Greater Scaup, *Aythya marila*, Nest Site Characteristics on Grassy Island, New Brunswick

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We studied Greater Scaup (*Aythya marilla*) nest site selection on Grassy Island, New Brunswick, during 1995 and 1996 by describing site selection in relation to habitat characteristics and association with larids using univariate comparisons. We pooled nesting data from both years and found that nesting sites were significantly closer to larid colonies and the edge of the patch of vegetation in which the nests were situated, had less forb canopy cover, more sedge cover, greater overhead concealment and lateral cover at 0–0.25 m, and less ground moisture than random sites. We evaluated Greater Scaup nests delimited as close to or far from larid colonies at 30 m and documented that nests closer to larid colonies were found in shorter vegetation that was closer to the edge of the patch of vegetation with less lateral cover at 0.25–0.5 m, but had greater overhead concealment than nests farther away. Advancements in the ecological understanding of the species, including habitat use patterns and species associations, will increase the likelihood of conservation successes.

Key Words: Greater Scaup, *Aythya marila*, nests, larids, Grassy Island, New Brunswick, waterfowl.

Habitat selection occurs when an animal uses a habitat in greater proportion than its availability (Johnson 1980). Nest site selection can dominate other forms of habitat selection due to the functional importance and relatively long-term commitment made to the site (Orians and Wittenberger 1991). Additionally, production of offspring is related to the quality of the surrounding habitat selected by the parent (Orians and Wittenberger 1991). Nest site selection may also be influenced by the presence of other species (Hilden 1965). Koskimies (1957) considered larids to be a releasing feature of habitat recognition for waterfowl and other birds nesting within their colonies, and it has been suggested that ducks will choose nesting sites with poor cover in order to be near larids (Koskimies 1957; Hilden 1964; Long 1970; Gerell 1985).

Greater Scaup (*Aythya marila*) often nest on treeless islands or treeless portions of islands and exhibit sociality towards larids (Hilden 1964; Weller et al. 1969; Bengtson 1972; Johnsgard 1975; Bellrose 1980; Fournier and Hines 2001). Objectives of this study were to document the habitat characteristics of nesting sites of Greater Scaup and to determine whether the proximity of larids affected Greater Scaup nest site selection. We hope that our study of nesting ecology will serve as a resource that may assist Greater Scaup conservation efforts.

Study Area

Our research took place on Grassy Island, New Brunswick, the southernmost documented nesting location of the Greater Scaup (McAlpine et al. 1988; Smith 1999; Tatman et al. 2009). Grassy Island is a 32-ha floodplain island located mid-channel (approximately 0.7 km from shore) in the Saint John River in Kings County, southern New Brunswick (45°31'N, 66°04'W). Island vegetation was dominated by grasses (*Calamogrostis* sp., *Phalaris* sp.), forbs (predominately *Lythrum salicaria*), sedges (*Carex* spp. and *Cyperus* spp.), and a few small stands of shrubs (*Cornus* spp. and *Alnus* spp.) and trees (*Fraxinus* spp. and *Acer* spp.). The surrounding area is deltaic, containing islands, coves, and widespread patches of aquatic vegetation. River levels fluctuate by several metres seasonally, completely submerging Grassy Island during the spring. Common Terns (*Sterna hirundo*), Ring-billed Gulls (*Larus delawarensis*), and Great Black-backed Gulls (*Larus marinus*) also nested on Grassy Island.

