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Research Papers

Mallard Use of Hen Houses™ in Eastern Ontario

Utilisation de nichoirs de type *hen house*^MD^ par le Canard colvert dans l'est de l'Ontario

J. Ryan Zimmerling[1], *Jim R. Fisher*[2], *C. Davison Ankney*[3], *and Christine A. Debruyne*[4]

ABSTRACT. Nesting structures for ground-nesting waterfowl may be an effective technique for increasing nesting success in regions in which nest success is below the 15% threshold needed to maintain a stable population. We studied the occupancy rate of artificial nesting structures called hen houses™ by Mallards (*Anas platyrhynchos*) nesting in two different wetland habitats, beaver ponds and sewage lagoons, in eastern Ontario during 1999–2001. We hypothesized that, because natural cover was sparse on sewage lagoons, Mallards would occupy hen houses at a higher rate on sewage lagoons than on beaver ponds. However, of the 248 hen houses distributed between beaver ponds and sewage lagoons, none was occupied by waterfowl. Common Grackles (*Quiscalus quiscula*) were the only avian species that nested in hen houses. However, Mallards successfully nested directly under several structures ($n = 6$) when water levels were low enough to expose the ground beneath them. Mayfield daily nest survival estimates for Mallards nesting in natural cover were similar on sewage lagoons and beaver ponds for all years (mean = 0.99) and were higher than most published estimates. Factors such as nesting cover, predation pressures, and structure design and material may influence the use of artificial hen houses and should be considered when planning a hen house program outside of the Prairie Pothole Region.

RÉSUMÉ. Des nichoirs conçus pour les espèces de sauvagine nichant sur le sol peuvent s'avérer une technique efficace pour accroître le succès de la reproduction dans les régions où ce succès est inférieur au seuil de 15 % nécessaire au maintien d'une population stable. Pendant la période de 1999 à 2001, nous avons étudié le taux d'occupation de structures de nidification artificielles appelées hen house^MD^ par les Canards colverts (*Anas platyrhynchos*) nichant dans deux types d'habitats humides de l'est de l'Ontario, soit des étangs de castor et des bassins de stabilisation des eaux usées. Nous avons émis l'hypothèse selon laquelle la proportion de nichoirs occupés par le Canard colvert serait plus élevée dans les bassins de stabilisation que dans les étangs de castor parce que le couvert naturel était plus clairsemé dans les bassins. Cependant, aucun des 248 nichoirs répartis entre les étangs de castor et les bassins de stabilisation des eaux usées n'a été occupé par la sauvagine. Le Quiscale bronzé (*Quiscalus quiscula*) est la seule espèce aviaire qui a utilisé ces nichoirs. Cependant, le Canard colvert s'est reproduit avec succès sous plusieurs de ces structures ($n = 6$) quand les niveaux d'eau étaient suffisamment bas pour que le sol sous-jacent soit exposé. Chez les Canards colverts nichant dans des microhabitats naturels, les estimations du taux journalier de survie au nid selon la méthode de Mayfield étaient très similaires dans les bassins de stabilisation et les étangs de castor pour toutes les années (moyenne = 0,99) et supérieures à la plupart des valeurs publiées. Des facteurs comme le degré de couvert végétal au nid, la pression exercée par les prédateurs ainsi que la conception de la structure et les matériaux utilisés peuvent avoir une incidence sur l'utilisation de nichoirs à canard et devraient être pris en compte dans la planification d'un programme d'installation de nichoirs *hen house* en dehors de la région des cuvettes des Prairies.

Key Words: *beaver pond; eastern Ontario; hen house; Mallard; Anas platyrhychos; nesting; occupancy; predation ; sewage lagoon*

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[1]Bird Studies Canada, [2]Delta Waterfowl Foundation, [3]University of Western Ontario, [4]University of Canterbury

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INTRODUCTION

In an effort to improve regional nest success, waterfowl managers have used a variety of techniques aimed at increasing suitable nesting cover and decreasing predation (see West and Messmer 2004). That elevated overwater artificial nesting structures increase waterfowl production is not a new concept (e.g., Bishop and Barratt 1970). According to Bishop and Barratt (1970), Bellrose (1980), and McNichol et al. (1997), nesting structures have proved useful in managing species such as such as Wood Ducks (*Aix sponsa*), Hooded Mergansers (*Lophodytes cucullatus*), and Giant Canada Geese (*Branta canadensis maxima*).

