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NURSERIES: A CONSIDERATION OF HABITAT REQUIREMENTS DURING THE EARLY CHICK-REARING PERIOD IN COMMON LOONS

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Concern with the physical aspects of avian habitat and its relationship to breeding success has traditionally focused on nest site factors. Many species produce nidifugous young which move to a separate location where parental care continues. For them, suitable sites where young can be raised are important, for breeding success assumes *fledging* success, and this has different implications than the term *hatching* success. However, these location differences have not been given much attention in the literature. This report presents habitat requirement data for the early chick-rearing period in Common Loons (*Gavia immer*) and compares it with the physical properties of nest-site locations.

Common Loon chicks are dependent on the adults for both food and protection for at least 2 months (Barr 1973, McIntyre 1975). Independence is gradual, although for the first 2 weeks they remain in nearly constant association with the adults, back-riding for up to 65% of the time during the first week, and at other times swimming between the parents or at the side of one adult. Later, young stray farther and farther from the adults and regular movements gradually include most of the parental territory. This study concentrated only on critical factors of the first rearing site for tiny chicks, the place here termed the "nursery."

STUDY SITE AND METHODS

All work was done on Hanson Lake in northern Saskatchewan, an oligotrophic lake at 54°45′ north latitude, 70 km west of Flin Flon, Manitoba. Data from 28 of the 86 territories were secured from 31 May to 18 August 1981. Fledged young were confirmed for all but one pair whose chick was only 3 weeks old at the time the study was terminated. Loons are considered fledged at 8 weeks when they are independent feeders, though they are not capable of flight until 11 or 12 weeks (Barr 1973). However, mortality is so rare after young are 4 weeks old that reproduction may be considered successful at that time (Yonge 1981).

Territory size was determined by mapping the location of pair members each time they were checked, which was at least once and usually several times per week. Sighting records for the entire season were combined on a master map and territory and nursery sizes were calculated to the nearest ha using a graphics tablet with an Apple II-Plus computer. Angle of view from the nest was found by taking compass readings while crouched on the nest. View of other territories was determined visually at the same time while sitting on the nest with head lowered to the height of an incubating loon's head. Sightings from nurseries were taken from the outer perimeter. Spatial arrangement of territories, nest sites, and nurseries used in this study are indicated in Fig. 1.

Nest cover was rated as follows: *excellent:* nest could not be seen from boat without looking under trees and was completely hidden from overhead viewing; *good:* nest could be seen from a boat but not from overhead; *moderate to fair:* some overhead cover; *no cover:* nest directly exposed to viewing, both from the side and above.

Slope of the lake bottom was measured by taking depths at 0.5, 1.0, 2.0, and 5.0 m intervals from the nest in the direction which the loons consistently used to approach and leave the nest (runway) and at the same intervals from the mid-point of the nursery shoreline. Depth was determined by throwing a weighted measure from a boat in 4 different directions from the approximate center of each nursery, and using all 112 measurements to calculate mean value.

Lake bottom was evaluated individually for each territory as to soil type and later assigned to one of 11 categories. "Muck" is a soft, sedimentous bottom; other types were sand, gravel, rock, and combinations such as sand/rock, muck/sand, etc. Vegetation was categorized by specific types, such as equisetum and sedge (*Equisetum* sp. and *Carex* sp.), phragmites (*Phragmites communis*), potamogetons (*Potamogeton* spp.), etc. If at least 3 emergents were present, including some combination of *Scirpus* spp., *Dulichium arundinacaeum*, *Equisetum* spp., *Carex* spp., *Zizania aquatica, Nuphar variegatum,* and *Potamogeton* spp., the term "Emergents" was used. Nurseries categorized as *Zizania aquatica* were cultivated monoculture patches of wild rice.

Distance to nearest neighbor was measured as the shortest line from nest site or periphery of nursery to the boundary of adjacent territories.

RESULTS

Size.—Territory size averaged 26.18 ± 1.52 ha, varied little from that of other territories on Hanson Lake, and was within the size range reported in other years by Yonge (1981). Nurseries occupied a little over 15% of total territory size on average ($\bar{x}$ = 1.75 ± .29 ha) but their sizes were probably determined more by natural physiographic features, particularly bays, which were most commonly used as nursery sites, than by a nursery/territory ratio per se.

