AN EXPERIMENT IN SONGBIRD MANAGEMENT

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A PROJECT for increasing the number of birds to control nut weevils in an orchard of blight-resistant chestnuts at the Bureau of Plant Industry Experiment Station near Glenn Dale, Maryland, was carried on cooperatively by that organization and the U. S. Biological Survey from 1926 to 1931. Entomological and management results have been reported in the papers listed in the terminal bibliography, and the more strictly ornithological findings are presented in this communication.

The area involved was about two and one-half acres the first two years and three and a half the last four. It was pretty fully occupied by the chestnut orchard and a rose garden, yet had ample openings. A bird bath, a martin house, and at the maximum 98 individual bird boxes including five sizes were installed. Response was good and, there being no hole-nesting species on the tract before, the threefold to fourfold increase in birds was clear gain. The bird population was multiplied but the nut weevils were not perceptibly reduced in numbers; their increase, however, may have been checked.

Ornithological gleanings are here summarized as 'Nest Analyses' and 'Nesting Results.'

NEST ANALYSES

On November 18, 1926, E. A. Preble helped me to collect twenty birds' nests from trees in the experimental chestnut orchard. Materials used in twelve of these (considered to be correctly identified) are reported on here. The insects and spiders using these nests as winter quarters were treated in papers by McAtee (1927b) and Malloch (1927b).

Building Materials

Tree Nests

Robin.—Three nests agreed in having weed stalks, dry grass, and mud in their foundations and fine dry grass for linings. One had a few twigs and another some leaves in their bases. In nest No. 1, a few grass seeds in the mud layer had sprouted, and in connection with an embedded garlic bulblet with its thread-like appendage, added fine green filaments to the lining. Nest No. 2 held a stratiomyid fly larva (*Odontomyia*) and three small bivalves (*Pisidium abditum*),

aquatic forms, undoubtedly gathered with the mud. Nest No. 3 also had a garlic bulblet as in No. 1.

Catbird.—Twelve nests were made of the following materials, the frequency of use of which is indicated by the numbers in parentheses. Foundation: coarse weed stalks (11), leaves (7), paper (7), coarse twigs (5), red-cedar bark (4), grass (3), chestnut bark (1), and lumps of dirt (1). Lining: in each case (12) made exclusively of rootlets.

Box Nests

On September 23, 1926, the contents of all bird boxes and on July 8 and August 16, 1927, of those not in actual use by birds, were removed to the laboratory for study. Materials used by the different birds (listed in the same order as in Table 1) are here noted.

Starling.—As a rule the Starling nests were of slight construction and with little differentiation between foundation and lining. In six nests analyzed, weed stalks (including *Solidago*) and grass (including *Andropogon*) were used in the foundations of six and five, respectively. Other objects were straws (up to 11 inches long), leaves, chestnut spikes, twigs, vines (up to 18 inches long), and a pod of wild bean (*Strophostyles*). The 'lining' included feathers in four nests, red-cedar bark in two, and leaves in two. Observations through five years showed that most Starling nests in actual use were adorned with one or more fresh leaves of yarrow (*Achillea millefolium*).

House Wren.—Thirty-three complete or partial nests were analyzed. Foundations included (in the number of nests indicated): twigs (33), feathers (16), chestnut spikes (13), wool (12), leaves (7), cord (6), and weed stalks (5). Materials used in fewer instances were: rootlets, red-cedar bark, cotton, grass, chestnut shell, paper, a large fragment of snail shell, exoskeletons of milleped and sowbug, and a spider cocoon. The twigs were characteristically coarse and included some up to eight inches in length and a few that were branched. Rose twigs with plentiful thorns were frequently employed, and in a few cases callow young were raised in such nests with little or no cushioning to protect them from the spines. The twig bases of nests were often from four to six inches deep. Flecks of wool and cotton were scattered through the twig bases to no conceivable purpose. The lining of the 33 nests included grass in 19 cases, hair, chiefly horsehair, in 16, feathers in 13, and rootlets in six. Other items were red-cedar bark, chestnut spikes, weed stalks, and grass. The material in one nest, loosened up in the process of analysis, filled a two-gallon bucket.