Using nesting structures to increase nest success for ground-nesting waterfowl has received much attention in the Prairie Pothole Region (PPR) of Canada and the United States because it is the most important breeding ground for North American ducks (Bellrose 1980). For decades, the PPR has been subjected to intense agricultural practices and, consequently, a substantial loss of waterfowl breeding habitat. As a result, nesting hens and predators tend to concentrate in areas of suitable habitat, thus creating ecological traps in which rates of nest predation are exceedingly high and nesting success is lower than the 15% threshold required to maintain a stable population (e.g., Cowardin et al. 1985, Johnson et al. 1989, Greenwood et al. 1995). It is important to acknowledge, however, that nesting structures only improve nest success for those species that use them and that the continued loss of natural wetland habitats will be reversed only by sound land-management practices that address waterfowl habitat requirements.

The hen house™ or nesting tunnel has been promoted by Delta Waterfowl for ground-nesting ducks and has become the most commonly used artificial nesting structure by waterfowl managers in the PPR because it is relatively inexpensive to build and requires less maintenance than other types of nesting structures (see Eskowich et al. 1998). More importantly, hen houses in the PPR consistently show rates of occupancy and nest success greater than 70% (e.g., Kowalchuk 1996, Eskowich et al. 1998, Yerkes and Kowalchuk 1999, Artmann et al. 2001) because their placement over water deters most mammalian predators (Doty 1979). In the PPR, Mallards (*Anas platyrhynchos*) are the most abundant duck species and make up more than 95% of the occupants of hen houses, but other species, including Redhead (*Aythya americana*), Canvasback (*A. valisineria*), Blue-winged Teal (*Anas discors*), and American black duck (*A. rubripes*) also use hen houses (Fisher 2004).

The economic efficiency of using nesting structures to increase waterfowl production depends on their occupancy rate. Mallard preference for hen houses relative to other types of nesting structures such as baskets has been well documented in the PPR (e.g., Doty 1979, Haworth and Higgins 1993, Eskowich et al. 1998). Occupancy rates of hen houses have ranged from no use (Sidle and Arnold 1982) to more than 70% (Eskowich et al. 1998) within 2 yr of the structures being erected. Several researchers have suggested that occupancy rates of hen houses by ground-nesting waterfowl should be higher in wetland habitats in which natural nesting cover is sparse, but the available evidence is equivocal (Artmann et al. 2001, Stafford et al. 2002, Chouinard 2003).

Extensive erection of hen houses by waterfowl managers outside of the PPR has been limited, in part because loss of nesting habitat has been less severe (but see Knowlton and Zolnowski 2000). Nonetheless, as breeding habitat declines with continued encroachment by agricultural, industrial, and residential developments in regions outside of the PPR, a hen house program may become necessary for locally increasing nesting success of species such as Mallards, especially in combination with improvements in habitat (see Evrard 1996). Consequently, the primary objective of this study was to determine if Mallards, the most common ground-nesting duck in eastern Ontario, would use hen houses and, if so, whether the occupancy rate would differ between sewage lagoon complexes and beaver ponds. We hypothesized that, because available nesting cover on sewage lagoons was sparse relative to beaver ponds, Mallards would occupy more hen houses at a faster rate on sewage lagoons than on beaver ponds.

METHODS

Study area

We studied ground-nesting waterfowl nesting on wetlands in eastern Ontario from the town of Cobden (45° 40’ N, 77° 10’ W) east to Vankleek Hill (45° 35’ N, 74° 40’ W) from 1999 to 2001.

Wetlands in the study area included 31 small (0.5–3.5 ha) beaver ponds, hereafter called "ponds," and nine municipal sewage lagoon complexes or secondary waste water treatment facilities, hereafter called "lagoons." On average, lagoons comprised three 1.5–4.0 ha lagoon "cells" (n_{cells} = 31). Extensive data have demonstrated that the availability of aquatic invertebrates is higher in lagoons than in other aquatic habitats, including beaver ponds, and, consequently, waterfowl often nest there at higher densities (e.g., Swanson 1977, Piest and Sowls 1985, Richardson and Knapton 1993). Cattails (*Typha* spp.) and rushes (*Carex* spp.) dominated the emergent vegetation on both ponds and lagoons, but most lagoons had only a thin strip of cattails, i.e., 1–3 m, around their perimeters, whereas ponds had much more extensive emergent vegetation. Grasses, which attained a maximum height of 1.0 m, were the dominant terrestrial vegetation surrounding lagoon cells. Agricultural crops of small grains and hay- and old fields surrounded lagoon complexes, and two lagoons were also close to mixed deciduous forests. Chain-link fence or barbed-wire fence surrounded all the lagoon complexes. In comparison, ponds were bordered by mixed deciduous forests of sugar maple (*Acer saccharum*), eastern white pine (*Pinus strobus*), and eastern white-cedar (*Thuja occidentalis*). Thick stands of speckled alder (*Alnus incana*) were present at the periphery of some ponds.

