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Ural Owls *Strix uralensis* at the border line: nesting places are not a limiting factor

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The Ural Owl *Strix uralensis* meets its westernmost distribution in Hedmark County, southeast Norway. Since 1979 we have provided the species with nest boxes in this region. A total of 80 nest boxes were put out in prime Ural Owl habitat, starting with 9 in 1979, 18 in 1982 and 53 in 1985. Two more nest boxes put up by others, and four made by ourselves, were later added, giving a total 86 nest-box localities. The nest boxes were checked up to 2004, when 28 nest boxes were moved to western ($n = 8$) and central ($n = 20$) Sweden. We have analysed the results for 25 seasons from 1980 to 2004. For comparison, the results for the 20 nest boxes in central Sweden for the seasons 2005–07 have been included. The Norwegian nest boxes offered a total of 1429 nest-box years. Since all boxes were not inspected each year, the total number of observation-years was 847 (59.3%). Ural Owls only used 4 nest boxes for breeding, occupied for the first time 1, 1, 1 and 10 years respectively after the boxes were put up. The four boxes were used for a total of 19 breedings. In central Sweden, 9 out of 20 nest boxes were used by Ural Owls for breeding ($n = 6$) or breeding initiations ($n = 3$), for a total use of 8 of 56 nest-box years. The Ural Owl nest-box use in Norway (1.3% of nest-box years) is very low compared to central Sweden (14.3% of nest-box years). Telemetry studies of Ural Owl hunting behaviour in 1989–90 (unpubl.) showed that the nest boxes were indeed placed in prime Ural Owl habitat. Despite this, there was no increase in Ural Owl nest-box breeding in Norway during the study period. We conclude that Ural Owls are not limited by nest sites at the species' westernmost borderline and hypothesize that food availability during winter is a more likely factor limiting the species.

Key words: nest, nest-box study, limiting factors, distribution, edge population, Ural Owl, *Strix uralensis*, Norway

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INTRODUCTION

The Ural Owl *Strix uralensis* is distributed from Japan to Fennoscandia (del Hoyo *et al.* 1999), and meets its westernmost range boundary in southeastern Norway (Haftorn 1971, Solheim & Bjørnstad 1985, Solheim 1994a). In the 20th century little was known about the

species' breeding habits and distribution in Norway (Haftorn 1971). In 1957, Ural Owls bred for the first time in artificial nest boxes put up in Hedmark County, southeast Norway (Hagen 1968). Similar nest boxes were then put out in the same county by several ornithologists, however with negative results. In 1979 we started a nest-box project for Ural Owls, with 9 nest

boxes put out in eastern Hedmark County. After visiting the Ural Owl study areas of Arne Lundberg (Uppsala, Sweden), and Pertti Saurola (Tavastland, Finland) in 1981, we questioned if the low numbers of breeding Ural Owls in Norway was due to lack of appropriate breeding sites. Inspired by the results from these two countries (Lundberg 1974, 1981, Pertti Saurola pers. comm., Saurola 2007), 18 more nest boxes were added in 1982, and finally 53 in 1985 (Solheim 1994b). Some replacement nest boxes were later added, and a few formerly unknown nest boxes included, resulting in a total of 86 nest-box localities.

METHODS

Although the first Norwegian Ural Owl nest boxes were made as imitations of open tree stumps (Hagen 1968), our nest boxes were made as ordinary type nest boxes with a roof, and an 18 cm diameter entrance hole in the front (Solheim 1986, Mikkola 1983). The first 9 were hollow logs with bottom and roof added, while the rest were square-type boxes of wood. This is the same type as used in most areas in Europe where nest boxes have been put out for Ural Owls. The nest boxes were placed 4–6 m above ground in coniferous forests along creeks, bogs, lakes and rich patches of moist woodlands, similar to the localities where Hagen (1968) made contact with the first nest-box breeding Ural Owls in Norway. The nest boxes were spaced out 1–3 km apart.

Nest boxes were inspected using a ladder to climb up to the front of the nest box. Usually the nest-box roof was removed, clearly exposing any signs of activity from visits by birds, mammals or insect nests (e.g. wasps *Vespula* sp.). We inspected nest boxes in late April or early May, and occupied nest boxes again in late May. Not all nest boxes were inspected each year, resulting in fewer observation-years than the total number of possible nest-box years. In 2004 the oldest nest boxes had been up for 25 seasons. A total of 60 nest boxes were still hanging up at this time. We relocated 28 of these further east into western ($n = 8$) and central ($n = 20$) Sweden (Fig. 1). We analysed the



Figure 1. Location of the Ural Owl nest-box study sites in Norway and Sweden, showing Counties 1: Hedmark, 2: Värmland, and 3: Dalarna.

results for the 25 seasons from 1980 to 2004 in Norway, and for comparison, the 20 nest boxes in central Sweden for the 2005–07 seasons.