English Sparrow.—Five nests studied were bulky and composed chiefly of dried grass and feathers, the latter forming most of the

lining in each instance. Other substances used, chiefly in the base, included: red-cedar bark, weed stalks, and rootlets. The nests apparently are relined with feathers as excreta accumulate, and there may be several layers of such bedding.

Bluebird.—In eight nests grass predominated both in bases (7) and cups (5). Other foundation material included weed stalks (4), twigs (3), leaves (2), and feathers (1); and lining, feathers (2).

Purple Martin.—The martins scarcely can be said to make nests, bringing in to their houses a miscellaneous collection of litter and bric-a-brac. Plant fragments included straws (up to 16 inches long) and other grass stems (including *Andropogon*), weeds (representing the genera *Rumex, Silene, Fragaria, Oenothera, Solanum,* and *Plantago*), leaves, twigs (up to nine inches long and a quarter of an inch thick) including some of rose with thorns, fragments of the wall of cornstalk, a pod of partridge pea (*Chamaecrista*), and bulblets of garlic. Odds and ends were: bits of oystershell and porcelain, pebbles, lumps of clay, and plant labels (one of wood measuring 0.5 by 3.5 inches).

Crested Flycatcher.—This bird's housekeeping was about on a par with that of the martin. Materials rudely piled in a thin nest included: weed stalks, rootlets, a twig of sassafras with flowers and green berries, maple samara, onion skin, and snake slough. It is of interest to note that a piece of this last substance also was incorporated into the only Tufted Titmouse nest that was built in the boxes. (A summary of the use of snake-skins by birds may be found in Contrib. 11, Baylor University Museum, 12 pp., 1927, by John K. Strecker.)

Food Remains

Examination of nests, particularly those in bird boxes, is a profitable method of learning about the food of birds, that has as yet been very little exploited. The results here given probably are typical of what can be expected. Care is necessary, as contamination is probable in direct proportion to the age of the nest. Some intrusive material as that brought by mice is easily recognized, but that introduced by invading birds may be more difficult to eliminate. In cases of doubt, records have been rejected as has also all evidence from boxes known to have been used by more than one species of bird. For safety's sake all scavenger forms have been omitted, though possibly some of them were food items.

Grateful acknowledgment is made in connection with these records for identifications of: dragonflies (to C. H. Kennedy), beetles (L. L. Buchanan), and Diptera and Hymenoptera (J. R. Malloch).

Asterisks following names in the lists denote insects of enough economic importance to be referred to in the list of common names approved by the American Association of Economic Entomologists. Various species besides those so designated, however, are known to be destructive.

Tree Nests

Robin.—Plant remains: seeds of sassafras, poison ivy, and smooth sumac.

Animal remains: spotted cucumber beetle (*Diabrotica 12-punctata*), ground beetle (*Carabidae*), caterpillar, and spider.

Catbird.—Plant remains: seeds of mulberry, sassafras, and cultivated cherry.

Animal remains: dragonfly, cricket (*Orocharis saltator*), stink-bug (*Pentatomidae*), ground beetle, leaf-chafer (*Scarabaeidae*), locust leaf-miner (*Chalepus dorsalis*), weevils, caterpillars, ants, yellow jacket (*Vespula*), and bee (*Agapostemon*).

Box Nests

Starling.—Plant remains: seeds of mulberry, sassafras, rose, blackberry, cultivated cherry, and dogwood.

