

## Migrating Lesser Spotted Woodpeckers *Dendrocopos minor* along the coast of southern Norway: where do they come from?

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The Lesser Spotted Woodpecker (*Dendrocopos minor*) is a partial migrant in Fennoscandia, where migratory autumn irruptions outside the regular breeding areas occur in some years. Little is known about the migration of this species along the coast of southern Norway, but such migrants might have an eastern origin. We evaluated this hypothesis, and the possibility that birds come from a more local population, by correlating the numbers ringed at Lista Bird Observatory with breeding-population indices from three regions: Sweden, Møre og Romsdal and Agder. Overall, 99 birds were trapped and ringed at Lista in autumn during 1989–2008 (median = 3.5, range 0–19). We found no correlation between numbers caught at Lista and the population indices from Møre og Romsdal. There was, however, a significant positive correlation between Lista numbers and the population index from the local Agder region. Breeding-population indices from Sweden were acquired from (1) long-term (1975–2009) summer point counts in observer-chosen routes, and (2) a combination of point counts and line transects along fixed routes systematically distributed across the country (1998–2008). Population trends differed somewhat between these two methods, the latter indicating an increasing population size whereas the former showed a more stable situation. The fixed-routes data were positively correlated with Lista catch numbers, whereas the indices from summer point counts were not. These results suggest that migrating Lesser Spotted Woodpeckers captured in autumn at Lista Bird Observatory may come from an extensive area in Scandinavia, including more local regions. There was no sex bias in the captured birds, but 98% were in their first year. Hence, migration intensity probably reflects reproductive output in source populations.

## 1. Introduction

Seasonal movements between breeding and wintering areas are common in birds, but the type of movements may vary both inter- and intra-specifically (Terrill & Able 1988, Alerstam 1990, Newton 2008). Species may be annual (or obligate) migrants in which the timing, direction and distance moved are mainly internally controlled and vary little between both individuals and years. In contrast, movements in partial (or facultative) migrants are to a greater extent responses to external stimuli, such as changes in food supply and population size. Such migration may vary greatly between years with regard to timing, distance and the proportion of birds that move. Studying movements of partial migrants may thus not only provide information on migratory behaviour, but also on aspects related to population ecology.

The Lesser Spotted Woodpecker (*Dendrocopos minor*) is a relatively common species in Fennoscandia, but some populations have previously decreased considerably (BirdLife International 2004). During the last 10–15 years, however, some populations have stabilised or even increased in Fennoscandia, and the species was therefore recently removed from national red lists in Finland (Mikkola-Roos *et al.* 2010) and Norway (Kålås *et al.* 2010). The Lesser Spotted Woodpecker is a partial migrant in northern Europe where populations sometimes show nomadic and irruptive movements into the southern part of the breeding range (Cramp 1985). Knowledge about the migratory pattern of Fennoscandian Lesser Spotted Woodpeckers (nominate subspecies) is scant. The species is presumably largely resident in Norway and Sweden, but at least some individuals from northern populations tend to migrate southwards in autumn (Hågvær & Hogstad 1991, Cramp 1985, Fransson *et al.* 2008). Lesser Spotted Woodpeckers regularly occur on passage along the coastline of southern Norway, although the number of birds fluctuates markedly between years (Haftorn 1971, Bekken 1994, Lislevand *et al.* 2009). Little is known about where these birds come from, and there are very few recoveries of ringed birds to indicate the source populations (Bakken *et al.* 2006, Lislevand *et al.* 2009).

It has been suggested that autumn irruptions of Lesser Spotted Woodpeckers in Norway may origi-

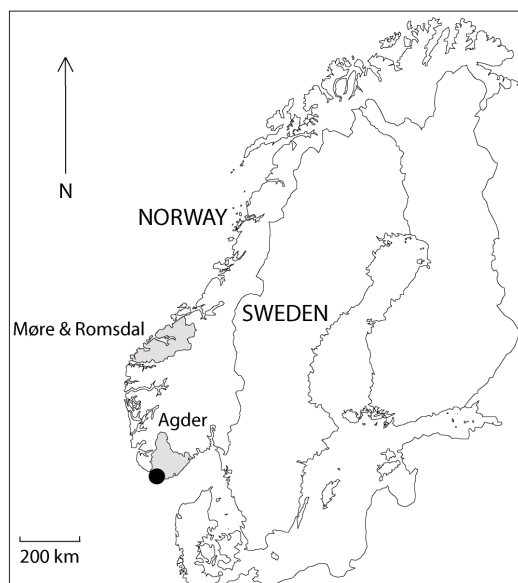


Fig. 1. Map of Fennoscandia, showing the location of Lista Bird Observatory (black dot), the regions of Agder and Møre og Romsdal counties (shaded areas) and Sweden.

