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Author: Lauff, Randolph F.

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First nest records of the Boreal Owl *Aegolius funereus* in Nova Scotia, Canada

Randolph F. Lauff¹

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A nine year search for the first nesting Boreal Owls *Aegolius funereus* in Nova Scotia, Canada culminated in the discovery of two nests in Cape Breton Highlands National Park of Canada in 2004. In 2005, one nest north of the Park and another nest on mainland Nova Scotia were also found. Nest start dates ranged from 20 March to 3 June over the two years; only the nest with the latest start date failed entirely, the other nests fledged two or three young each. Nests were in boreal forest, with Balsam Fir *Abies balsamea* and White Birch *Betula papyrifera* normally dominating. These findings extend the known breeding distribution of the Boreal Owl eastwards by approximately 450 km at the latitude found.

Key words: Boreal Owl, *Aegolius funereus*, Nova Scotia, Canada, nest

¹Department of Biology, St. Francis Xavier University, Antigonish, Nova Scotia B2G 2W5 Canada (rlauff@stfx.ca)



INTRODUCTION

The Boreal Owl *Aegolius funereus* is a small, often quiet, nocturnal owl whose North American breeding range was for the longest time thought to be restricted to much of northern Canada and parts of Alaska (Macoun & Macoun 1909, Taverner 1949). Its cryptic habits have led to late documentation of breeding even within its purported range. For example, the Boreal Owl was only first documented to breed in Ontario, Canada in 1975 (Bondrup-Nielsen 1976). Within the Maritime Provinces of Canada, the only previous nestings have been reported from the Grand Manan Island group in New Brunswick (Lloyd 1925, Tufts 1925, and records by Robie Tufts (1928–33) on file with the Maritimes Nest Records Scheme, c/o Canadian Wildlife Service, Sackville, N.B.). There have been no breeding records reported from Prince Edward Island or Nova Scotia.

Since 1979, the species' known breeding range has been expanded southward into the northern contiguous states of the United States of America; the first report was from Minnesota (Eckert & Savaloja 1979), with subsequent reports from the Rocky Mountain states, south to the northern-most aspect of New

Mexico (Hayward & Garton 1983, Palmer & Ryder 1984, Holt & Ermatinger 1989, Stahlecker & Duncan 1996, Stepniewski 1996). In the eastern states, the first breeding was documented in the White Mountains of New Hampshire in 2001 (Mirick 2002).

As in other areas, the perceived status of the Boreal Owl in Nova Scotia has undergone shifts since the earliest records, but for most of the 1900s it has been classified as a rare winter visitor (Tufts 1986). Early documentation is sketchy, with the status varying from 'resident inland' (Blakiston & Bland 1856) to 'rare' (Jones 1879, Downs 1888); never has a nest been mentioned in those reports. Only when the first atlas of breeding birds was initiated in the Maritime Provinces did birders make a concerted effort to listen for courtship calls. Although a few singing males were heard in the extreme north of Nova Scotia, no further evidence of breeding was collected (Dalzell 1989); the species was thus assigned a ranking of 'probable breeder' (Erskine 1992). One late spring record has been published (Lauff 1997); other than that owl being in appropriate habitat at the correct time of year, no further evidence of breeding had been recorded until the establishment of a regimented nocturnal owl sur-

vey. Zero to 11 courtship calls per year (0–1.57 owls per route) have been detected in the nocturnal owl surveys in each of the Maritime Provinces since the survey's inception in 2000 (Whittam unpubl. data, Myers unpubl. data, Hart & Doucette unpubl. data).

In this paper, the habitats of the first four documented Boreal Owl nest sites in Nova Scotia are described; the phenology of the nestings and the possibility of bigyny are also addressed.

METHODS

General site descriptions

Most of the work for this project was done in the Cape Breton Highlands National Park of Canada (CBHNP) and surrounding areas (Fig. 1). Elevations range from sea level to over 500 m, much of which is covered by boreal forest, though Acadian Forest, bogs and barrens exist as well. Much of this site underwent a population explosion of Spruce Budworm *Choristoneura fumiferana* in the late 1970s and 1980s (MacLean & Ostaff 1989), resulting in areas with numerous snags and coarse woody debris. Despite the budworm's effects, Balsam Fir *Abies balsamea* was the dominant tree at all sites, although White Birch *Betula papyrifera* was common as well. In contrast, the site on mainland Nova Scotia was dominated by post-silviculture, white spruce-dominated forests, interspersed with pockets of boreal forest, especially near the Atlantic shore; this site is richly endowed with small lakes and numerous barrens. Elevations at nest sites were provided by Parks Canada, based on positions acquired by a GPS unit (Garmin GPS 12, Olanthe, Kansas).