RESULTS

The Norwegian nest boxes offered a total of 1429 nest-box years. We were not able to inspect all nest boxes each year, thus, we have data for 847 observation-years (59.3%). Of these, 751 inspections resulted in an empty nest box. Judging from the lack of signs of nest-box use, we estimated a total of 1327 (of 1429) empty nest-box years. Nest boxes were used as nesting places by five bird species, and as a denning site by one mammal (the Red Squirrel *Sciurus vulgaris*), and by wasps *Vespula* sp. for summer nest building (Table 1). A few boxes were

Table 1. Nest-box years with occupation of different species, from a total of 1429 available nest-box years.

	Tengmalm's Owl	Ural Owl	Kestrel	Red Squirrel	Ducks ^a	Wasps <i>Vespula</i> sp.
Nest boxes	16	4	1	21	11	43
Nest-box years	19	19	2	37	20	-

^aMerganser and Goldeneye *Bucephala clangula*.

occasionally used by the Great Tit *Parus major* and Redstart *Phoenicurus phoenicurus* (not included in Table 1).

Only four nest boxes were used for breeding by Ural Owls, resulting in a total of 19 Ural Owl nest-box years. This is the same degree of use that we recorded for Tengmalm's Owls *Aegolius funereus*, but with a striking difference in location fidelity (Table 1). The four nest boxes used by Ural Owls were first occupied 1, 1, 1 and 10 years after they were put up, respectively, and used for breeding in 1, 1, 5 and 10 seasons.

In late 2004, 16 nest boxes were moved to the Dalarna County in central Sweden. Four more were moved the next year, giving a total of 20 nest boxes. After three seasons (2005–07), 9 of these 20 nest boxes had been used by Ural Owls for breeding ($n = 6$) or breeding initiations ($n = 3$), with a total of 8 Ural Owl nest years of 56 nest-box years (Table 2). No Tengmalm's Owls used the central Swedish nest boxes during these three years, but Kestrels bred in three nest boxes, and Mergansers *Mergus merganser* in one.

DISCUSSION

The coniferous taiga forest in east Hedmark differs from the Ural Owl forests in Värmland and Dalarna in several aspects. The logging history in Norway and Sweden also differs. Logging intensified in Norway several hundred years earlier than in Sweden, removing the oldest and largest pine trees *Pinus sylvestris* from large areas (Nyhus & Mæhlen 2003). Forest fires are important in creating dead pine trees that eventually evolve into tree stumps suitable as breeding places for Ural Owls. Such forest fires have been less frequent in the owls range in Norway than in Swedish areas (Nyhus & Mæhlen 2003). Historically, these differences may have played a major role in limiting the Ural Owls' westward expansion into southcentral Norway. Since 1980 we found only three Ural Owl nests in Norway in natural nest sites, all were in Aspen *Populus tremula* stumps. If the lack of suitable nest sites did play some role in limiting the species range in Norway before 1980, we would have expected to see an increase in the distribution and number of breeding pairs after new nest boxes were provided, as was seen in Sweden and Finland (Mikkola 1983). Interestingly, nest boxes in a dense Ural Owl population north of Uppsala, Sweden rarely became occupied before reaching an age of eight years or more (Arne Lundberg, pers. comm.). Our nest boxes ranged from 19 to 25 years of age, and would have extended over several Ural Owl generations.

Although the nest box that was used for the longest time span was first occupied after 10 years, the three other Norwegian nest boxes were occupied by Ural Owls the very first year they were available. Also, owls occupied the central Sweden nest boxes fairly quickly.

Since 2000, G. Nyhus and A. Mæhlen have expanded the Ural Owl nest-box area from eastern Hedmark into neighbouring Värmland County in Sweden (Nyhus & Mæhlen 2003). They have also updated and inspected most of the Swedish nest boxes that were put up in Värmland by Swedish ornithologists in the early 1980s. The total number of nest boxes in the joined projects is now around 250 (Nyhus et al. 2005). The region called Norra Ny was well documented as having a dense Ural Owl population 25–30 years ago (Svensson et al. 1999). After the nest-box updating, there are still 15–20 breeding pairs in this region (Gunnar Nyhus pers. comm.). Nyhus and Mæhlen (2003) speculate that the Norwegian Ural Owl localities may be too far away from this core population to reach by owls dispersing from Sweden. Although most Ural Owls show a fairly short natal dispersal, there are several records of Ural Owls moving 100–150 km from their hatching site (Saurola 2007). A most striking example was revealed in 2006, when a new female turned up breeding in our most-used nest box in Norway. This female was ringed

Table 2. Ural Owl occupation of nest boxes in Dalarna, central Sweden, 2005–07.