Methods

We conducted systematic searches for Greater Scaup nests on four occasions in 1995 (15, 22, and 27 June and 6 July) and three occasions in 1996 (18 and 25 June and 3 July). Five to 10 people participated in each search, which took place mid-morning. Nests were

also found opportunistically during field work. We mapped located nests and classified forb, sedge, grass, dead, and other canopy cover on a scale of 1–6 (sparse to dense; Daubenmire 1959) and overhead concealment of the nest (Choate 1967). We estimated percentage lateral cover from nests at a distance of 10 m (height intervals of 0.0–0.25 m, 0.26–0.5 m, 0.51–1.0 m, and 1.1–1.5 m) (Nudds 1977; Krasowski and Nudds 1986). We also measured vegetation height (m) and distance to the edge of the patch of vegetation (m). We recorded ground moisture (scaled from 1–10; driest to wettest) and distance to larid colony at nesting sites as habitat variables. We grouped estimated distance to larid colony into one of four classes: 0–10 m, 11–30 m, 31–60 m, and ≥61 m. To ensure habitat data were similar to the habitat at the time of nest initiation (and nest site selection), we included only nests less than 14 days old (from initiation to time of measurement) in the analysis.

Using the variables listed above, we compared habitat characteristics of nesting sites with characteristics of paired random sites to determine nest site selection by Greater Scaup. We excluded small stands of shrubs and trees from possible random site assignment because Greater Scaup generally do not nest in this type of habitat (Hilden 1964; Bengston 1970). Additionally, we included only terrestrial sites in the random pairings. We compared variables using Wilcoxon rank sum or *t*-tests, depending on the normality of the data. To determine whether Greater Scaup nesting sites had less cover when Greater Scaup were nesting in association with larids, we combined distance classes 1 and 2 (0–30 m = "close to") and classes 3 and 4 (31 to ≥61 m = "far from") to analyze distance from larid colonies. We used Wilcoxon rank sum tests to compare overhead concealment, vegetation height, distance to patch edge, and lateral cover.

Results

We found significant differences between nesting sites (n = 100) and random sites (n = 111) in 7 of 12 variables assessed (Table 1). Greater Scaup selected nesting sites with more sedge cover (P = 0.0001), less forb cover (P = 0.0001), and greater overhead concealment (P = 0.0001) than random sites. We found that distance to the edge of the patch of vegetation at nesting sites was smaller than at random sites (P = 0.0390) and that lateral cover at 0.0–0.25 m was greater at nests than at random sites (P = 0.0254). Nesting sites were also drier than random sites (P = 0.0001; Table1).

We found that Greater Scaup selected nest locations closer to larid colonies (P = 0.0001) than random sites (Table 1). When we compared sites close to and far from larid colonies, we found that nests closer (≤30 m) had significantly more overhead concealment (P = 0.0234), were located in shorter vegetation (P = 0.0080), were closer to the edge of the patch of vegetation (P = 0.0176), and had less lateral cover at 0.51–1.0 m (P = 0.0001) than nests >30 m from larid colonies (Table 2).

Discussion

Studies in traditional breeding areas suggest that Greater Scaup tend to nest in clumps or patches of vegetation in open areas or with openings nearby (Hilden 1964; Weller et al. 1969; Bengsten 1970). During our study, Greater Scaup on Grassy Island selected sites that provided overhead concealment, provided more vegetation lateral cover at 0.0–0.25 m, and were closer to the edge of the patch of vegetation or opening. Waterfowl may select sites with overhead concealment as an anti-predator adaptation (Choate 1967; Guyn and Clark 1997), for favourable micro-climatic conditions (Gloutney and Clark 1997), or a combination of both. Conversely, Hilden (1964) reported that at Valassaaret, Finland, between 58% and 84% of Greater Scaup nests were half or completely exposed, and suggested this was a relic from nesting in tundra regions and could vary geographically.

Greater Scaup have been found to nest in grass, sedge, forb, and shrub habitats (Hilden 1964; Weller et al. 1969; Bengtson 1970). However, forb cover did not appear as desirable nesting cover for Greater Scaup on Grassy Island during our study. Forbs did not mature until late in the nesting season (W. A. Smith, personal observation), and they may not have provided adequate cover during the nest initiation period. Tatman et al. (2009) reported significantly lower temperatures and increased precipitation during the late incubation, hatching, and early brood rearing periods on Grassy Island in 1996, and these conditions could have had an impact on vegetation growth during our study. Meta-analysis striated among Greater Scaup breeding regions may expose nesting vegetation preferences.