inate further east (Bakken *et al.* 2006). This eastern-origin hypothesis is based on observations of Lesser Spotted Woodpeckers moving westward in Finland (Hildén 1971) and a singleton ringed in Åland, Finland which was recaptured in Sweden 480 km west of the ringing locality. Although largely speculative, a recent recovery of a Swedish-ringed Lesser Spotted Woodpecker at Lista, Vest-Agder (southernmost Norway), in autumn 2008 (Lista Bird Observatory, unpubl. data) support the eastern-origin hypothesis. Nevertheless, the possibility that the majority of migrating individuals come from more local breeding areas could not be ruled out. For instance, breeding numbers of the Lesser Spotted Woodpecker in southern Norway fluctuate in synchrony with the population of the moth *Argyresthia goedartella* (Selås *et al.* 2008). This moth species is an important food item for these woodpeckers early in the breeding season (Olsson 1998). Hence, it is possible that variation in the number of birds observed on autumn migration along the coast of southern Norway reflects variable reproductive output in local populations.

Using autumn migration data from Lista, we tested predictions of two hypotheses that the mi-

grating Lesser Spotted Woodpeckers have (1) an eastern origin or (2) a more local origin. We did so by regressing autumn numbers from Lista on population indices from the preceding breeding season in southern Norway (Agder and Møre og Romsdal) and Sweden; see Fig. 1 for a map showing the location of these regions. If migrating birds have an eastern origin, Lista numbers should correlate with data on breeding population size in Sweden but not with population measures from the more local regions. On the other hand, if the origin is local, Lista numbers should correlate with the population index from southernmost Norway (Agder), i.e., an area adjacent to Lista, but not with population indices from more distant regions. Finally, if autumn migration activity in Lista primarily reflects reproductive output in the source population, there should be no bias in sex ratio, and the majority of captured should be first-year individuals.

## 2. Material and methods

Data on autumn occurrence of Lesser Spotted Woodpeckers were available from ringing activities at Lista Bird Observatory, Vest-Agder County (58°06'N, 06°34'E), in the period 1989–2008. Mist-netting of migrating birds (primarily passerines) was standardized with regard to the number and length of mist-nets, and play-back was never used to increase catch efficiency. Each year mist-netting was carried out every day when weather conditions allowed, in the period 15 July–15 November.

Lista Bird Observatory is situated in an area which mainly consists of farmland, with scattered gardens and coniferous plantations. Lesser Spotted Woodpeckers do not usually breed within five kilometres from the observatory, suggesting that captured birds are almost certainly dispersing over longer distances. Age and sex determination was done according to Baker (1993).

We used four different data sets of woodpecker indices which presumably reflected the population size of Lesser Spotted Woodpeckers in each breeding season. In Norway, the numbers of observed individuals were available from two regions where the species is fairly common (Steen *et al.* 2006,

Lislevand *et al.* 2009). These regions are (1) Aust-Agder and Vest-Agder counties (where Lista bird Observatory is situated), hereafter referred to as Agder, and (2) Møre og Romsdal county (approx. 500 km north of Lista). Breeding-season observations from Norway were not made in a standardized manner. They were reported by voluntary bird watchers to the Norwegian Ornithological Society (NOF) and made available at “Norsk Hekkefuglatlas” (<http://www.fugleatlas.no/>). Most of the data from Møre og Romsdal, however, come from annual and systematic woodpecker inventories (particularly the White-backed Woodpecker *D. leucotos*) carried out by IS during February–May 1985–2000. In order to reduce the influence of non-breeding birds we restricted the time for observations to the period March to mid-June. Data were available from the periods 1991–2004 and 1990–2002 for Agder and Møre og Romsdal, respectively.

The data from Sweden are from the Swedish Breeding Bird Survey (Lindström *et al.* 2009) and were reported as population indices calculated by the TRIM method (Pannekoek & Van Strien 2001). Such indices are statistically controlled for effects of missing data caused by survey routes not being covered in a given year. The Swedish breeding-season data were collected by two different methods: (1) summer point counts in routes freely chosen by observers (hereafter summer point counts; mainly southern Sweden, period 1975–2009) and (2) a combination of point counts and line transects along fixed routes within standard squares systematically distributed across a national map grid (hereafter fixed routes; period 1998–2008). Since long-term population trends differed somewhat between these two methods, we use both types of indices in our analyses. The two Swedish population indices were reported as values relative to the actual records in 1998 (reference population size = 1).