Animal remains: earthworm cocoon, centiped, millepeds, grasshoppers (including *Arphia xanthoptera* and *Melanoplus*), crickets (including *Gryllus* and *Nemobius*), stink-bugs (*Euschistus* sp., *E. tristigmus, Hymenarcys nervosa,* and *Peribalus limbolarius,* assasin-bug (*Sinea*), tiger beetle (*Cicindela*), ground beetles (including *Calosoma calidum, C. sayi, Poecilus* sp., *P. lucublandus, Percosia obesa, Galerita, Cymindis, Chlaenius* sp., *C. tomentosus, Cratacanthus dubius, Harpalus caliginosus, H. erythropus, H. pennsylvanicus, Triplectrus rusticus, Anisodactylus, Omophron*), fireflies (*Chauliognathus marginatus*), click-beetles (*Monocrepidius auritus, Hemicrepidius memnonius, Melanotus*), darkling beetle (*Opatrinus notus*), dung beetles (*Canthon laevis, Bolbocerosoma farctum, Geotrupes*), leaf-chafers (*Diplotaxis, Phyllophaga crenulata, P. fraterna, P. luctuosa, P. tristis, Anomala, Pachystethus lucicola, Dyscinetus trachypygus, Ligyrus gibbosus*, Euphoria herbacea*), leaf beetles (*Leptinotarsa 10-lineata*, Zygogramma suturalis, Disonycha triangularis, Chaetocnema, Chalepus dorsalis**), weevils (*Epicaerus imbricatus*, Brachyrhinus ovatus, Hypera punctata*, Hyperodes, Listronotus, Gymnetron tetrum, Chalcodermus collaris, Tyloderma foveolata, Sphenophorus inaequalis*), caterpillars and chrysalides (Lepidoptera), parasitic wasp (Ichneumoninae), paper wasp (*Polistes*), honeybee (*Apis mellifera*), ants (in-

cluding *Lasius*), spiders, and snails (including *Gastrodonta ligera* and *Planorbis*).

House Wren.—Animal remains: grasshoppers (including *Melanoplus*), crickets, stink-bugs (including *Euschistus* sp. and *E. tristigmus* var. *pyrrhocerus*), *Alydus eurinus,* ground beetles (including *Calathus* and *Harpalus*), leaf-chafers (including *Anomala undulata*), striped blister-beetle (*Epicauta vittata**), click beetles (including *Monocrepidius auritus*), caterpillars, moths, paper wasp (*Polistes*), ants (including *Camponotus* and Myrmicinae), and spiders.

English Sparrow.—Plant remains: corn, wheat, oats, and wild-grass seeds.

Animal remains: earthworm cocoon, grasshoppers (including a locustid), stink-bugs (Pentatomidae, including *Peribalus limbolarius, Euschistus* sp., *E. tristigmus, Hymenarcys nervosa, Acrosternum hilare,* and *Stiretrus anchorago*), *Orthaea basalis,* tree-hopper (*Thelia bimaculata*), leaf-hoppers (*Draeculacephala mollipes, Deltocephalus inimicus, Phlepsius irroratus*), tiger beetle (*Cicindela*), ground beetles (including *Cratacanthus dubius,* and *Triplectrus rusticus*), flower beetle (*Mordellistena*), click-beetles (including *Monocrepidius auritus, M. vespertinus,* and *Melanotus,* both adult and larva), ladybird beetles (*Hippodamia 13-punctata, H. parenthesis,* and *H. convergens*), *Isomira sericea,* dung-beetles (*Aphodius* sp., *A. distinctus, Psammobius*), leaf-chafers (*Phyllophaga* probably *gracilis, Macrodactylus subspinosus**, *Anomala undulata, Pachystethus* sp., *P. lucicola, Ligyrus gibbosus**, *Cotinis nitida**, *Euphoria* sp., *E. inda**), leaf beetles (*Chrysochus auratus, Chalepus dorsalis**), weevils (including *Phyxelis rigidus, Epicaerus imbricatus**, *Sitona hispidula**, *Hypera punctata**, *Phytonomus, Hyperodes, Balaninus algonquinus* and *B.* sp., *Lixus, Baris, Anacentrus* sp., *A. bracata, Tyloderma*), bill bugs (*Sphenophorus* sp. and *S. destructor*), flies (*Nephrotoma incurva, Chrysogaster, Syrphus americanus, Rivellia micans*), parasitic wasps (Ophioninae, including *Ophion*), ants (including *Lasius*), and spiders.

Bluebird.—Animal remains: grasshopper, cricket, ground beetle, dung-beetle (*Aphodius*), and spider.

