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The aims of the Ontario Bird Banding Association are the study of birds with emphasis on banding and other marking techniques, the promotion of ornithological investigations, the publication of scientific and educational papers pertaining to ornithology, and cooperation with organizations with similar objectives. Particular emphasis is placed on studies within the Province of Ontario. Focal points for field activities are the Long Point and Point Pelee Bird Observatories.

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THE AMERICAN GOLDFINCH; THE WELL-KNOWN ENIGMA

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INTRODUCTION

The American goldfinch (Spinus tristis), is undoubtedly one of the most common summer birds in eastern North America. Since the male of the species is colourful and the birds comparatively tame, the goldfinch is conspicuous and easily observable. As a result the goldfinch is a well studied species (Walkinshaw, 1938, 1939; Stokes, 1950; Nickell, 1951; Berger, 1968; Holcomb, 1969). However, most studies have been restricted to the breeding season and there is little available information on other aspects of the biology of the goldfinch.

In 1967 a study of the American goldfinch was started by the author at the University of Guelph. The prime aim of the study was to examine the gonadal cycle in relation to the environmental factors which might affect its timing. The scope of the study was soon expanded when it was discovered that many questions remained unanswered concerning even basic aspects of the biology of the goldfinch.

The aim of this paper is to show with reference to the goldfinch project, how ornithological problems emerge as data accumulate, and to show how the amateur and professional ornithologist can combine their efforts to attack common problems.

METHODS AND MATERIALS

Frequently the biologist assumes that his study will be enhanced if it is carried out on some impressive area distant from his home and if it is financed substantially by a granting agency. This is an unfortunate attitude since there are many basic biological problems to be solved, literally in one's own "back-yard" with a minimum of expensive equipment. At Guelph, the goldfinch study is carried out on the University campus within walking distance of my office. The study area comprises 170 acres (68 hectares) of uncultivated land, bordered by maple (*Acer* spp.)-elm (*Ulmus* spp.) woodlot, containing thickets of elderberry (*Sambucus canadensis*), willow (*Salix* spp.). red-osier dogwood (*Cornus stolonifera*) and cedar (*Thuja occidentalis*). The basic equipment is provided by 10 x 50 binoculars, mist-nets of various dimensions, Potter traps, and a cassette tape-recorder.

THE BREEDING SEASON

Apart from the basic information concerning nest-sites, clutch-sizes, incubation and fledgling periods, little worthwhile information can be collected unless a population of individually-marked birds is studied. To date only Stokes (1950) has attempted to study a colour-marked population of goldfinches. Thus at Guelph emphasis has been placed on the colour-banding of the breeding population. At present, 59 male and 68 female goldfinches have been colour-banded, so that in 1970 most of our breeding birds were individually recognizable. In addition, nestling goldfinches have been banded wherever nests have been found. A total of 528 goldfinches have been banded during the three years of the study.

The colour-banding programme is already producing worthwhile results. At present we have detailed breeding histories of two females over a

two-year period, and of one female over a three-year period. These histories show that the adult birds are apparently attached to a breeding area, since none of the nests of the female birds in question were separated by more than 300 m. With colour-banding we have also been able to verify that the goldfinch will produce a double brood in one season, provided that her first nest is successful. In the three cases where double broods have been raised, the second nest was started by the female before the young in her first nest had fledged. This meant that the male had to look after the first brood on his own. In two cases the female deserted her old mate for a new one, but in the third instance, the female remained true to her mate.

Another area of interest during the breeding season, is the effect of nest-parasitism by the brown-headed cowbird (Molothrus ater) Berger (1968) and Holcomb (1969) showed that the incidence of cowbird parasitism on the goldfinch is low. However, at Guelph cowbirds parasitised 7 of 97 (7.2%) of nests held under close observation, which is a higher incidence of parasitism than reported elsewhere. Of the seven cowbird eggs laid only one hatched and the nestling died within 48 hours. Of great interest was the apparent fledging of a cowbird fostered by goldfinches on 3 August, 1970. The nest, containing three goldfinches and one cowbird was not on the study area, but because of the thriving cowbird within the nest, it was checked daily. Although fledging was not actually observed, the nest was empty on the 13th day after hatching, which was quite normal; alarmed adult goldfinches were observed in the vicinity of the nest, and there were no obvious signs that the nest contents had been preyed upon. Certainly, the cowbird nestling survived for a longer period of time in the nest than any on record, and if it did fledge successfully, it is the first known record of this occurrence from a goldfinch nest.