	2005	2006	2007
Number of nest boxes	16	20	20
Number of breeding Ural Owls	2	2	4
Breeding/breeding attempt by Ural Owls; accumulated	2	7	9
Percentage nest boxes used by Ural Owls	12.5	35	45

Table 3. Ural Owl occupation of nest boxes in east Norway, Hedmark County, 1979–2004, and in central Sweden, 2005–2007.

	Norway	Sweden
Nest-box years	1429	56
Ural Owl years	19	8
Percentage	1.3	14.3
Nest boxes used for breeding	4	6
Percentage	4.7	30

as a juvenile in 1999, close to the easternmost nest box in our central Sweden study area, a dispersal distance of 128 km.

The marked difference in the degree of owl occupation between southeastern Norway and central Sweden (Table 3), underscores that even an excess of suitable nesting places in prime habitats is not enough to expand the Ural Owl's range westwards. When we did not see an immediate increase in the number of nest-box inhabitants, we suspected that availability of food was a more likely limiting factor, especially during winter (Solheim & Bjørnstad 1985). In 1989 we thus equipped three adult Ural Owls with radio transmitters to follow their hunting habits during winter (Solheim, Sonerud & Strøm unpubl.). Although we soon learned that this species was very difficult to approach for behavioural studies, we acquired very good data on the habitat types that the owls used for hunting. These observations showed that most of our Ural Owl nest boxes were indeed placed in prime Ural Owl hunting habitat. If the owls were there, they most surely would have found a majority of our nest boxes during the 25 years that passed since the first nest boxes were put up.

We hypothesize that the lack of food, and especially during winter, is the most likely limiting factor for the Ural Owl's westernmost range boundary in Norway. In the summer of 2007, Gunnar Nyhus and Geir Sonerud equipped 20 Ural Owls with radio transmitters (17 in Värmland, 3 in Hedmark). This may give new opportunities to determine the species' winter habits and diet.

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SAMENVATTING

Het broedareaal van de Oeraluil *Strix uralensis* bereikt haar westgrens in Hedmark in het zuidoosten van Noorwegen. Vanaf 1979 zijn hier in geschikt habitat (ongepubliceerd telemetrieonderzoek in 1989–90) 80 nestkasten voor de soort ter beschikking gesteld (9 in 1979, 18 in 1982 en 53 in 1985). Zes nestkasten werden later toegevoegd, hetgeen een totaal oplevert van 86 kasten. De nestkasten werden tot en met 2004 geïnspiceerd, waarna 8 kasten naar West- en 20 kasten naar Midden-Zweden werden overgebracht. De Noorse broedresultaten van 1980 tot en met 2004 worden vergeleken met die van de nestkasten in Midden-Zweden in 2005–07. De nestkasten in Noorwegen boden gedurende 1429 nestkastjaren broedgelegenheid aan Oeraluilen. Doordat niet alle kasten elk jaar werden gecontroleerd, waren er gegevens voor 847 (59,3%) nestkastjaren voorhanden. Oeraluilen gebruikten slechts vier nestkasten (drie één jaar en één tien jaar na ophangen van de kasten). Dit leverde in totaal 19 broedsels op. In Midden-Zweden waren negen van de 20 nestkasten bezet door Oeraluilen. Dit leverde zes broedsels en drie broedpogingen op tijdens acht van de 56 beschikbare nestkastjaren. De bezetting van de kasten in Noorwegen (1,3% van de nestkastjaren) is erg laag in vergelijking met die in Midden-Zweden (14,3% van de nestkastjaren). Ondanks het feit dat de nestkasten in Noorwegen in geschikt habitat waren opgehangen, was er tijdens de onderzoeksperiode geen toename in nestkastbezetting. Er wordt daarom geconcludeerd dat de Oeraluil aan de westgrens van zijn verspreidingsgebied niet beperkt wordt door de broedgelegenheid. Verondersteld wordt dat de voedselbeschikbaarheid in de winter hier de voornaamste beperkende factor is.

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