We detrended all data before analysis using the first difference, which is the change in population size from one year to the next ( $N_t - N_{t-1}$ ; Royama 1992). Due to non-overlapping data sets from Lista and the three regions, sample sizes differ in the analyses. Means are presented with standard deviations and tests are two-tailed with  $\alpha = 0.05$ .

Table 1. Numbers of Lesser Spotted Woodpeckers caught by constant-effort mist-netting at Lista Bird Observatory, numbers recorded during the breeding season in Agder and Møre og Romsdal in Norway, and two population indices from the national Swedish Bird Survey (Lindström *et al.* 2009).

Year	Lista	Agder	Møre og Romsdal	Sweden, summer point counts	Sweden, fixed-route counts
1988	–	–	14	0.58	–
1989	1	–	8	0.43	–
1990	1	9	8	1.14	–
1991	0	16	40	1.15	–
1992	0	18	26	1.16	–
1993	6	32	36	1.01	–
1994	0	17	20	1.58	–
1995	2	26	52	0.75	–
1996	6	17	12	1.66	–
1997	2	13	13	1.34	–
1998	4	17	22	1.00	1.00
1999	8	21	15	1.04	5.44
2000	4	15	8	0.90	3.63
2001	12	23	6	1.00	6.22
2002	3	8	1	1.12	2.46
2003	13	15	–	1.41	3.47
2004	6	8	–	1.59	5.15
2005	0	–	–	1.58	7.07
2006	0	–	–	2.04	3.24
2007	19	–	–	1.28	10.72
2008	12	–	–	1.00	4.00

3. Results

All data used in our analyses are shown in Table 1. During 1989–2008 the number of Lesser Spotted Woodpeckers ringed at Lista varied from 0 to 19 per year (median = 3.5, Q1 = 0.75, Q3 = 6.5,  $n = 99$ ; Fig. 2). The overall temporal distribution of

these birds showed a marked peak in October (Fig. 3). Breeding season numbers in Agder ranged between 8 and 32 (median = 17, Q1 = 13, Q3 = 21,  $n = 255$ ) and similar numbers in Møre og Romsdal ranged between 1 and 52 (median = 14, Q1 = 8, Q3 = 26,  $n = 281$ ). The Swedish population indices

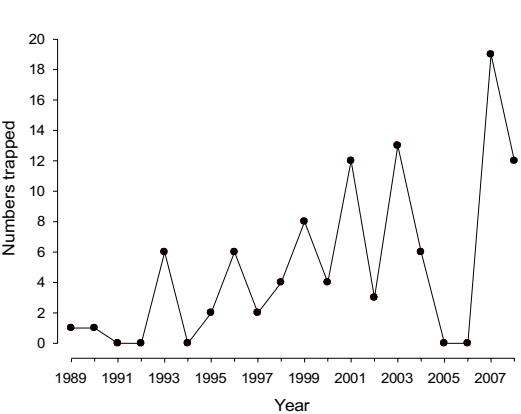


Fig. 2. The numbers of Lesser Spotted Woodpeckers trapped in autumn at Lista Bird Observatory 1989–2008 (total  $n = 99$ ).

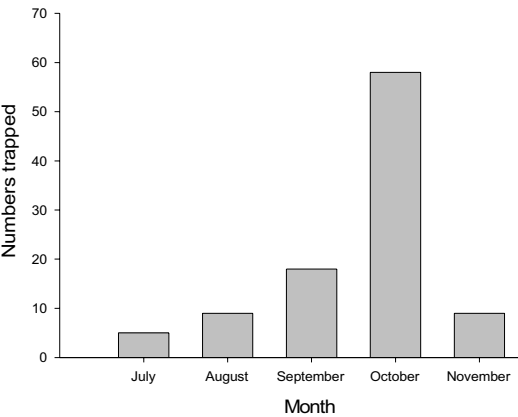


Fig. 3. Temporal distribution of Lesser Spotted Woodpeckers trapped in autumn at Lista Bird Observatory 1989–2008 (total  $n = 99$ ).