Finally, the role of territory as it affects the goldfinch has not been adequately resolved, as shown by the controversy which exists in the literature (Walkinshaw, 1938; Nice, 1939; Drum, 1939; Stokes, 1950; Nickell, 1951). Observations made during this study suggest that the importance of territory may vary with the age of the individual, and with the stage of the next "cycle". For example, the reaction of male goldfinches to a dummy bird placed close to the nest is very variable. Likewise the spiralling song-flight (Stokes, 1950) may end abruptly without antagonism when two or more birds are involved, or it may result in a violent head-head flight, the participants fluttering to the ground as they engage each other. Clearly, more observations on individually-marked birds are required.

MOULT

Moult, the periodic shedding and renewal of feathers (Thomson, 1964), is another aspect of the biology of species which is closely synchronised with breeding. Generally it has been accepted that breeding and moult are exclusive processes in temperate region passerine species. However, recent work (Middleton, 1970) has shown that this is less common than previously suggested.

The American goldfinch is an unusual carduline finch (Thomson, 1964) since it has two moults during the year. It is commonly believed that the nuptial plumage is acquired by a complete post-nuptial moult in September (Tyler, 1968). Although the moult of this species has not yet been studied in detail, observations from captured birds show that new feathers (pin stage) are routinely found in the body tracts of adult birds in every month of the year with the exception of late July and early August. Thus it appears that body moult in adult goldfinches is a prolonged and gradual process. A similar situation apparently exists for the immature birds. For the latter,

observations show that new feathers are consistently found throughout the autumn and early winter, by which time the birds have already started to assume their adult breeding plumage. Thus the first adult plumage is apparently attained by a prolonged and gradual moult. Moult in this species may therefore be more protracted than previously anticipated. On the other hand, it is possible that the new feathers developing during the winter months are necessary for increased insulation. These suggestions are tentative, however, and much more information is required before definitive answers can be given.

SEASONAL MOVEMENT

According to the literature the American goldfinch has a distinct summer and winter range (Godfrey, 1966; Robbins, et al. 1966; Tyler, 1968). Observations made at different localities, e.g. Long Point, Ontario, show that distinct seasonal movements of goldfinches occur in both spring and autumn (Page, pers. comm.). Thus there is evidence that seasonal shifts do occur over the continental range of the goldfinch. However, the significance of these movements when related to the local conditions are not clear.

At Guelph goldfinches are known to be resident throughout the year. It is not known, however, whether the birds that overwinter are the same as those which breed at Guelph during the summer, since my banding has been restricted to the summer, and I have no recoveries outside the breeding season. Luckily, winter banding has been done by Mr. C. H. Richards, of Toronto, who has kindly permitted me to use his results. However, these do little to clarify the picture. To date he has recaptured 13 birds at his banding station, one year after banding; four birds two years after initial capture; and two birds three years after initial capture. From this limited information it appears that the winter birds return to their

winter localities. Where these birds have been in the interim is not known. The situation is further obscured when Mr. Richards' long distance recoveries are examined. One female bird (22-49564) banded at Toronto on 18 July, 1957, was killed by a car in Haliburton, Ontario (105 miles N.E.) on 7 August, 1960; and a male (29-69140) banded at Toronto on 15 April, 1963, was killed by a car near Kewadin, Michigan (250 miles w.) on 20 July, 1968. Thus two birds at least, moved a considerable distance from the banding site, but in opposite directions. Berger (1968) reported only four recoveries from 1,148 banded birds, and these recoveries were made within three miles of the banding site.

To supplement our banding data we have requested the recovery information on goldfinches from the Canadian Wildlife Service. These data should help to clarify the situation with regard to seasonal movement, but I suspect that much further banding of goldfinches will be necessary before a definitive answer can be given.

CONCLUSIONS

This paper has looked briefly at three basic aspects of the biology of the American goldfinch, and problem areas have been highlighted. At this stage of the Guelph study, the prime aim is to increase the number of banded and individually-marked goldfinches. Here is an area where the amateur ornithologist who enjoys banding can be of great assistance to the professional. At the present time it is becoming increasingly difficult for the amateur to obtain a banding licence. This problem can be circumvented if the amateur is to align himself with the professional ornithologist working on a project of ornithological merit, or with a group of dedicated amateurs who have developed their own worthwhile project. By so doing the amateur could fulfil his desire to band birds, but would also receive the satisfaction of

knowing that his efforts were of genuine value, and of seeing his work fit into place.

