The Role of Nestboxes in Bird Research and Management[1]

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Abstract.-- Modern management of cavity-nesting birds has evolved from over 240 years of nestbox use by humans. Species have been maintained using nestboxes for economic, aesthetic, scientific, and conservation purposes. Implications of nestbox studies for management, including several risks of using nestbox derived data, are discussed.

INTRODUCTION

Progress in the scientific study and management of cavity-nesting birds in this century is largely due to the creative and extensive use of nestboxes. Detailed information on breeding biology and population dynamics of several species (e.g., the Great Tit *Parus major*, Pied Flycatcher *Ficedula hypoleuca*, and Eastern Bluebird *Sialia sialis*) is available because of their readiness to nest in boxes. At least 102 bird species are represented in nearly 1,000 nestbox-oriented studies in the international literature.

This paper presents historical background, and discusses implications of nestbox studies for wildlife management in artificial and natural cavity habitats. Properly used, nestbox-derived data are potentially useful to the design of snag management prescriptions by wildlife biologists and foresters.

HISTORICAL BACKGROUND

Pre-20th Century

Carolus Linneaus (*in* Phillips 1925) reported that Scandinavians over 240 years ago hung nestboxes in trees for Common Goldeneyes (*Bucephala clangula*) to provide a harvestable supply of eggs for human consumption.

In North America, the Purple Martin (*Progne subis*) benefited from the hospitality of Indians and white settlers, and they from the presence of the martins. Alexander Wilson (1831) wrote: "even the solitary Indian seems to have a particular respect for this bird. The Chactaws and Chickasaws cut off all the top branches from a sapling near their cabins, leaving the prongs a foot or two in length, on each of which they hang a gourd, or calabash, properly hollowed out for their convenience." John James Audubon (1831) observed the relationship between the Indians and martins, and explained: "the bird keeps watch and sallies forth to drive off the Vulture that might otherwise commit depredations on the dear-skins or pieces of venison exposed to the air to be dried." Mark Catesby (1731) noted that the settlers of Florida and the Carolinas had adopted the Indian's accomodations to martins: "they breed like Pigeons in Lockers prepared for them against Houses, and in Gourds hung on Poles for them to build in, they being of great Use about Houses and Yards for pursuing and chasing away Crows, Hawks, and other Vermin from the Poultry."

Audubon (1831), in his dedicated scientific travels, noted that: "Almost every country tavern has a martin box in the upper part of its signboard."

20th Century

Economic values of martins, bluebirds, and other insectivorous cavity-nesting species have continued to justify their management using nestboxes to the present day. W.L. McAtee (e.g., 1940) with the Bureau of Biological Survey, performed extensive experiments using nestboxes to increase numbers of birds for control of nut weevils and other injurious insects in orchards. Since McAtee's work, there have been numerous major research programs dedicated to increasing insectivorous bird populations in timber and food crop environments; and Russian ornithologists (see Poznanin 1956) particularly have used large number of nestboxes for this purpose.

At the 1930 meeting of the International Committee for Bird Preservation, chaired by National Audubon Society president T. Gilbert Pearson, Sokolowski (1931) described Poland's new national nestbox program aimed at replacing disappearing old-growth forests suitable for cavity-nesting birds. Following an epidemic of noctuid caterpillars which deforested much of Poland, boxes designed by Sokolowski and suitable to 16 species were widely used

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by private citizens and the government in every national forest. Manufacture of tens of thousands of nestboxes was the job of prison workshops, schools and other state institutions. Massive nestbox projects for forest and orchard insect control continue today to characterize Polish ornithology (e.g., Graczyk 1974, Graczyk et al. 1970).

In 1930, Musselman (1934, 1940) was concerned about the effects of habitat loss on Eastern Bluebirds in Illinois, and noted that the old-time fences, wood fence posts, and stubs of apple trees which formerly had hosted the excavations of Downy Woodpeckers (*Picoides pubescens*) and, by inheritance, the nests of bluebirds, had disappeared. The fences had been replaced by iron and wire, while modern horticulture dictated that orchard trees be trimmned and stubs be painted. Musselman promoted the use of nestboxes to fill the nest site deficiency and to stem the decline of bluebirds. The now popular and effective institution of nestbox projects including multi-state and -province "trails", hundreds of miles long with thousands of monitored and maintained boxes is accredited to Musselman; and the subject has been carefully reviewed by Kibler (1969).