Nest boxes

Nest boxes were used to facilitate the documentation of Boreal Owl nestings; boxes were typically made of rough-cut pine, and followed the design of Korpimäki (1985); this design was previously found to be useful for the North American subspecies of Boreal Owls (*Aegolius funereus richardsoni*, Hayward *et al.* 1992). Most boxes were erected at a height of approximately 4.0 m, which corresponded to the top of the collapsible, backpack-mounted ladder (QuickStep, Armor Holdings, Inc.) needed for backcountry work, though a range of box heights from 2.5 to 8.0 m was used depending on the nature of the tree. The hole was oriented to allow for a clear flight path to the box, however a direction between south and east was chosen when possible to avoid the cold northerly and westerly winds which could drive snow or rain into the boxes. Whether this

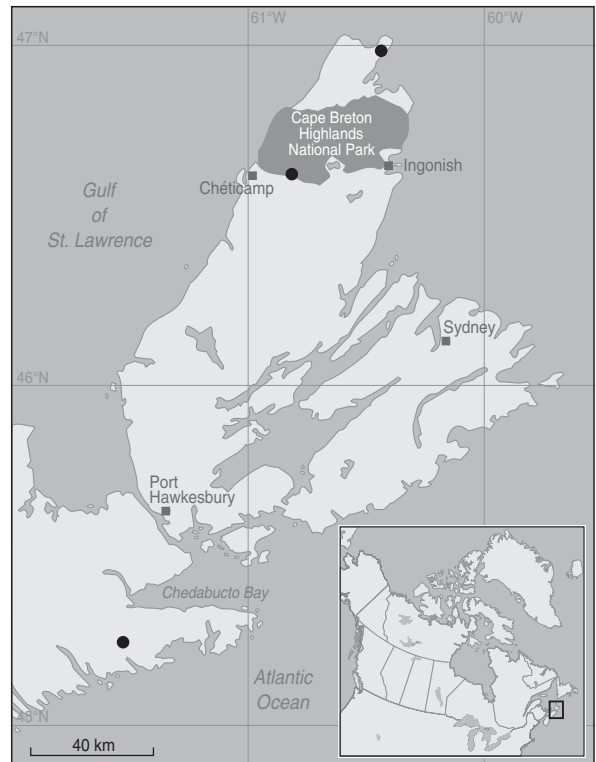


Figure 1. The distribution of four Boreal Owl nests in Nova Scotia. The two nests from 2004 were both found at the marker (●) on the south border of Cape Breton Highlands National Park. The other two markers indicate the nests from 2005.

was necessary or not is unclear since Dobkin *et al.* (1995) have shown that in some species of cavity nester, hole orientation is governed more by the direction to foraging areas than by other factors.

Nest box sites were chosen by qualitatively judging whether the tree spacing would allow an owl to freely fly through the area, and whether the trees were large enough to naturally have suitably-sized cavities in them. The type of forest was not a factor in ruling out a potential site since habitat preferences of the owl was trying to be determined, i.e. forested lands of many types were sampled (e.g. Boreal, Acadian, plantation, virgin). Nest boxes were checked for occupancy at least twice per season, commencing in late March. Deep snow, particularly the irregular, wide drifts of the highlands on Cape Breton Island, often prevented access to many nest boxes until late May or even mid-June. Once the active nests were discovered, visits were made approximately once per week, when practical. At each visit to an occupied nest, the number of eggs and chicks were recorded. Chicks were weighed and their wing was measured in order to predict when fledging would

occur, and more importantly for this study, to back-calculate to the nest commencement date; an incubation period of 29 days was used (Hayward & Hayward 1993).

Studies utilizing artificial nests have come under scrutiny (Møller 1989, 1992, Mezquida & Marone 2003), with those authors justifiably demanding tighter interpretation of studies utilizing artificial nests. This study acknowledges the biases and interpretations will be made in light of them.

RESULTS

By early June 2004, all sites had been visited and most of the nest boxes checked twice. By 11 June 2004, the snow had cleared sufficiently to allow access to the interior highlands of the Cape Breton Highlands. On that date, two nest boxes, spaced 500 m apart, were found occupied by Boreal Owls (Fig. 1). The nest boxes were in the Steep Slopes District of the Highlands Theme Region (Davis & Browne 1996) at elevations of 440 m (Box 29) and 420 m (Box 39). Box 29 was mounted 3.0 m high on a Black Spruce *Picea mariana*, with the hole facing southeast, Box 39 was mounted 5.0 m high in a White Birch, facing south. Balsam Fir was dominant at both nest sites, almost exclusively so at Box 29; White Birch made up most of the remaining trees around Box 39.