We found that ground moisture was a significant predictor of nesting sites selected by Greater Scaup. Greater Scaup likely selected dry sites because it was possible for hens to control the thermal environment of the eggs (which is critical to the development of embryos) (Afton and Paulus 1992). Additionally, by selecting dry nesting sites, hens would also reduce the risk of nests being flooded by changing water levels (the Saint John River is tidal at Grassy Island).

Greater Scaup nesting sites on Grassy Island were often associated with larid nesting sites. Other studies have found associations between nesting Greater Scaup and larids (Hilden 1964; Weller et al. 1969; Fournier and Hines 2001). Nesting associations have also been reported between larids and Lesser Scaup (*Aythya affinis*; Vermeer 1968), Tufted Ducks (*Aythya fuligula*; Newton and Campbell 1975), Redheads (*Aythya americana*) and Canvasbacks (*Aythya valisineria*; Featherstone 1975), suggesting that these relationships may be common among members of the genus *Aythya*. Although large gulls may be predators of waterfowl

Table 1. Mean characteristics of Greater Scaup nesting sites (n = 100) and random sites (n = 111) on Grassy Island, New Brunswick, mean for 1995 and 1996 combined.

Habitat characteristic	Nesting site	Random site	P
Grass cover (1–6)[a]	3.18	3.42	0.3744
Sedge cover (1–6)[a]	3.12	1.56	0.0001
Forb cover (1–6)[a]	1.69	2.64	0.0001
Overhead concealment (1–4)[b]	3.339	2.43	0.0001
Height (m)	0.80	0.74	0.4646
Distance to patch edge (m)	1.12[f]	1.74[g]	0.0390
Ground moisture (1–10)[c]	4.32	6.04	0.0001
Lateral cover (0.0–0.25 m) (1–5)[d]	4.99	4.85	0.0254
Lateral cover (0.26–0.50 m) (1–5)[d]	4.55	4.30	0.4208
Lateral cover (0.51–1.0 m) (1–5)[d]	2.33	2.61	0.2605
Lateral cover (1.1–1.5 m) (1–5)[d]	1.09	1.16	0.2197
Distance to larid colony (1–5)[e]	2.65	3.59	0.0001

[a]Measured within 0.25 m^2 of nest; class 1 = 0–5%, 2 = 6–25%, 3 = 26–50%, 4 = 51–75%, 5 = 76–95%, 6 = 96–100% (Daubenmire 1959).
[b]Portion of nest concealed when viewed from above; class 1 = 0–25%, 2 = 26–50%, 3 = 51–75%, 4 = 76–100% (Choate 1967).
[c]Scaled 1–10, from driest to wettest.
[d]Portion of a layer of vegetation profile board concealed at a distance of 10 m; class 1 = 0–20%, 2 = 21–40%, 3 = 41–60%, 4 = 61–80%, 5 = 81–100% (Nudds 1977; Krasowski and Nudds 1986).
[e]Distance to nearest larid colony; class 1 = 0–10 m, 2 = 11–30 m, 3 = 31–60 m, 4 = ≥61 m.
[f]n = 99
[g]n = 110

Table 2. Vegetative characteristics of Greater Scaup nesting sites on Grassy Island, New Brunswick, that were close to (≤30 m) and far from (>30 m) larid nests, mean for 1995 and 1996 combined.

Habitat characteristic	Nesting site		
	Close to larids (≤30 m) (n = 47)	Far from larids (>30 m) (n = 52)	P[a]
Overhead concealment (1–4)[c]	3.60	3.23	0.0234
Height (m)	0.72	0.86	0.0080
Distance to patch edge (m)	0.73	1.50[b]	0.0176
Lateral cover (0–0.25 m) (1–5)[d]	4.98	5.00	0.3023
Lateral cover (0.25–0.5 m) (1–5)[d]	4.21	4.85	0.0001
Lateral cover (0.5–1.0 m) (1–5)[d]	2.09	2.54	0.0714
Lateral cover (1.0–1.5 m) (1–5)[d]	1.02	1.15	0.3553