Frank Bellrose (1976), who has been a luminary in American waterfowl management, reminded us that in the early 20th century, the Wood Duck (*Aix sponsa*) was feared to follow the Laborador Duck (*Camptorhynchus laboradorius*) into extinction. Overhunting caused the decline before rigid enforcement of new protective laws permitted its dramatic increase into the 1940's. It was apparent to waterfowl managers, however, that suitable nest sites were in short supply, and that a saturation of available breeding habitat was close at hand. Consequently, in 1939, personnel of the Illinois Natural History Survey erected several hundred boxes for the ducks, and witnessed a 52% occupancy in the first season. Bellrose (1976) emphasized the drastic impacts of bottomland drainage and timber harvest on Wood Duck populations, and left the question of determining to what extent there is a "trade-off" between an increase of duckling production from nestboxes, and a population decline due to loss of natural habitat.

Incidentally, Hesselschwerdt (1941) prepared an economic analysis of the Illinois duck box project, and summarized that in addition to ducks, 56 boxes constructed at a cost of $98 and placed in a 4 square-mile farmland, during the first 2 years produced a total of 32 young Screech Owls (*Otus asio*), 19 young American Kestrels (*Falco sparverius*), 37 young Fox Squirrels (*Sciurus niger*), 112 pounds of honey, and good winter shelter for a number of wildlife species.

Concurrent early waterfowl programs in Scandinavia included the nestbox work of Siren (e.g., 1951) on Common Goldeneyes in Finnish lakes, and Grenquist (e.g., 1953) on Gooseanders (*Mergus merganser*) on the Finnish archipelago. In similar spirits as Purple Martins which nested in empty jugs provided by early American settlers, Finnish Gooseanders benefited from the secondary values of old packing cases for whiskey and brandy that had washed ashore from passing vessels. Later, these cases were brought directly from Helsinki by Grenquist and colleagues.

Since the early scientific observations by Wolda (1917) and others that populations of certain passerines could be increased and controlled by use of nestboxes, there has evolved an abundance of detailed long-term studies on the Great Tit (see Perrins 1980), Pied Flycatcher (see von Haartman 1971), and other Eurasian species. The Wytham Woods program of the Edward Grey Institute near Oxford, and the "hole-breeders programme" of the Vögelwelt Helgoland in Germany are particularly notable for extensive field investigation of cavity-nesting birds using nestboxes and banding.

IMPLICATIONS FOR MANAGEMENT

Although there are clear advantages of nestboxes as research tools (i.e., accessibility of nests, eggs, and birds; experimental control, etc.), there are risks involved in relying on boxes as primary sources of breeding data. Van Balen et al. (1982) reviewed and presented new data on the problems of nestbox populations deviating from populations occupying natural nest sites in: 1) breeding density, 2) composition of breeding species, 3) clutch size, and 4) nesting success. The authors argued that, with the exception of their present study and that of Nilsson (1975), too few systematic studies of cavity-nesting birds in natural cavities are available to give relevance to box-derived data.

Population Trends

In their 30-year study of Screech Owls in Ohio, VanCamp and Henny (1975) stated that boxes may affect bias in data, particularly in terms of population trends and rate of annual recruitment. They warn that trends in regional populations should not be based on percent of box-occupancy each year, bacause boxes are often placed in optimal habitat, and population changes caused by alteration of suitable natural habitat would be underestimated by this approach. Box and cavity data should be segregated for population estimates.

Nestbox Preference

Preference by birds for nestboxes over natural cavities apparently is common in several species. Ben Pinkowski (1976) reported 72% selection of boxes by pairs of Eastern Bluebirds in an area where natural cavities were available; and he suggested that boxes may have been selected because they were in more suitable locations and had more optimal interior dimensions.