Although the main function of bird-banding is to release marked birds into the population, there is much more information which can be collected at the time of banding. As stated previously, the American goldfinch is an interesting species because of its two annual moults. Moult is accompanied by changes in metabolism of the organism. It has been widely accepted for passerine birds, that the energy demands of breeding and moult are so high that the two processes must be mutually exclusive. Recently, King and Farner (1961) have shown that the energy demands accompanying moult are not as great as had been previously anticipated. In addition there is evidence to show an overlap between breeding and moult in temperate region passerines (Middleton, 1970). However, more data on other species are required.

Again we have an area where the amateur can play a vital role. Once a bird is in the hand it can be quickly checked for moult. The data can be easily tabulated using the numerical system established by Ashmole (1962) and modified by Newton (1966) and Middleton (1970). If banders could be encouraged to check for moult in the species chosen for study, a mass of potentially valuable information could be quickly assembled. These data could in turn help solve some of the problems still surrounding our understanding of moult. In addition, the careful examination of plumage could lead to the discovery of valuable clues for sexing, and estimating the age of the captured birds.

Although there is much available information on the breeding biology of the goldfinch (Stokes, 1950; Nickell, 1951; Berger, 1968; Holcomb, 1969), the information has been collected from populations at approximately the same latitude in

eastern North America. The goldfinch is known to breed well north and south of the areas used in the studies cited above. In view of Lack's (1947) theory that clutch size increases with latitude, it would be of interest to receive information on the basic aspects of breeding biology of the goldfinch from northern and southern localities. Obviously an observer cannot work in more than one locality at any one time, and thus the cooperation of interested individuals in different areas of a species range, could prove to be invaluable.

Finally, the problem of cowbird parasitism as it relates to the goldfinch has been mentioned. The breeding seasons of the two species barely overlap. Thus parasitism of goldfinch nests will only occur early in its breeding season. As reported, the cowbird has very little success in producing fledglings from goldfinch nests. We do not know whether this low success is the result of low fertility, or of an inadequate diet for the developing cowbird. There are other species which are characteristically late nesters, e.g. cedar waxwing (Bombycilla cedrorum) and least flycatcher (Empidonax minimus). What is the situation concerning nest parasitism in these and other species? More information on this aspect of ornithology is needed. Once again an area exists where the cooperation between the interested amateur and the professional could provide useful data.

In this paper I have discussed some of the problems which pertain to my study on the American goldfinch at Guelph. In addition I have attempted to show areas in which the assistance of amateur ornithologists could greatly assist me. This has not been done with a selfish motive; the example has been used because I am most familiar with this study. I am sure there are other professional ornithologists in other parts of the country who have similar problems to mine. I have little doubt that they would also welcome the type of

approach which I have suggested. I hope that this suggestion will bear fruit so that the gulf which all too often exists between the amateur ornithologist and the professional may be bridged.

Acknowledgement

I owe a debt of gratitude to Mr. C. H. Richards for his enthusiastic interest in my project, and for his kindness in making his data available to me.

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THE EASTERN BLUEBIRD IN THE OSHAWA-SCUGOG AREA

Dennis Barry

Group 15, Box 17, RR#3
Bowmanville, Ontario

Photographs by:

James M. Richards

During the early years of this century the eastern bluebird, Sialia sialis, was still present in Southern Ontario in fairly large numbers. Charles W. Nash (1913:76) speaks of seeing "many thousands" passing over Toronto "from west to east" during March. Mrs. Hilda McKay, in a letter to the author, mentions a sighting of "hundreds of bluebirds" in High Park, Toronto, on an autumn afternoon in 1911.

According to local observers, the eastern bluebird population in the Oshawa-Scugog area of Southern Ontario has been declining since the 1920's. By 1967, when the current nesting-box scheme was undertaken, the breeding population had dwindled to a few scattered pairs inhabiting the oak-ridges moraine between Lakes Ontario and Scugog.