Purple Martin.—Animal remains: dragonflies (including *Tetragoneuria canis* and *Pachydiplax longipennis*), earwig (*Labia minor*), grasshopper (*Melanoplus*), stink-bugs (including *Euschistus tristigmus* var. *pyrrhocerus, Hymenarcys nervosa, Trichopepla semivittata, Nezara hilaris,* and *Podisus*), other bugs (*Anasa armigera, Alydus pilosulus, Acanthocephala terminalis, Leptoglossus corculus, Cnemodus mavortius, Heraeus plebejus, Ligyrocoris, Nabis, Lygus pratensis**, and

Pelocoris femoratus), leaf-hoppers (*Aulacizes lateralis, Phlepsius*), spittle insect (*Clastoptera*), ground beetles (including *Poecilus chalcites, Curtonotus pennsylvanicus, Leiocnemis avida,* and *Amara*), water beetles (*Sphaeridium scarabaeoides, Helophorus*), click beetles (including *Limonius, Monocrepidius bellus, Pheletes nimbatus, Crigmus abruptus, Megapenthes limbalis,* and *Melanotus*), flat-headed wood-borer (*Buprestis rufipes*), sap beetles (*Pallodes pallidus, Glischrochilus sanguinolentus*), *Isomira sericea,* powder-post beetle (*Scobicia bidentata*), dung-beetles (*Onthophagus janus, Aphodius distinctus, A. fimetarius, Ataenius cognatus*), leaf-chafers (*Anomala undulata, Pachystethus oblivia, Euphoria herbacea, Cotinis nitida**), round-headed wood-borers (*Judolia cordifera, Stenostrophia nitens, Typocerus sinuatus, Calloides nobilis*), leaf-beetles (*Paria canella, Chalepus dorsalis**), weevils (*Sitona hispidula**, *Hypera punctata**, *Balaninus*), engraver beetle (*Ips grandicollis*), caddis-flies, two-winged flies (Chironomidae, *Michrochrysa, Tabanus,* Dolichopodidae, *Eristalis, Sphaerophoria, Phorocera,* and another tachinid), parasitic wasps (*Tiphia, Odynerus,* Psammocharidae, Sphecidae, Ophioninae, *Amblyteles,* Ichneumoninae, Braconidae), ants (*Formica, Camponotus herculeanus**, *Lasius niger**, *Myrmica rubra,* Ponerinae), bees (*Halictus, Agapostemon, Apis mellifera*), sawfly (*Urocerus albicornis*), and spiders (including Attidae).

Crested Flycatcher.—Plant remains: seeds of mulberry.

Animal remains: green stink-bug (*Acrosternum hilare*), dung beetle (*Bolbocerosoma farctum*), leaf-chafers (*Euphoria sepulchralis, E. herbacea, Pachystethus lucicola*), firefly (*Photinus*), butterfly, and spider.

NESTING RESULTS

Proportions of Complete and Incomplete Nests

Occupancy of the individual bird boxes, with special reference to the relative numbers of complete and partial nests 1926–31, is summarized in Table 1.

Wrens as a group are noted for building false nests and the House Wren upheld the reputation of the family in that respect by its conduct as observed in the Glenn Dale investigations. Not only were well-developed nest bases built that were never further used, but a few coarse twigs of the type so freely used by the wren were placed in almost every box. It is of interest that the English Sparrow built about 20 per cent of unnecessary nests and the Starling nearly 25 per cent, the latter bird thus keeping pace with the wren in this futility,

TABLE 1

Complete and Partial Nests

Species	*In 46 boxes*		*In 98 boxes*					*Percentage of partial nests*
	1926	1927	1928	1929	1930	1931	*Totals*	
Starling								
Complete nest	—	9	14	36	31	35	125	
Partial nest*	1	4	11	12	9	3	40	24.24
House Wren								
Complete nest	12	21	34	39	29	18	153	
Partial nest	9	9	9	8	10	7	52	25.36
English Sparrow								
Complete nest	—	6	7	5	8	16	42	
Partial nest	—	6	1	—	2	1	10	19.23
Bluebird								
Complete nest	4	5	6	7	4	5	31	
Partial nest	3	11	8	9	2	3	36	53.75
Crested Flycatcher	1	—	1	1	1	1	5	—
Flicker	—	1	1	—	—	—	2	—
Tufted Titmouse	—	—	—	1	—	—	1	—
Unknown bird	—	2	—	1	—	—	3	—
Total boxes with complete or partial nests of birds†	26	44	67	82	72	61	352	—

* Or roost.

