large cottonwood trees, but to a greater extent in a locust grove. This grove, covering a plat of perhaps fifteen acres, is a veritable thicket. The trees were planted originally for the production of fence posts and were planted very close to prevent the formation of lateral branches. After the trees had been cut for posts, new growth sprouted out from the stumps. This growth is now about sixteen to twenty feet high and extremely dense. Here the roosting crows are absolutely immune from human interference.

According to Mr. E. R. Kalmbach, of the Biological Survey, roosts known to have been occupied during the winter of 1911-12 in Oklahoma, were located in Ottawa, Craig, Noble, and Payne counties. Bulletin No. 128 of the Oklahoma Agricultural Experiment Station, published in October, 1919, records crow roosts in Lincoln, Logan, Garvin, Grant, Kay, Oklahoma, and Garfield counties in addition to Payne county which was listed by Mr. Kalmbach. The crow roost noted for Grant county is situated near Honeyville and is a different one from that referred to in this paper as occurring in the northeastern corner of the county. Mr. Kalmbach records crow roosts in eleven counties in Kansas, but does not include Sumner County, where the above mentioned roost has been recently established in the locust grove.

In the Oklahoma bulletin it was estimated that the crow cost the state between \$1,200,000 and \$1,424,000 during the winter of 1918. This estimate was made largely on the basis of grain consumed or destroyed. No account was taken of the injury to the pecan crop, which, as has been pointed out above, may amount to as much as a thousand dollars per year in a single pecan grove. If the crows should turn their attention to the large paper-shelled pecans grown extensively in the south, the monetary loss would be enormous.

Friends of the crow have often maintained that any grain, other than waste, which the crows get is secured due to the farmer's carelessness. The writer, however, is not able to concur in this opinion. He distinctly recalls a forty-acre field of

milo-maize which was completely stripped by the crows during a time when the weather was too wet for harvesting or even pasturing the crop. He has also seen standing corn, as well as that in the shock, taken by the crows.

Another very important economic problem in connection with the abundance of crows is the effect upon other bird life of the community. Much has been written about this subject, and while it is not the purpose of this paper to discuss the question, attention is invited to the fact that in this locality the crow has certainly become numerous enough to modify the balance of nature. Not only do the crows get many eggs and young of our game and other birds but they consume a great deal of the food needed by these species. Mr. Joseph Kalbfus, secretary to the Pennsylvania Game Commission, has said that the destroyers of our game, song, and insectivorous birds include wild cats, house cats, foxes, weasels, skunks, mink, common rats, owls, crows, blue jays, and blackbirds. The investigations of the Game Commission indicate that the crow belongs at the head of this list. Evidently the crow presents a big problem in connection with the conservation of wild life. That the wild life of our country should be conserved, along with other natural resources, goes without saying. Mr. Hornaday has said, "If game birds and game quadrupeds had been properly conserved they would now be yielding ten million dollars worth of food annually." The food value of these animals is not the only consideration, for they are also of aesthetic, educational, and recreational value. It has been estimated that the residents of Kansas carry ten million dollars out of the state every year while on the mad scramble to find hunting, shooting, and other recreational sports. The State Fish and Game Department is doing all in its power to provide suitable recreational facilities within the confines of the state, and during the past year distributed 280,000 young fish, 5,714 bob-whites, 288 Chinese ring-necked pheasants and 206 imported Hungarian partridges. What effect will the presence of thousands upon thousands of crows have upon these birds? The writer fears for the quail, pheasants, and partridges when they have to compete with the horde of hardy, omnivorous, and predatory crows.