Time of ice breakup in spring was similar for both lagoons and ponds, with the exception of one aerated lagoon cell, which became ice-free earlier. Pond water levels did not fluctuate more than 1 m seasonally or annually during the study period. In contrast, water depth varied, on average, 1.75 m seasonally, in a range of 0–3 m, within and among sewage lagoon complexes, and large fluctuations in water depth usually occurred in May and October.

Field methods

In February 1999, when sewage lagoons and beaver ponds were ice-covered, four hen houses were erected equidistantly apart 1–3 m from the edge of the emergent vegetation at each wetland site. It was thought that four hen houses per wetland site were sufficient to provide nesting hens with several alternatives to determine if orientation and placement were important factors of occupancy rate (but see Chouinard 2003). Hen house design was similar to the carpet-style design described by Artmann et al. (2001) and consisted of a 1.0 m tunnel constructed with a wire mesh, lined with a layer of porous polypropylene carpet rolled into a cylinder 0.3 m in diameter and secured onto a wooden plank. To prevent collapse because of heavy snowfall or freezing rain during the winter, re-enforcement rings made of steel rods 6 mm in diameter were placed in all hen houses. Each structure was then attached to a metal pole with a 0.6 m section of PVC tube 0.2 m in diameter as a predator guard. Hen houses were half-filled with brome grass (*Bromus* spp.). A total of 248 carpet-style hen houses were equally distributed between lagoons and beaver ponds. Each year, before the arrival of hens on the nesting grounds, necessary repairs and maintenance along with the replacement of nesting material were performed for all hen houses. Hen houses were positioned 1 m above the average water level with all entrances perpendicular to the prevailing wind. Some hen houses were reinforced with a second pole to stabilize structures in extreme winds.

Hen houses were checked at least once weekly for evidence of nesting attempts and the presence of eggs from April to July. In addition, we searched all emergent vegetation weekly, and all vegetation within 25 m of the perimeter of each lagoon cell and beaver pond every other week for waterfowl nesting in adjacent cover. When a nest was located, we determined the species either visually, if the hen was present, or by breast feathers and egg size and color. Nest sites were mapped, and the fate of each nest recorded on repeat visits. Inspections of eggshell and membrane remains were used to determine if eggs hatched or had been destroyed by a predator. Using the Mayfield method (Mayfield 1961, 1975), we calculated the daily survival rates of nests across all years for lagoons and ponds, respectively. The Mayfield daily survival rate is the probability that nests will survive until the next day. Standard errors for Mayfield estimates were calculated using methods described by Johnson (1979)

RESULTS

No waterfowl nests were found in hen houses during 1999–2001. Common Grackles (*Quiscalus quiscula; n* = 23) were the only avian species that nested in hen houses. However, Mallards successfully nested directly under six hen houses on lagoons when water levels were low enough to expose the ground beneath them. Although none of the hen houses on lagoons were occupied, we located a total of 144 Mallard nests in the emergent vegetation or the ground cover around lagoons (mean = 4.9 ± 3.2 SD per lagoon complex per year). We located 25 Mallard nests on ponds during the same period (mean 0.26 ± 0.20 per pond per year). During the 3 yr of this study, 14 of the 144 (10%) ground nests that we monitored at lagoons and four of 25 (17%) found on beaver ponds were depredated during the breeding season. Mayfield daily nest survival rates were similar on both lagoons ($mean_{1999-2001}$ = 0.9913 ± 0.0023) and ponds ($mean_{1999-2001}$ = 0.9895 ± 0.0067).

DISCUSSION

In many areas of the Prairie Pothole Region (PPR), e.g., northeastern North Dakota, Mallards occupy more than 75% of available hen houses (Eskowich et al. 1998). Occupancy rates tend to be low during the first year or two after nesting structures are erected, but increase thereafter as females that have successfully nested, and their offspring, return to nest in hen houses (Artmann et al. 2001). Mallard occupancy of hen houses is expected to be highest in nesting structures in areas in which natural nesting cover is scarce because structures and natural cover "compete" for females (Cowardin et al. 1985). We therefore hypothesized that Mallards would use hen houses at a higher rate on sewage lagoons than on beaver ponds in eastern Ontario. Although 248 hen houses were erected throughout eastern Ontario, a number comparable to hen-house occupancy studies in the PPR, these structures were never occupied in either wetland habitat.

Early research assessing nesting structure designs similar to hen houses in the PPR also found zero occupancy. In North Dakota, Sidle and Arnold (1982) placed 17 covered cylinders in waterfowl production areas (WPAs), but they were never occupied during the 2-yr study period. Lee et al. (1968) used a mailbox tunnel design consisting of a wood base with aluminium arched over the base; none were ever used by waterfowl. These authors did not examine possible factors associated with the zero occupancy of these nesting structures.