† Including records of well-developed bases but not of a few twigs or a little debris.

but it was a surprise that the Bluebird should far exceed any of these common breeders with more than 50 per cent of false starts.

The 'unknown' bird nests entered in the table were probably those of native sparrows experimenting with bird-box occupation but not persistent enough to go through with the tests.

Size of Clutches and Length of Nesting Season

Although eggs were not counted in all instances, they were enumerated in a sufficient number of clutches, believed to be complete, to make a summary of the results of interest (see Table 2). The modal number of eggs in a clutch was five in the case of each species other than the House Wren and for it six. It seems probable that the nine recorded for the Starling were a composite clutch; moreover it came to a bad end.

Where re-nestings in the same box were involved, the number of eggs in the first clutch was usually, but not always, larger. Data as to

tandem clutches are presented in Table 3. A triple nesting by English Sparrows violated the rule by running four, five, five.

TABLE 2

Frequency of Clutch Sizes

Species	*Number of eggs*								*Total clutches*
	2	3	4	5	6	7	8	9	
Starling									
Number	6	10	27	42	15	—	—	1	101
Per cent	5.94	9.9	26.73	41.58	14.45			0.99	
House Wren									
Number	—	4	16	28	30	20	—	—	98
Per cent		4.08	16.32	28.57	30.61	20.41			
English Sparrow									
Number	5	3	9	10	2	—	—	—	29
Per cent	17.24	10.34	31.03	34.48	6.90				
Bluebird									
Number	2	5	6	7	—	—	—	—	20
Per cent	10.0	25.0	30.0	35.0					

TABLE 3

	Number of clutches	*First larger*	*First smaller*	*Average of first*	*Average of second*
Starling	15	10	1	5.13	4.00
House Wren	7	5	—	6.14	4.57
English Sparrow	5	2	1	4.6	4.00
Bluebird	2	2	—	4.5	3.00

Clutches of a few other species numbered: Flicker, seven, five; Crested Flycatcher, four, five, five; and Tufted Titmouse, three.

Dates for the earliest eggs and latest young in nests may be tabulated as follows:

	Earliest eggs	*Latest young*
Starling	April 23	July 8
House Wren	May 10	August 8
English Sparrow	May 2	July 24
Bluebird	April 30	July 7

For the three other species, corresponding data based on only a few records are: Flicker, July 8, July 21; Crested Flycatcher, June 9, July 7; and Tufted Titmouse, June 13, July 10.

The peak of the nesting season, that is, the visiting day upon which most houses contained eggs or young, was as follows: 1928, May 22; 1929, June 13; 1930, May 21; and 1931, June 3.

Serial Nestings

If incomplete nests were considered, the record of imposition of one on another of a different species would be prolix and confusing. To make the confusion worse, birds incorporated in their nests those of mice and the latter animals and bumblebees appropriated bird nests. Even building upon an occupied nest possibly containing eggs was not taboo, and in a few cases this activity went on to completion and eggs were buried by the intruding nest. Examples: wren on Bluebird nest with one egg; wren on Bluebird nest and two eggs; English Sparrow on wren nest containing one young wren—a brood of wrens had fledged so this youngster was probably dead before the sparrows began building.

Non-conflicting re-nestings producing 'broods' in single boxes during the same year are recorded in Table 4.