In order to evaluate the cost-effectiveness of a Mississippi Wood Duck nestbox project which had a box utilization rate of more than 90%, Strange et al. (1971) investigated the availability and possible duck use of local natural cavities; and found that, although tree cavities were available, none was used due to an apparent preferences for nestboxes.

Nesting Success

Relative nesting success in nestboxes versus natural cavities is a major consideration for management which aims to sustain populations by natural reproduction. As part of a 12-year study of Black-bellied Whistling Ducks (*Dendrocygna autumnalis*), Bolen (1967) found predation to be a major factor of nest failure in boxes and natural sites: natural cavities and boxes without predator guards had 44% and 46% nest success, respectively; and boxes with guards had 77% nest success. Similar data of Bellrose et al.(1964) for Wood Ducks included 40-49% in natural cavities, 36% in unprotected boxes, and 73% success in boxes with predator guards.

Accepting Kalmbach's (1939) conclusion that 70% minimum nest success is required for satisfactory waterfowl management, these data for Wood Ducks and whistling ducks indicate the futility of erecting unprotected nestboxes or relying on non-modified tree cavities for duckling production.

L.F. VanCamp and C.J. Henny (1975) contended that due to a reduction of European Starlings (*Sturnus vulgaris*) in boxes within the feeding area of Screech Owls, Wood Duck nesting success is enhanced by presence of nesting owls and resultant reduced starling competition; and, therefore, management should provide adequate numbers of nest sites for both owl and duck species.

The benefit of nestboxes to increase nesting success by reducing interspecific competition for nest sites is highlighted by the Puerto Rican Parrot (*Amazona vittata*) recovery program (Wiley 1980, Snyder and Taapken 1981). Competition with the parrots for nest cavities by the Pearly-eyed Thrasher (*Margarops fuscatus*) has been a serious limiting factor against population recovery by the parrot. Placement of optimally configured thrasher nestboxes near parrot boxes has diverted thrashers from the parrot nests; and the territorial thrashers protect the nest vicinity of both species by fending off intruding other pairs of thrashers.

Blowflies (Diptera: Calliphoridae) are common ectoparasites of cavity-nesting birds, and may limit nesting success by weakening or killing nestlings (Kenaga 1961). In Eastern Bluebirds in the Huron National Forest, Pinkowski (1977) found that blowflies (*Apaulina* sp.) parasitized natural cavities and nestboxes at comparable rates (85% and 82%, respectively). The difference in the mean number of parasites per loaded nest, however, was significant, with 51.5 in natural cavities, and 91.4 in nestboxes. The author explained that blowfly numbers are affected by the amount of grass nesting material available as blowfly habitat, and the larger size and square shape of boxes require the bluebird to add more grass to make a nest cup, thereby increasing the number of parasites in the nestbox. Therefore, box designs that conform to dimensions and shapes of natural cavities would be beneficial to bluebirds, as would management for more natural cavities available to the species.

CONCLUSION

Nestboxes provide amateur and professional ornithologists and conservationists with a convenient and essential tool for their work to understand and maintain populations of cavity-nesting birds. Direct and controllable access to the contents of a nest cavity, or to the contents of many nest cavities, permits evaluation of the success of both the nesting birds and our management effort. Flexibility of the design and placement of nest sites provides for limitless experimentation, and hence a greater insight to the relationships of the nesting bird and its physical and biological environment.

Nestboxes obviously do not <u>replace</u> natural cavities; and they cannot effectively mitigate for the loss of natural nest sites in avian habitat. The majority of box-oriented studies relates to specific geographical and ecological conditions surrounding a limited number of species; and replication of multiple-species communities using nestboxes in the absence of natural habitat is not possible. Nestbox programs of the large extent common in Europe and occasional in North America are, when properly monitored and maintained, expensive. Wildlife and forest managers require detailed biological and economic information for cost:benefit analysis decisions to integrate possible nestboxes into forest management programs for cavity-nesting birds.

If nestboxes are to be considered in a management program, it is recommended that planners take full advantage of the extensive and intensive literature and experience on the subject, a minor portion of which has been introduced in this paper.

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