On the day of discovery, the nest in Box 29 contained two very young chicks and two eggs, indicating a nest initiation date of approximately 10 May (Table 1). A third egg had hatched in Box 29 by the time of the second visit on 18 June; on the third visit (25 June) the final egg had still not hatched and was assumed to be sterile, so it was collected and deposited at the Nova Scotia Museum of Natural History, Halifax (catalogue number NSMNH 65728). Three well-developed chicks were present on 9 July, but all had presumably fledged prior to the last visit on 21 July.

Table 1. Nesting parameters of four Boreal Owl nests found in Nova Scotia, Canada, 2004 and 2005.

Box	Earliest possible nest start date	Number of eggs laid	Hatching success (%)	Fledging success (%)
19	2 May 2005	3	100	100
29	10 May 2004	4	75	100
39	1 June 2004	3	67	0
59	20 March 2005	4	100	50

The nest in Box 39 contained three eggs and no chicks on the day it was discovered. By 4 July 2004, two eggs had hatched; since the unhatched egg was still there five days later, it was assumed sterile, collected, and also deposited at the NSMNH (catalogue number NSMNH 65727). The nest initiation date was estimated to be 1 June (Table 1). This nest was depredated between 9 and 21 July.

On 11 May 2005, a nest was found in Box 19, near Bay St. Lawrence, Victoria County, Cape Breton Island, approximately 14 km north of the northern border of CBHNP (Fig. 1). Nest box 19 was also located in the Steep Slopes District of the Highlands Theme Region (Davis & Browne 1996) at an elevation of 330 m; the box was mounted 3.6 m high in a Balsam Fir, facing north. The forest was dominated by Balsam Fir, with White Birch being second-most abundant. On that first visit, the female was incubating three eggs. On 14 June, the nest had three half-grown chicks. On 27 June, three near-fledging chicks were still present. Due to logistical issues, this nest was only visited the three times.

The one nest on mainland Nova Scotia was found in Box 59 on 10 April 2005; this nest was located near the community of New Harbour, Guysborough County. Box 59 was located in the Canso Barrens district of the Granite Barrens theme region (Davis & Browne 1996), at an elevation of 65 m. When the nest in Box 59 was discovered, the female was incubating four eggs; on either 18 or 19 April, the first egg hatched, giving 20 March 2005 as the approximate nest initiation date (Table 1). The penultimate visit to the nest was on 19 May; two very large, active chicks were present (two had previously died in the nest) and appeared ready to fledge. On 24 May, the chicks were no longer present. Once again, the forest was dominated by Balsam Fir and White Birch. The box was mounted on a Balsam Fir, facing southeast. Due to impending silviculture operations, this nest box has since been removed.

DISCUSSION

Bondrup-Nielsen (1976) does list breeding records for Nova Scotia, however the three records referred to are undoubtedly the early New Brunswick records (Lloyd 1925, Tufts 1925); a search of the records from the Canadian Museum of Nature (the original source of Bondrup-Nielsen's information) revealed three New Brunswick records and no Nova Scotia records. The two nests (Boxes 29, 39) found in 2004 were the first two nests recorded in the province of Nova Scotia, and the first nests in all of the Maritimes in over 70 years since

Tufts (1926) reported nests from Grand Manan, New Brunswick. The nest in Box 59, found in 2005, was the first nest reported on mainland Nova Scotia. Although significant tracts of Boreal Forest, the species' typical habitat affiliation (Hayward & Hayward 1993), are lacking in Nova Scotia save for northern Cape Breton Island (Davis & Browne 1996), pockets do exist, mostly along a narrow strip bordering the Atlantic Ocean (pers. obs.).

The discovery of Boreal Owls nesting in Nova Scotia is largely unsurprising given the number of extensions of the species' known range reported in the last 30 years (e.g. Bondrup-Nielsen 1976, Eckert & Savaloja 1979). Some of these extensions have been nearby (e.g. New Hampshire, Mirick 2002), and results from the nocturnal owl surveys in the Maritimes have also suggested more widespread (but still uncommon) breeding here (B. Whittam 2005, unpubl. data; Myers 2001, unpubl. data; Hart & Doucette 2003, unpubl. data).

Nesting Habitat

In Newfoundland, Gosse & Montevecchi (2001) found Boreal Owls only in Balsam Fir stands greater than 80 years old. In contrast, Spruce Budworm defoliated a large area of the Cape Breton Highlands in the late 1970s and early 1980s, thus the oldest Balsam Fir at the nest boxes in this study were less than 30 years old. Nonetheless, Balsam Fir was the dominant tree species at all nest sites, though Red Maple, White Spruce *Picea glauca*, Yellow Birch *Betula alleghaniensis* and White Birch grew in the surrounding areas. If there truly is a predisposition to older Balsam Fir forests, then one would expect an increase in the local Boreal Owl population as the forest matures (assuming sufficient cavities are created, food is not limiting, etc.). Hakkarainen *et al.* (1996) found higher fledging success in forests with more than 30% clear-cut logged, relative to those with less. Similarly, spruce budworm created many openings in the forest of Cape Breton Highlands, resulting in the proliferation of herbaceous plants; these areas became suitable habitat for many small mammals, the major prey category of these owls.