Bottom.—Nursery bottoms were soft (muck or muck plus another substrate such as sand or rock) 3 times as often as were bottoms adjacent to the nest site, which were sand, gravel, or rock in 22 of 28 cases. Aquatic vegetation was abundant in all but 5 nurseries, while usually there was none in the nest runway.

The slope was significantly different between the nest site and nursery (Fig. 2). The steeper drop in bottom contour found adjacent to the nest site was expected, as loons commonly use underwater approaches and exits during nest exchanges, and adequate depth for underwater swimming confers an advantage. Nurseries, on the other hand, have a fairly

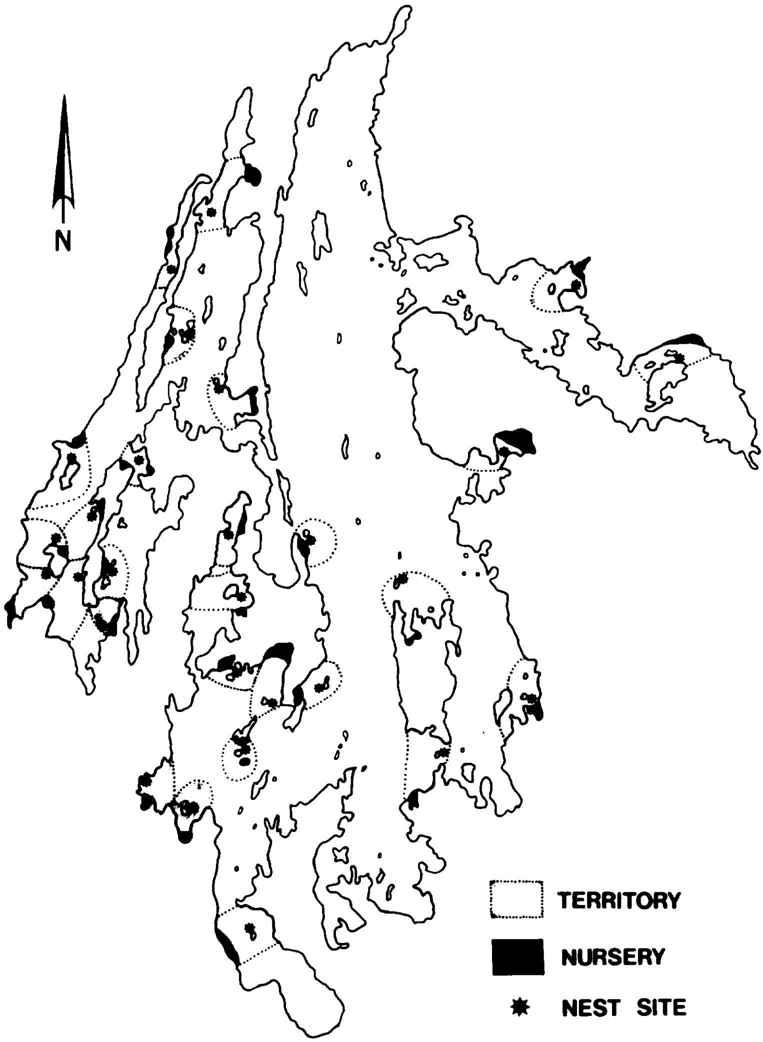

FIGURE 1. Hanson Lake, Saskatchewan, showing the 28 territories and their nurseries and nest sites as discussed in this paper. There were 58 other territories on the lake in 1981, but they are not shown on this map.

uniform depth, with only a slight variability among nurseries ($\bar{x}$ = 1.38 ± .072 m).

Visibility.—Visibility was addressed in 2 ways: (1) how much of the loons' own territory and (2) how many neighboring territories could a bird see while either on the nest or in the nursery. Ability to see was recorded in degree angles, and there was a significant difference between