The project was initiated by Mr. James M. Richards during the autumn of 1966, and during the winter of 1966-67 ninety-six nest boxes were constructed. These were erected during early March of 1967. In 1968 and again in 1969, the number of boxes was increased and the territory expanded.

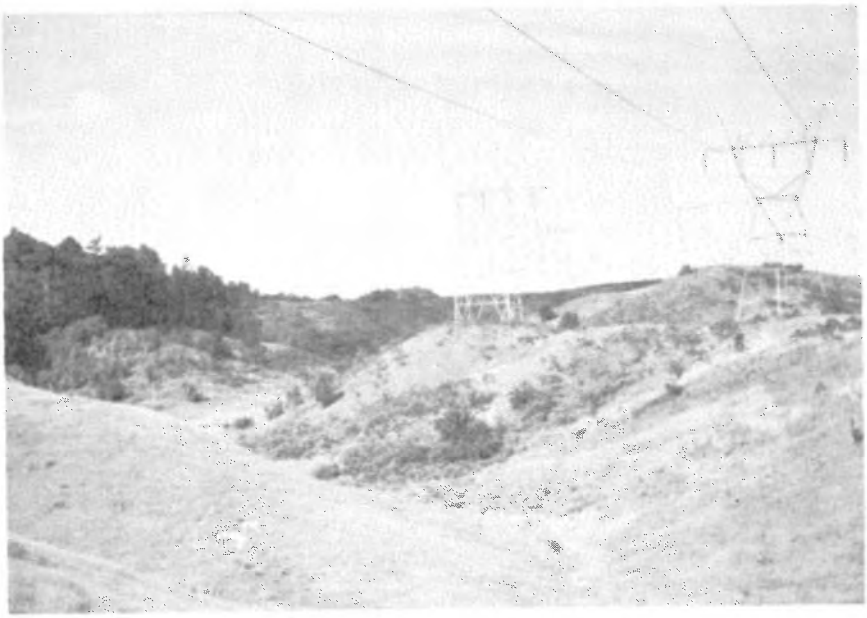


Fig. I. Typical Bluebird habitat, Darlington Township, Durham County, Ontario.

The scheme is centred in Durham and Ontario counties, in the northern third of Darlington and East Whitby Townships with some overlap into adjacent sections of the four adjoining townships. Agriculture in the region is not as intensive as in the southern portions of these townships, much of the land being devoted to pasture. In some parts where the soil is sandy, the growing of Scots pines, Pinus sylvestris,for Christmas trees has replaced subsistence farming.

Nest boxes are placed on fence posts in open, short-grass pasture, or along the railway right-of-way which bisects the area. Since eastern bluebirds are primarily ground feeders, a heavy growth of grass such as is found in hay fields is detrimental. During spells of cold wet weather, nestlings in boxes in such sites are the first to succumb to

Figs. II and III. Male (left) and female Bluebirds at a natural nest site.

starvation. Placement within one hundred yards of woods, especially plantations of evergreems, encourages predation, and competition from certain mammal and bird species. Bluebirds will use boxes as close together as one hundred feet, if competition for nest sites is keen. More often, however, one aggressive male will defend two boxes, and he and his mate will raise a first brood in one box and a second in the other.

Boxes are constructed of waterproof plywood with 5/8" being used for the bottom, back and front and 3/8" for the sides and roof. Two nails at the top hinge the front which is secured in place by two removable nails at the bottom. This allows the

Fig. IV. Typical clutch of six blue eggs in a nest lined with pine-needles.

front to swing out for easy access for checking and cleaning. A deep box is preferable to reduce destruction from predators which can easily reach into an unprotected shallow box. The bottom of the 1½" diameter entrance hole is placed 8½" from the floor of the box in the 12" front.

Destruction and loss of nest boxes is due primarily to human vandalism. Those boxes placed along the railway tracks seem particularly susceptible to destruction or damage by thoughtless "hunters". A few boxes have been stolen and an equal number simply torn or smashed apart. Groundhogs, Marmota monax, seem to have a liking for some ingredient in either the paint or the plywood glue, and a number of boxes have been completely eaten by these animals. Red squirrels, Tamiasciurus hudsonicus, and less frequently, flying squirrels, Glaucomys volans,enlarge the entrance and damage the interior by chewing.