TABLE 4

Multiple Nestings in Single Boxes in the Same Year

	1926	1927	1928	1929	1930	1931
Two 'broods'						
Starling	—	2	—	8	5	8
House Wren	—	2	3	2	3	1
English Sparrow	—	1	—	1	1	4
Bluebird	1	—	1	1	—	1
Three 'broods'						
English Sparrow	—	—	—	—	—	1
Wren following Bluebird	—	1	2	1	—	—
Wren following sparrow	—	—	1	1	—	1
Wren, sparrow, wren	—	—	1	—	—	—
Bluebird following sparrow	—	1	—	—	—	—
Flicker following Starling	—	—	1	—	—	—

Apparently the Starlings did not grasp the idea firmly at first but later were strong for it. The instances of species following others in various orders are of interest. The 'Flicker following Starling' case shows that if there was any battle it was not lost by the Flicker. In fact, in the box involved in the 1928 record, Starlings had made a nest and laid four eggs which, lying unchanged from May 22 to June 9, were removed. Whether Flickers had anything to do with this failure to incubate is unknown, but on July 7 there were five young Flickers in the house, of which three were raised. In 1927, seven Flicker eggs were laid in a box from which a dead adult Starling had been removed. This bird had a hole in its head and a female Flicker

similarly wounded was found in 1928 in a box in which the base of a Starling nest was present both before and after the Flicker's demise but in which no eggs were laid.

One of the strongest complaints about the Starling is that charging excessive competition with native birds for nesting sites and victimization of the Flicker is especially deplored. So far as the evidence of conflict developed in this study is concerned, however, the Flicker seemed to come out slightly ahead.

Returning to the subject of re-nestings, the usual rule was for a house to be occupied by the same species year after year. There were some deviations and in the period 1928–31, out of 86 occupied boxes, 16 were used by two species and three by three. The birds in the last series were in each case, Wren, English Sparrow, and Bluebird.

Broods produced in bird houses annually and per acre, reckoning as a 'brood' anything from one egg to a nestful of fledglings, are recorded in the following Table (5).

TABLE 5

Year	*Total 'broods'*	*'Broods' per acre*
In 46 boxes (on 2.5 acres)		
1926	17	7.6
1927	39	15.6
In 98 boxes (on 3.5 acres)		
1928	64	18.3
1929	93	26.6
1930	69	19.7
1931	72	20.5

These figures do not include tree-nesting species nor do they indicate pairs per acre. Authentic figures in either of those respects probably could have been obtained only by intensive banding and trapping. The first year evidently was a get-acquainted period; the birds required time to learn about the boxes. Response measured by gross production of 'broods' increased for four years (1926–29) then dropped 30 per cent in 1930. No correlation seems probable except with the drought of that year. A weather-reporting station is on the ground where the work was done and the records as to temperature and precipitation for the months April to August, 1926–31, inclusive, have been carefully scanned. The only considerable departure from normal is in precipitation for 1930, a year which is on record as the driest in Maryland since 1870. The drought began in December 1929 and ended in February 1931; for the calendar year 1930, precipitation was 29.58 inches, which is 21.51 inches, or 58 per

cent, below normal. According to the local station, only 7.47 inches of rain fell in the months of April to August 1930, inclusive. Apparently this dry weather had an adverse effect upon collective bird propagation that wore off only slowly the next year, which was 2.25 inches deficient in precipitation.

Nesting Success

More definite figures as to the production of eggs and young by the four more common species of birds using the single-apartment houses are presented in Table 6.

TABLE 6

Species *Year*	*Total eggs in all boxes*	*Known nesting success*			*Probable total young produced in all boxes*
		Eggs laid	*Young fledged*	*Efficiency rate*	
Starling					
1928	50	50	36	72.0	36
1929	148	148	122	82.5	122
1930	128	128	115	89.7	115
1931	146	146	137	93.7	137
Totals	472	472	410	av. 84.5	410
House Wren					
1928	140	140	121	86.4	121
1929	193	182	152	83.5	161.1
1930	113	99	91	91.9	103.8
1931	71	48	35	72.9	51.7
Totals	517	469	399	av. 83.7	437.6
English Sparrow					
1928	23	23	17	73.9	17
1929	19	16	11	68.7	13
1930	16	16	12	75.0	12
1931	69	59	57	96.6	66.6
Totals	127	114	97	av. 78.5	108.6
Bluebird					
1928	21	21	17	80.9	17
1929	25	25	21	84.0	21
1930	13	13	13	100.0	13
1931	15	15	15	100.0	15
Totals	74	74	66	av. 91.2	66