In the western United States, where most North American Boreal Owl work has been done in the last two decades, nesting habitat is normally conifer-dominated forest, composed typically of Engelmann Spruce *P. engelmannii* and Subalpine Fir *A. lasiocarpa* (Baldwin & Koplín 1966, Palmer & Ryder 1984, Hayward & Hayward 1993). In northeast Minnesota, Boreal Owls utilize a variety of mature forest types for nesting, including those dominated by Trembling Aspen *Populus tremuloides* (Lane *et al.* 1987a,b). The first report of

nestlings from Washington state was surprisingly from a residential area in Pullman, Whitman Co. (Batey *et al.* 1980). The habitat there was considered by Stepniewski (1996) to be inconsistent with all previous accounts of Boreal Owl nesting habitat, but consistent with Northern Saw-whet Owl *Aegolius acadicus* breeding habitat, suggesting that an identification error had been made. Stepniewski himself reported Washington state's first nest from one of his nest boxes in a Lodgepole Pine *Pinus contorta* stand at 1900 m elevation (Stepniewski 1996).

Although the habitats where the owls in this study nested were broadly similar to other Boreal Owl nesting habitats in North America, the elevation (420–440 m) was much lower than those found in Idaho and Montana (normally higher than 1580 m), Colorado (normally higher than 3050 m, Hayward & Hayward 1993) and British Columbia (normally higher than 1500 m; Richard Cannings, pers. comm.). The only records of Boreal Owls breeding at lower elevations than those found in NS were the near-sea level sites from the Grand Manan Island group in the Bay of Fundy, off New Brunswick (Lloyd 1925, Tufts 1925).

Phenology

As this report only involves four Boreal Owls nests, the data should be interpreted as preliminary, and not necessarily indicative of the population as a whole. The Boreal Owl is typically an early nesting bird; previous studies in North America have shown nesting to commence as early as late March (Lane 1988) though Palmer (1986 in Hayward & Hayward 1993) reported a nest in Colorado starting on 1 June. The New Harbour nest (Box 59) commenced on 20 March, making it the earliest-documented nest in North America. Presumably, the milder climate in Nova Scotia relative to that in the Rocky Mountains allows for earlier commencement of nesting. Given that serial biandry is known in Boreal Owls (Haase & Schleper 1973, Kondratzki & Altmüller 1976) it would not be unreasonable to suggest that the nests in this study which commenced in May and June (boxes 19, 29 and 39) were second nests or replacement nests.

Bigyny

The closely-related and partially sympatric Northern Saw-whet Owl, which does not occur in Europe, has been shown to be both bigynous and trigynous (Marks *et al.* 1989), with nests being as close as 15 m apart. However, that study and all the European studies previously cited (except for Kondratzki & Altmüller 1976), also utilized artificial nest sites, which shows only that

bigyny *can* happen, not that it *does* happen under more natural conditions. Only Kondratzki & Altmüller (1976) have demonstrated that bigyny in Boreal Owls occurs under natural conditions; they also demonstrated serial biandry in that same study.

In all cases of bigynous Boreal Owls reported in Europe, the minimum distance between the two nests has not been less 650 m and averaged over 900 m (Kondratzki & Altmüller 1976, Carlson *et al.* 1987, Korpimäki 1994). Since the two nests found in 2004 during this study were approximately 500 m apart, this led to the hypothesis that a bigynous male was involved. The possibility of the two nests in this study being serviced by a single male is speculatively high; clearly though, the proof of this phenomenon must wait for another season.

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SAMENVATTING

Na een zoektocht van negen jaar werden in 2004 in het Cape Breton Highlands National Park de eerste twee broedgevallen van de Ruigpootuil *Aegolius funereus* voor Nova Scotia, Canada, vastgesteld. In 2005 werden nog twee broedgevallen geconstateerd, een ten noorden van het park en een op het vasteland van Nova Scotia. De datum van de eerste eileg van deze broedgevallen lag tussen 20 maart en 3 juni. Het laatste broedsel ging volledig verloren. De andere broedsels leverden elk 2–3 uitgevlogen jongen op. De broedplaatsen lagen in het boreale bos met Balsemspar *Abies balsamea* en Papierberk *Betula papyrifera* als dominante boomsoorten. Met deze vondsten wordt het bekende broedareaal van de Ruigpootuil op de breedtegraad van de vondsten 450 km naar het oosten uitgebreid.

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