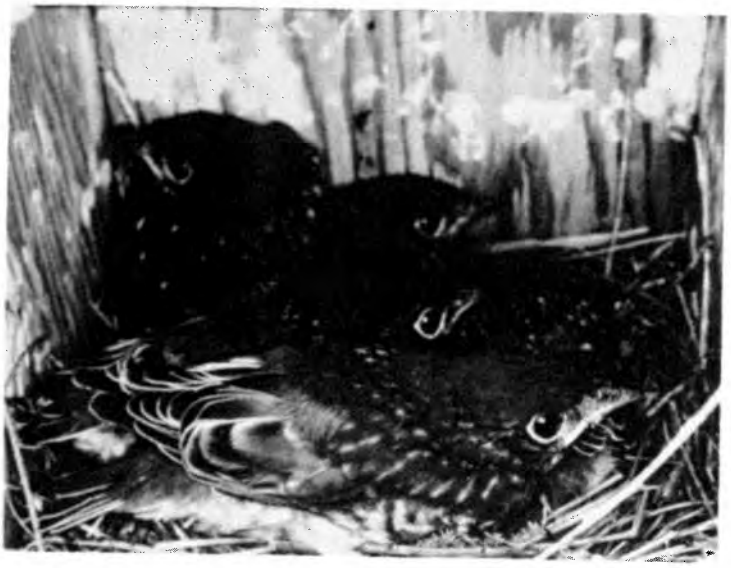


Fig. V. Nearly-fledged brood of Bluebirds.

During the first three years of operation no attempts were made to protect the nest boxes from predators other than to select the least susceptible nest sites available. Increased losses from predators during the three-year period indicate that some manner of protecting the box will have to be employed, or the boxes will become a hazard rather than a benefit to bluebirds. During 1970 some boxes were placed on steel towers along hydro-electric power lines. No destruction due to predators occurred in these boxes compared with nearly fifty per cent losses in the unprotected boxes.

Two types of predation occur, one in which the predator enters the box and destroys its contents. and a second in which the predator reaches in and destroys or disrupts the contents, often killing the incubating or brooding female. Squirrels, mainly red squirrels, are responsible for the first type. Far more common is destruction by larger predators which reach into the boxes. Several

species contribute to this, but increasing evidence points to cats as the main culprits. Definite proof in several cases was provided by paw prints on the front of the box, and hair about the entrance hole. Almost every box affected in this way has claw marks near ground level on the supporting post characteristic of a cat "sharpening" its claws in preparation for climbing. Racoons, Procyon lotor, may be a problem but no evidence definitely incriminating them has been found. In one instance a crow, Corvus brachyrhynchos, was seen reaching into a shallow nest box apparently in an attempt to remove the small nestlings which were inside.

Some species which compete with bluebirds for possession of nest boxes also destroy bluebird eggs or young. Squirrels, and occasionally deer mice, Peromyscus maniculatus, destroy clutches of eggs in the course of preparing the box for their own use. House wrens, Troglodytes aedon, will puncture. remove, or cover clutches of eggs, but I have never known them to interfere with nestlings. In two instances a male house sparrow, Passer domesticus. was found at a box containing large nestling bluebirds. In one case all five young were dead, while in the second box three of the five young had died. In both cases the bodies of the nestlings, particularly about the head and back, were covered with bruises indicating internal bleeding. The two live young were also bruised, but less severely. I have seen no other dead or live nestlings bruised in this manner, and I feel quite certain that the male house sparrow was responsible. Tree swallows, Iridoprocne bicolor, use the nest boxes but only if they are not occupied at the time by bluebirds.

The only parasite which has any obvious marked effect on the nestlings is a fly, Apaulina sialia. The bloodsucking larvae of this insect attach themselves to the legs or wings of the nestlings. If present in large enough numbers, especially on a small brood, and when combined with other factors

Number of clutches with 0,1,2,3,4,5,6 or an unknown number (?) of eggs laid, young hatched, and young fledged.