Of interest in Table 6 is the showing of highest efficiency by a native bird,—the Bluebird. The numbers of eggs and young involved are perhaps not large enough to have as good statistical value as those for the Starling and the House Wren. They are comparable with those for the English Sparrow, however, and show that this supposedly dominant species is very poor in nesting efficiency in comparison to the Bluebird,—78.5: 91.2%. The average efficiency rates for the Starling and wren are for all practical purposes the same.

Similar records for three unusual breeders for the same period are given in Table 7. The efficiency rates in this case, while of interest, are not statistically significant.

TABLE 7

Species	*Broods*	*Eggs*	*Young*	*Efficiency*
Crested Flycatcher.....	3	14	8	57.1
Flicker.....	1	7	5	71.4
Tufted Titmouse.....	1	3	3	100.0

Nesting Losses

The birds discussed in this paper belong to the favored hole-nesting association which, on the average, suffers fewer nesting losses than other groups (upland ground-nesters, 43%; bush- and tree-nesters, 52%; and hole-nesters, 73%; see Kalmbach, E. R., Trans. Fourth No. Amer. Wildlife Conference, 1939, p. 601), yet from the human point of view the wastage in eggs and young seems unnecessarily high. In a study such as this carried on by periodic inspections (often at longer than desirable intervals), the causes of losses could hardly be determined.

In some instances eggs disappeared from a nest one at a time, in others they vanished as entire clutches. On the other hand, eggs remained in several nests over the winter,—a period of more than eight months. Usually there was no clue to the agent responsible for losses and except in a few cases the eggs were cleanly removed. Those found broken in the nests appeared to have been destroyed by family inefficiency rather than by interference by intruders. Squirrel gnawing was noted about the entrances of a few nest boxes but no other evidence was obtained of depredations by these animals. In a box occupied by wrens, a set of five eggs observed on July 7 remained without change until August 18. On that date, examination revealed parts of a snake slough in the house. Had a snake captured one or both of the parents? If so, why did it not eat the eggs? Snake sheddings are used by wrens as nest material so their presence

in this bird house may be explained in that way. The case was a mystery as were most of those involving losses of eggs or young.

In some instances one or more eggs disappeared but the remainder were hatched and the nestlings fledged. If the egg remover was animate, why did it not persist? Perhaps something ended its career. Possibly some bird neighbor had sufficient motive for a certain degree of trespass, then lost the urge. Who knows? Who can know?

Interference on our part changed the course of one nesting loss. On May 22, we found two Bluebird eggs on the ground below a box. We put them in the house, on May 30 found three eggs in it and on June 13, three young that were successfully fledged June 26.

Tables 8 and 9 show recorded losses of eggs and young. Roughly, they seem to keep pace with production, the high number in each series occurring in 1929 when reproductive effort was at its maximum for the period of the investigation.

At this point it may be enlightening to mention briefly the findings of this study as to the bird's-nest fly, *Protocalliphora*. Blood-sucking larvae of this genus may well have been responsible for the death of a good many of the nestlings found dead in the boxes, but that they are not fatal invariably or even in a high percentage of cases is shown by the abundance of puparia (their resting stage) in nests from which broods had fledged without loss. As an outstanding case, 340 specimens (in all stages) of the flies were sorted out of the contents of the martin house in 1927 when no dead young were found. This is

TABLE 8

ABANDONED EGGS*

[Number of nests involved and (in parentheses) total number of young]

Species	*Year*						*Totals*
	1926	1927	1928	1929	1930	1931	
Starling	No observations	—	—	6(7)	4(5)	—	10(12)
House Wren		1(2)	6(10)	6(13)	4(7)	1(2)	18(34)
English Sparrow		2(2)	1(1)	—	—	1(1)	4(4)
Bluebird		—	1(1)	3(4)	—	—	4(5)
Crested Flycatcher		—	—	1(1)	—	1(1)	2(2)
Flicker		—	—	—	—	—	—
Tufted Titmouse		—	—	—	—	—	—
Totals		3(4)	8(12)	16(25)	8(12)	3(4)	38(57)

* Including also infertile, addled, and broken eggs but not those which disappeared from the nests.