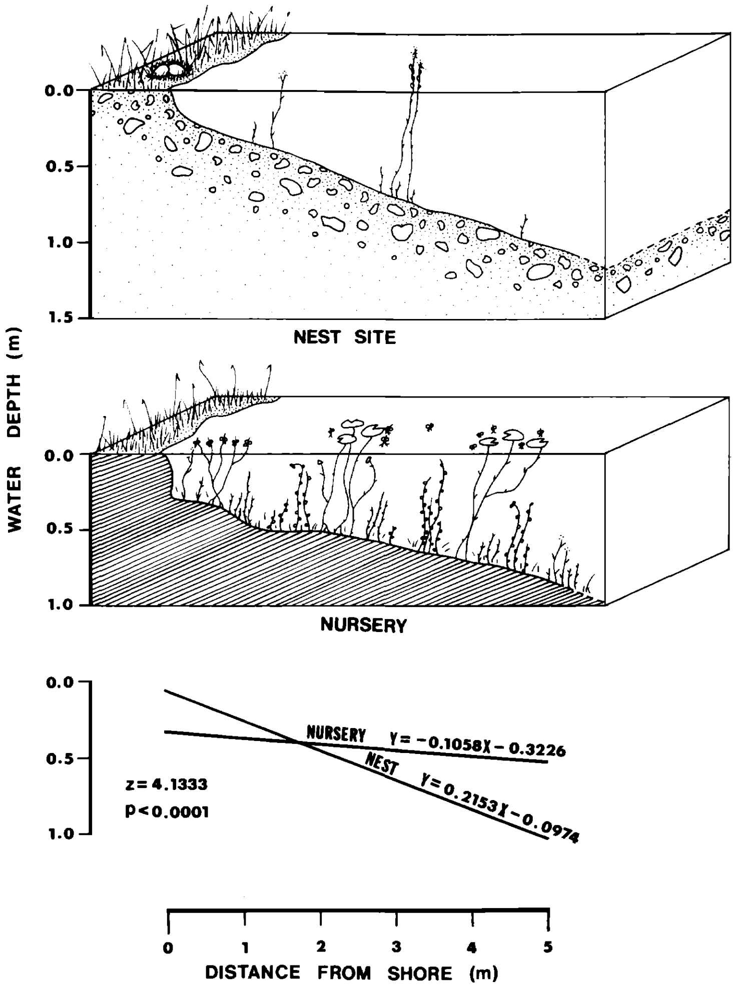

FIGURE 2. Slope of lake bottom, vegetation, and soil types in nurseries and along nest runways. Slopes as shown in the pictorial representation have been taken from the average and match those shown as regression lines below; vegetation and soil types portrayed are typical for the study sites. Regression equation shows a highly significant difference between the two slopes ($P < .0001$).

nest site and nursery ($t = 2.65$, df = 54, $P < .02$; Fig. 3). There was no consistency as to number of neighboring territories that could be viewed: 0–6 from the nest sites and 0–3 from the edge of the nurseries.

Location.—As soon as chicks were dry, adults moved them away from the nest site ($\bar{x} = 499.1 \pm 57.04$ m between nest and nursery) and this removed them even farther from adjacent territories, an average of

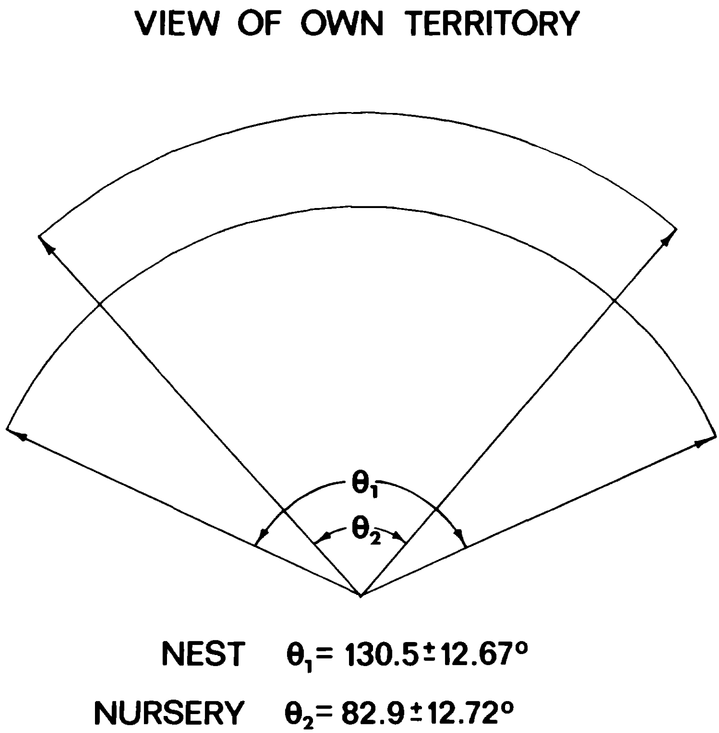

FIGURE 3. Territory visibility from nests and nursery perimeters. Average degree angles of line of sight are shown as θ_1 = nest, and θ_2 = nursery, both given as $\bar{x} \pm 1$ SE.