	Number	1967	1968	1969
Eggs laid	0	0	3	6
	1	0	1	0
	2	0	3	0
	3	1	7	7
	4	5	24	33
	5	13	24	55
	6	1	1	8
	?	4	43	24
Young hatched	0	3	22	24
	1	0	1	2
	2	0	2	4
	3	3	14	11
	4	7	28	23
	5	7	16	43
	6	0	1	6
	?	4	22	20
Young fledged	0	3	31	38
	1	0	1	3
	2	0	4	8
	3	4	12	16
	4	5	23	25
	5	6	11	25
	6	0	1	4
	?	6	23	14

Table I

Egg Colour of Bluebirds

	1967	1968	1969
Total no. of broods where egg colour known	31	68	86
No. of clutches with blue eggs	30	65	78
% of clutches with blue eggs	96.8	95.6	91.0
No. of clutches with near-white eggs	0	0	2
% of clutches with near-white eggs	0.0	0.0	2.3
No. of clutches with white eggs	1	3	6
% of clutches with white eggs	3.2	4.4	6.7

Table II

such as cold, wet weather, they serve to weaken the nestlings enough to contribute to the death of some or all of them. As many as fifty of the brown cylindrical pupal cases of this parasite may be found at the base of a nest after a brood has fledged. Few broods are completely free from infestation.

Only one egg of brown-headed cowbird, Molothrus ater, has ever been found in our nest boxes During 1969 an egg with a partially developed viable embryo was found in a nest box with five young bluebirds which were almost ready to fledge It apparently must have been laid after the nestlings had hatched, and developed because of their body heat.

Nesting Success of Bluebirds

	1967	1968	1969
Available nest boxes	90	240	330
Total no. of broods	24	106	133
No. of broods per available nest box	0.27	0.44	0.40
Total no. of eggs laid	113	426	587
Average no. of eggs laid per brood	4.70	3.71	4.41
% of eggs hatched	71.0	77.2	82.0
Average no. of eggs hatched per brood	3.34	3.10	3.62
Total no. of young fledged	79	285	370
% of young fledged	99.0	86.8	77.1
Average no. of birds fledged per brood	3.29	2.69	2.78
% of eggs fledged	70.0	66.9	63.2

Table III

In this area the bluebirds arrive on their nesting territories in late March and early April. Nests of grasses and/or pine needles, Pinus strobus, and infrequently Pinus sylvestris, are under construction by mid-April in most years. From three to six eggs are laid (see Table I for details) and incubation does not begin until a full clutch has been reached. Both nest building and incubation seem to be carried out exclusively by the female. An unmated male will place a few pieces of grass in a nest box when he claims it, and then sing until a female is attracted. On two occasions I have found a male bluebird in a nest box containing eggs, but in neither case was he incubating the eggs when

Suspected Causes of Nesting Failure

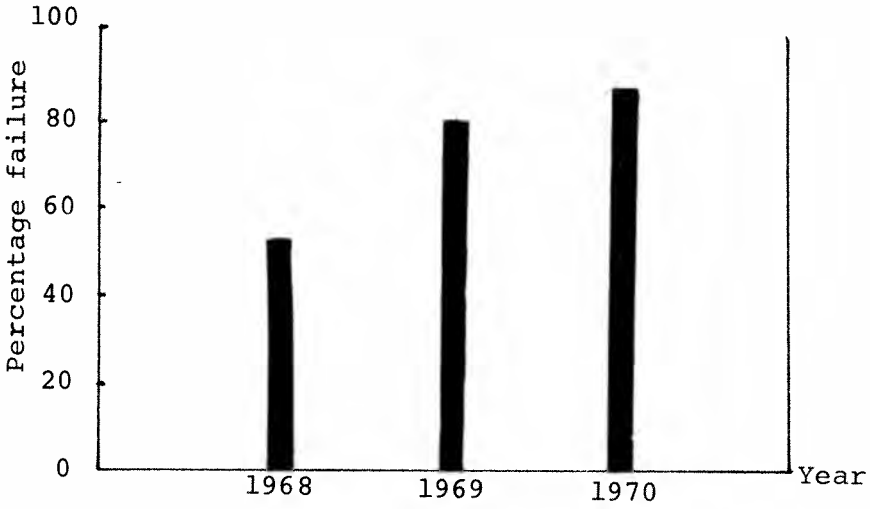
	1967	1968	1969
Cold weather	3	5	0
Predation: number	0	18	25
% of total	0	53	81
Human vandalism	0	1	2
Lid of nest box off	0	2	1
Eggs infertile	1	0	0
Competitors	0	5	1
Unknown	1	3	7
Totals	5	34	36