TABLE 9

Dead Young in Nest Boxes

[Number of nests involved and (in parentheses) total number of young]

Species	*Year*						*Totals*
	1926	1927	1928	1929	1930	1931	
Starling	—	3(3)	1(4)	8(13)	6(12)	3(7)	21(39)
House Wren	3(4)	1(1)	7(10)	3(8)	—	2(10)	16(33)
English Sparrow	—	1(1)	—	1(4)	2(2)	—	4(7)
Bluebird	—	—	1(1)	—	1(2)	—	2(3)
Crested Flycatcher	1(3)	—	—	—	—	—	1(3)
Flicker	—	—	1(2)	—	—	—	1(2)
Tufted Titmouse	—	—	—	—	—	—	—
Totals	4(7)	5(5)	10(17)	12(25)	9(16)	5(17)	45(87)

an average infestation of nearly 90 of the bloodsuckers to a brood of nestlings, yet all of the latter survived. Ornithologists doubtless will be pleased to learn that the *Protocalliphora* themselves suffer severely from the attacks of parasites and predators, 50–65 per cent mortality being disclosed in this study.

It was difficult to resist the conclusion that desertion was the cause of some of the losses of nestlings, as, for example, those of two broods of three each of Starlings on June 26, 1931. Starlings were at that time near the end of their nesting season and the pull of the flock may have overpowered the urge to care for their young. The fledging of part of the brood may have provided the stimulus to depart; in one case a single nestling and in the other, two, may have taken to wing before their nest mates.

It may well be remarked, however, that in the District of Columbia region the cycle of Starling activities appears very confused. Pairs frequent their nesting sites and males sing there, if not continuously, at least at intervals, throughout the year. Again, flocking in some degree is a practically perennial phenomenon, remnants of the bands that spend the winter nights in the city persisting past the time when settled pairs are nesting and almost up to the time when new flocks of young birds are formed.

Hence if occasional Starling parents desert a belated brood, the action may be attributable to confusion in instinctive drives. To paraphrase an entomological couplet, the Starling, if it could, might well say:

My urges strong, now here, now there,
Oppress my bosom with despair.

History of the Purple Martin Colony

Most of the discussion and tabulation has ignored the martin colony not because it lacked interest but because its comparatively elevated abode could not be inspected like the readily accessible houses of individual bird families. The martins as always were a musical, active, and colorful component of the bird population, and we were fortunate in getting a colony the first year and in retaining it through the investigation. Like most of the other birds, the martins had their best year in 1929. Intrusion into their quarters (with no interference from us) tended to increase though it never became serious. Occupancy of the martin house and known losses of martins are shown in the following tabulation.

Year	*Pairs* of Martins*	*Losses*	*Intrusion by other species (pairs)*
1926	3	4 young	—
1927	4	2 eggs	English Sparrow, 1
1928	7	—	English Sparrow, 1
1929	9	—	English Sparrow, 2
1930	7	—	English Sparrow, 1
1931	7	—	English Sparrow, 2; Starling, 1; Bluebird, 1 (in support).

* The house had 16 apartments.

Summary

A bird-attraction project carried on for six years in Prince Georges County, Maryland, had for its primary objective increasing bird enemies of chestnut weevils. A threefold to fourfold increase in the bird population was easily attained but the nut weevils were not perceptibly reduced in numbers; their increase, however, may have been checked. Entomological and management results have been published in eight papers that are cited. This communication is devoted to the more strictly ornithological findings, including analyses of nest-building materials and of food remains found in the nests; and tabulations of the proportions of complete and incomplete nests, size of clutches and length of laying seasons, serial nestings in single boxes, nesting success, and nesting losses. The history of a Purple Martin colony also is briefly sketched.

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