298.2 m farther (nest to adjacent territory, $\bar{x} = 387.57 \pm 37.93$, and nursery to adjacent territory, $\bar{x} = 696.79 \pm 64.64$ m), a significant difference ($t = 3.98$, df = 52, $P < .001$).

Shelter is important at both nest sites and nurseries but the terminology can be confusing. Nest sites are vulnerable to avian predators, hence shelter = "hidden," while on the other hand, young chicks are vulnerable to wind and wave action, so a sheltered nursery means one protected from the wind.

DISCUSSION

A steeper slope by the nest was expected because loons generally arrive and leave the nest underwater. A quick drop thus helps to hide the comings and goings of incubating birds from sightings by potential nest scavengers. I also expected that nurseries would have fairly uniform shallow depths with at least some aquatic plants to provide optimal habitat for the small fish which adults feed to the young. Large fish are predators on loon chicks (Yonge 1981) and shallow bays might afford some protection against *Esox lucius*, the primary predator, but large pike were commonly seen in these bays so I don't consider this to be a factor in the choice of shallow bay nurseries.

Winds on large open lakes frequently whip up substantial waves, and small chicks are subject to parental separation under such conditions. Their vulnerability then increases and I have seen separated young killed both by conspecific neighbors and Herring Gulls (*Larus argentatus*).

A third factor which may play a role in nursery requirements concerns feeding site learning by chicks. M. Christoff (pers. comm.) found that young loons initiated self-feeding by returning to locations where adults had fed them when they were small. Shallow quiet bays would provide suitable feeding grounds, as novice hunters are limited in diving ability and inexperienced at prey capture. Only short dives are needed in the nursery sites as there is no chance of a deep water escape route for the fish, and fish would remain readily visible.

The relationship between nest and nursery sites and adjacent territories of conspecifics was consistent among territories. Nests were closer to territorial boundaries than were nurseries, but incubating birds had a better view of their own territories. Loons are vulnerable on the nest, and a long lead time to see the approach of anything coming toward the nest would be advantageous in permitting them to slip under water and away from the nest. Adults with young stay away from conspecifics, but because they are already in the water and so are more mobile and ready to defend, visibility might not be as important as it is for nesting birds.

Young may imprint during the move from nest site to nursery. I noted that young had to swim all or most of the way from the nest to the nursery and were not carried there on the adults' backs, and suggested that young may imprint during their first long swim (McIntyre 1975). Hand-reared young imprint to humans almost immediately during their first day post-hatching, and their following response is so strong even before they leave the nest that our greatest problem during toe-banding these tiny chicks is for us to get away from them before they can follow us. At this point, imprinting during nest-site to nursery moves is speculative, but the long mandatory swim that each chick must make as soon as it leaves the nest argues for the likelihood that imprinting does begin within the first 24 h post-hatching, and the long distance (averaging nearly 0.5 km in this study) provides the chance for imprinting to occur.

Loon territorial requirements include: (1) an adequate food resource and clear water for ready prey visibility (McIntyre 1975); (2) nest sites with overhead protection, deep water and/or a steep slope directly off the nest, and a good view of the owners' territory; and (3) a place to raise young chicks that is as far as possible from neighbors, usually in back bays, sheltered from wind, and with food for 2 small chicks for at least 2 weeks. Adult loons frequent feeding locations other than within their territories, but food for chicks is all secured within the territory.

There are concerns for loon populations in many parts of their range.

Several surveys have shown that population declines range from 35 to 75% during the past 2 to 3 decades in the northeastern U.S. (Sutcliffe 1979), and concerns about other populations are apparent (Vermeer 1973, Ream 1976, Titus and Van Druff 1981). Those currently engaged in management practices for purposes of retaining or increasing loon habitat must be aware that more than a single habitat type is important to ensure maintaining stable loon populations. For example, presentation of artificial islands to increase nest sites, without assurance that nursery habitat is also available, could increase hatching success yet not improve reproductive success. Workers involved with solving problems of declining numbers of other avian species might also take heed to assess habitat needs in many dimensions prior to adopting management plans.

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