One possible explanation for the lack of hen house use in eastern Ontario is that Mallards and other ground-nesting waterfowl were not limited by safe nesting habitat and hence did not search for additional nest sites such as hen houses. However, evidence that the availability of nesting cover is an important factor determining the occupancy rate of hen houses is equivocal. In North Dakota, Artmann et al. (2001) found that, 2 yr after hen houses were erected, the occupancy rate of structures placed in areas in which nesting cover was relatively abundant was four times higher (17.8%) than in areas in which cover was sparse (3.9%). However, this difference was largely a function of greater Mallard density in the areas with abundant nesting cover. In Minnesota, nesting structure occupancy was positively related to vegetation height and density early in the nesting season, but the relationship was negative later in the season (Bremicker 2004). Kowalchuk (1996) suggested that habitat quality could affect the number of hens that nest in nesting structures in the Prairie Pothole Region, but found no meaningful differences in coarse- or fine-scale habitat around occupied structures and unoccupied structures. Although little is known about nest site selection by Mallards in eastern Ontario, the ground cover and upland habitat around beaver ponds in our study area appeared suitable for ground-nesting waterfowl (see Merendino and Ankney 1994), especially in comparison to the Prairie Pothole Region. Conversely, nesting cover around lagoons, especially early in the breeding season, was structurally simple and consisted mainly of flattened cattails and grasses from the previous year. Indeed, the sparse nesting cover on and around lagoons facilitated nest searching and, in addition to higher nesting density, likely contributed to the higher number of nests that we located on sewage lagoons vs. beaver ponds.

Intuitively, differences in the availability of quality nesting cover on lagoons and ponds should have resulted in different rates of nest predation or nest success between these two habitats, but it did not. Rates of nest predation on ground-nesting Mallards were similar on lagoons and on ponds in eastern Ontario and were much lower than the 70% or greater reported in the Prairie Pothole Region (PPR; e.g., Phillips et al. 2003, Sovada et al. 2005). Consequently, nest success (> 80%) and Mayfield daily nest survival rates (> 0.99) were several-fold higher than for ground-nesting Mallards in many regions of the PPR (Beauchamp et al. 1996), but similar to that reported for Mallards occupying hen houses (Artmann et al. 2001). In the PPR, habitat changes and human activities have increased the distribution and abundance of some predators at the expense of ground-nesting waterfowl (Sargeant et al. 1993, Greenwood and Sovada 1998). For example, raccoons (*Procyon lotor*) have benefited from the increased availability of grain, buildings, and trees on the prairies. Moreover, red foxes (*Vulpes vulpes*), the principal predators of nesting ducks and eggs in the PPR, have replaced large predators such as the gray wolf (*Canis lupus)* and the coyote (*C. latrans*; Johnson et al. 1989, Sovada et al. 1995). Factors such as chain-link fences and agricultural areas devoid of trees surrounding most lagoons may have been responsible for the relatively low rate of predation found on lagoons despite sparse nesting cover early in the nesting season (Stafford et al. 2002). Hence, compared to Mallards in the PPR, the increased safety of nesting sites provided by hen houses may be less important to ground-nesting Mallards in our study area in eastern Ontario because their nesting success was so high.

The factors that prompt an individual female Mallard to nest in a hen house are unknown. We acknowledge that subtle details of construction, materials, and/or placement may have been involved in the zero occupancy that we found. Notably, Mallards have occupied flax-style hen houses concealed with eastern white cedar (*Thuja occidental*) limbs erected along lakeshores with large stands of cattail 50 km south of our study area in eastern Ontario (F. Girdwood, *unpublished data*). This other type of hen house design, commonly used in the PPR, was not used in this study because of initial concerns related to its construction, and it was thought that carpet-style hen houses would be easier and more cost-effective to maintain on a long-term basis (see Kowalchuk 1996). However, when given a choice, Mallards in the PPR preferred the flax-style hen house vs. a more artificial design similar to the carpet-style hen house (65 vs. 35%, respectively) that we used (Kowalchuk 1996; also see Yerkes 1999).

CONCLUSION

Clearly, there is a lack of understanding about the factors that influence the use of hen houses in eastern Ontario. Currently, waterfowl managers in the Lower Great Lakes region of southern Ontario and Pennsylvania are interested in establishing a hen house program (S. Petrie, *personal communication*). Given regional variability in structure occupancy, several factors including structure design and material, nest habitat cover, and predation pressures should be considered before establishing Mallard hen house programs outside of the Prairie Pothole Region.

Responses to this article can be read online at:
http://www.ace-eco.org/vol1/iss2/art6/responses/

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