[a]P values from a Wilcoxon rank sum test.
[b]n = 51
[c]Portion of nest concealed when viewed from above; class 1 = 0–25%, 2 = 26–50%, 3 = 51–75%, 4 = 76–100% (Choate 1967).
[d]Portion of a layer of vegetation profile board concealed at a distance of 10 m; class 1 = 0–20%, 2 = 21–40%, 3 = 41–60%, 4 = 61–80%, 5 = 81–100% (Nudds 1977; Krasowski and Nudds 1986).

nests and ducklings (Dwernychuk and Boag 1972; Swennen 1989; Walker and Lindberg 2005), management and conservation of larids—preferentially smaller gulls or terns that do not prey on eggs or ducklings—may be useful to maintain local nesting duck populations.

Nesting in open habitat by colonial birds is believed to be an anti-predator strategy which allows the birds to observe approaching predators and allows for the aggressive and communal defense of nests, as in larids (Dyrcz et al. 1981). Waterfowl and other birds have been found to use relatively open habitats with reduced cover when nesting with larids (Hilden 1965; Featherstone 1975; Gerell 1985). Our study found that Greater Scaup nesting sites near larids were closer to the edge of the patch of vegetation or were in an opening with shorter vegetation and less lateral cover; however, these sites had greater overhead concealment than nests further from larids.

Differences between this study and others may be due to sampling techniques. Gerell (1985) did not differentiate between overhead and lateral cover, using only a single subjective measurement of concealment (i.e., poor, fair, good). Ultimately, nesting association

with larids and subsequent nesting success must be assessed on a site-by-site basis,[1] because larids can serve as a predator of Greater Scaup eggs or they can lessen the effects of other predators (Flint et al. 2006).

Lastly, an important factor affecting our nesting results was the presence of cattle grazing on Grassy Island during the study period. Moderate grazing likely shaped the vegetative structure of the island and affected Greater Scaup nesting. The duration of our study prevented us from identifying the magnitude of the effect of grazing on nest site selection; however, the presence of grazing should be recognized in ecological or conservation implications generated from our study.

We found that habitat characteristics were important predictors of Greater Scaup nesting sites at Grassy Island, New Brunswick; we also found evidence that Greater Scaup selected nesting sites near larid colonies and that nest site habitat of Greater Scaup nesting near larids was different from the habitat of those nesting further away. When conducting nest site selection studies, researchers should be aware of the presence of other species and their potential influence on the behavior and nesting patterns of the subject species.

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Literature Cited

Afton, A. D., and **S. L. Paulus.** 1992. Incubation and brood care. Pages 62-108 *in* Ecology and management of breeding waterfowl. *Edited by* B. D. J. Batt, A. D. Afton, M. G. Anderson, C. D. Ankney, D. H. Johnson, J. A. Kadlec, and G. L. Krapu. University of Minnesota Press, Minneapolis.

Bellrose, F. C. 1980. Ducks, geese and swans of North America. Stackpole Books, Harrisburg.

Bengtson, S. A. 1970. Locations of nest-sites of ducks in Lake Myvatn area, north-east Iceland. Oikos 21: 218-229.

Bengtson, S. A. 1972. Reproduction and fluctuations in the size of duck populations at Lake Myvatn, Iceland. Oikos 23: 35-58.

Choate, J. S. 1967. Factors influencing nesting success of eiders in Penobscot Bay, Maine. Journal of Wildlife Management 31: 769-777.

Daubenmire, R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33: 43-64.

Dwernychuk, W., and **D. A. Boag.** 1972. How vegetative cover protects duck nests from egg-eating birds. Journal of Wildlife Management 36: 955-958.

Dyrcz, A., J. Witkowski, and **J. Okulewicz.** 1981. Nesting of 'timid' waders in the vicinity of 'bold' ones as an antipredator adaptation. Ibis 123: 542-545.

Featherstone, J. D. 1975. Aspects of nest site selection in three species of ducks. Ph.D. dissertation, University of Toronto, Toronto.