Table IV

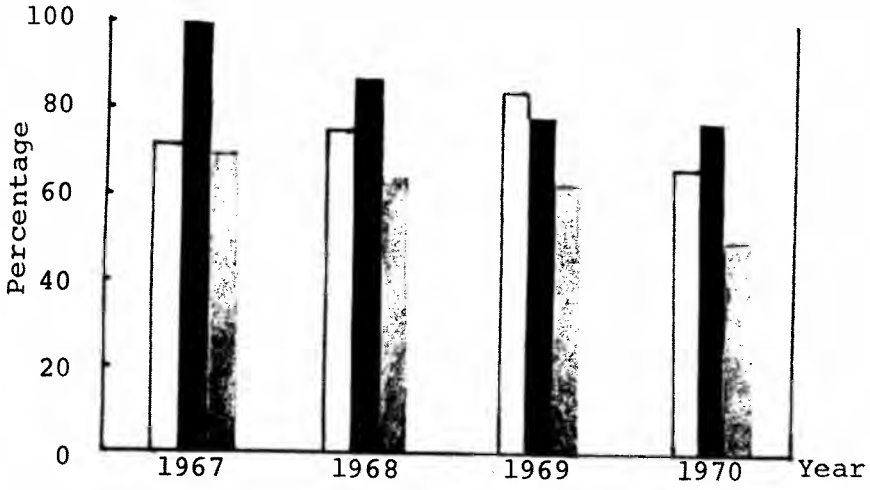
the box was opened.

Eggs are normally blue in colour, somewhat paler than robin's egg blue, but clutches of white or near-white eggs occur regularly (see Table II). Since incubation begins only after the last egg is laid, the young usually all emerge within a twenty-four hour time period. Both adults help to feed the young. Caterpillars, grasshoppers and small moths make up the bulk of their diet. When the young leave the nest they are able to fly quite well. For the first few days the fledglings are cared for by both parents. The male then begins to devote part of his time to defending the nest site to be used for raising a second brood, whether it be the one used for the first brood, or a different one. Within two weeks the young are

Graph I: Comparison of total nesting failures attributable to predation during 1968-1970.



Graph II: Comparison of percentages of eggs hatched (white), young fledged (black), and eggs fledged (the product of the first two percentages divided by 100) (grey), 1967-1970.



left in the care of the male while the female begins construction of a nest for the second brood. The number of eggs laid in this nest is, on the average, less than the number laid in the first clutch, but clutches of six eggs do occur. During 1970 at least one female raised six young in a first brood and laid a second clutch of six eggs in the same nest box (see Table III for details of numbers of eggs laid, young hatched and young fledged). Two broods is usually the maximum number raised by one female during a single season. However, during 1969 two broods were fledged from one nest box and a third clutch of eggs laid, but it is not known if one female was responsible for all three nestings. The first of these three nestings was the earliest of all 1969 nestings, being started about April 15.

Table III also shows the details of the number of boxes available and the nesting success each year. A late cold spell during May of 1967 and again in 1968 caused the destruction of a number of clutches of eggs. Since the female does not incubate partial clutches, the unprotected eggs often freeze and crack during severe cold spells. No losses due to this cause occurred during 1969 or 1970. The high fledging success rate for those eggs which did hatch during 1967 indicates a very low level of predation. As individual predators began to recognize the nest boxes as potential food sources, the losses due to this cause increased, (Graph I) while the nesting success decreased (Graph II). Data from the first brood nestings in 1970 is included in these graphs to show the continuation of this trend. The key factor, fledging success, shows a more or less constant decline. For other causes of nesting failure see Table IV.

SUMMARY AND CONCLUSIONS

From the data gathered in this project and from similar experiences in two other projects,

there are a number of conclusions to be drawn which might be of interest to others involved in bluebird nesting box projects in Southern Ontario:

(1) It appears that a high proportion of broods are fledged successfully during the first year of operation of such a project, but predation increases rapidly during subsequent years and nesting success decreases accordingly. Expansion of the project during the second and third years of operation tends to make this fact less obvious. since many new boxes in new locations havenot yet been discovered by predators.

(2) Deep nest boxes are preferable to shallow ones because they tend to reduce predation, but they are only effective against the "reaching" type of predator and their benefit is nullified when the nesting bird builds a deep nest bringing the top of the nest close to the level of the entrance.

(3) Since building a nest box which is completely predator-proof seems an impossibility, the boxes in any successful nesting box project will have to be made inaccessible to predators by the use of some type of metal protector or support.

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