Flint, P. L., J. B. Grand, T. F. Fondell, and **J. A. Morese.** 2006. Population dynamics of greater scaup breeding on the Yukon-Kuskokwim Delta, Alaska. Wildlife Monographs 162: 1-22.

Fournier, M. A., and **J. E. Hines.** 2001. Breeding ecology of sympatric greater and lesser scaup (*Aythya marila* and *Aythya affinis*) in the subarctic Northwest Territories. Arctic 54: 444-456.

Gerell, R. 1985. Habitat selection and nest predation in a common eider population in southern Sweden. Ornis Scandinavica 16: 129-139.

Gloutney, M. L., and **R. G. Clark.** 1997. Nest-site selection by mallards and blue-winged teal in relation to microclimate. Auk 114: 381-395.

Guyn, K. L., and **R. G. Clark.** 1997. Cover characteristics and success of natural and artificial duck nests. Journal of Field Ornithology 68: 33-41.

Hilden, O. 1964. Ecology of duck populations in the island group of Valassaaret, Gulf of Bothnia. Annales Zoologici Fennici 1: 153-279.

Hilden, O. 1965. Habitat selection in birds: A review. Annales Zoologici Fennici 2: 53-75.

Johnsgard, P. A. 1975. Waterfowl of North America. Indiana University Press, Bloomington.

Johnson, D. H. 1980. The comparison of usage and availability measurements for evaluating resource preference. Ecology 61: 65-71.

Koskimies, J. 1957. Terns and gulls as features of habitat recognition for birds nesting in their colonies. Ornis Fennica 34: 1-6.

Krasowski, T. P., and **T. D. Nudds.** 1986. Microhabitat structure of nest sites and nesting success of diving ducks. Journal of Wildlife Management 50: 203-208.

Long, R. J. 1970. A study of nest site selection by island nesting anatids in central Alberta. M.Sc. thesis, University of Alberta, Edmonton.

McAlpine, D. F., S. Makepeace, and **M. Phinney.** 1988. Breeding records of Greater Scaup, *Aythya marila*, in New Brunswick. Canadian Field-Naturalist 102: 718-719.

Newton, I., and **C. R. G. Campbell.** 1975. Breeding of ducks at Loch Leven, Kinross. Wildfowl 26: 83-102.

Nudds, T. D. 1977. Quantifying the vegetative structure of wildlife cover. Wildlife Society Bulletin 5: 113-117.

Orians, G. H., and **J. F. Wittenberger.** 1991. Spatial and temporal scales in habitat selection. American Naturalist 137, supplement, pages S29-S49.

Smith, W. A. 1999. Nest site selection and nest fate of Greater Scaup on Grassy Island, New Brunswick: the influence of habitat, larids and weather. M.S. thesis, University of New Brunswick, Fredericton.

Swennen, C. 1989. Gull predation upon eider *Somateria mollissima* ducklings: destruction or elimination of the unfit? Ardea 77: 21-45.

Tatman, N. M., J. T. McRoberts, W. A. Smith, W. B. Ballard, F. P. Kehoe, and **T. G. Dilworth.** 2009. Nest success

[1]Nesting success at Grassy Island, New Brunswick, was 61% and 21% in 1995 and 1996, respectively (Tatman et al. 2009).

and duckling survival of Greater Scaup, *Aythya marila*, at Grassy Island, New Brunswick. Canadian Field-Naturalist 123: 323-328.

Vermeer, K. 1968. Ecological aspects of ducks nesting in high densities among larids. Wilson Bulletin 80: 78-83.

Walker, J., and **M. S. Lindberg.** 2005. Survival of scaup ducklings in the boreal forest of Alaska. Journal of Wildlife Management 69: 592-600.

Weller, M. W., D. L. Trauger, and **G. L. Krapu.** 1969. Breeding birds of the West Mirage Islands, Great Slave Lake, N.W.T. Canadian Field-Naturalist 83: 344-360.

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