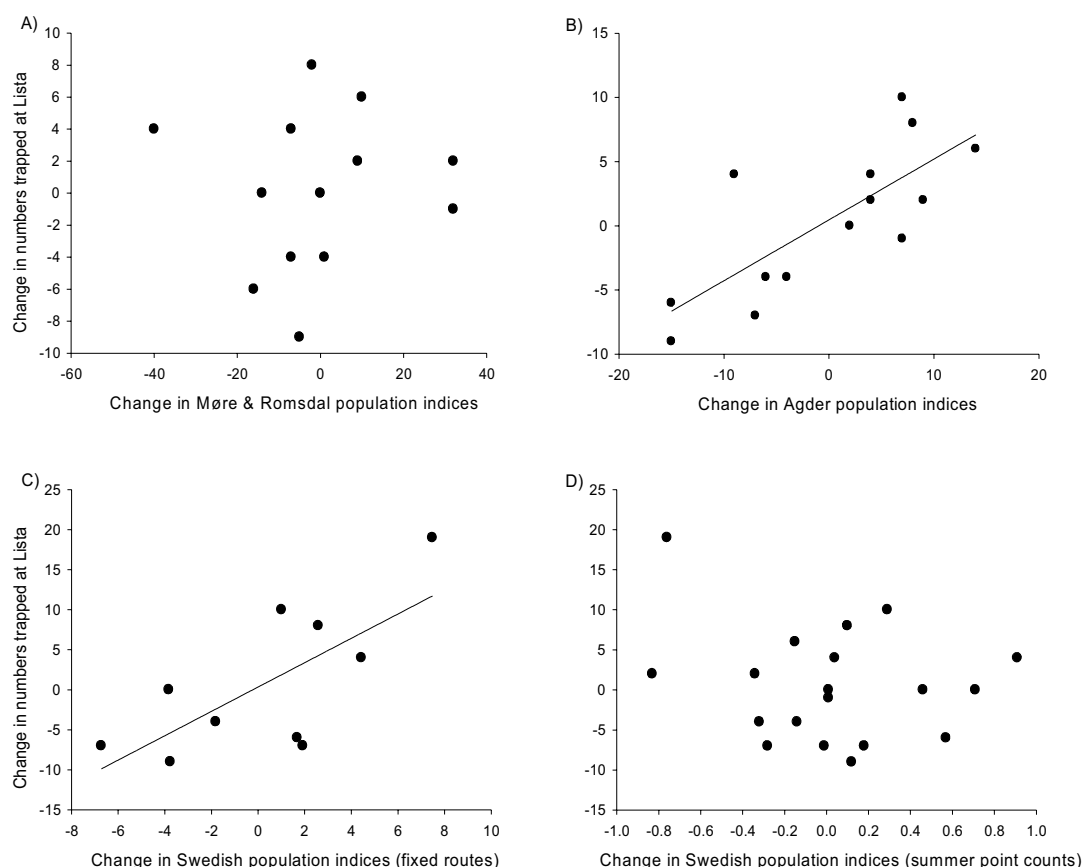


Fig. 4. Annual changes in the numbers of Lesser Spotted Woodpeckers caught in autumn at Lista Bird Observatory in relation to the corresponding changes in population indices between preceding summers in (A) Møre og Romsdal ( $r^2 = 0.002$ ,  $P = 0.84$ ,  $n = 15$ ), (B) Agder ( $r^2 = 0.59$ ,  $P = 0.001$ ,  $n = 14$ ), (C) Sweden, fixed-route method ( $r^2 = 0.50$ ,  $P = 0.02$ ,  $n = 10$ ) and (D) Sweden, summer point-count method ( $r^2 = 0.05$ ,  $P = 0.36$ ,  $n = 19$ ).

were based on records of an annual average of 16 and 12 Lesser Spotted Woodpeckers in the summer point counts and in the fixed routes, respectively.

There was no relationship between catch numbers at Lista and woodpecker indices from either Møre og Romsdal or from the Swedish summer point counts ( $F_{1,11} = 0.045$ ,  $r^2 = 0.002$ ,  $P = 0.84$  and  $F_{1,17} = 0.872$ ,  $r^2 = 0.05$ ,  $P = 0.36$ , respectively; Fig. 4A–B). However, the capture numbers at Lista were positively correlated with breeding-population indices from both the Swedish fixed-route counts and Agder (Sweden, fixed routes:  $F_{1,8} = 8.1$ ,  $r^2 = 0.50$ ,  $P = 0.02$ , Agder:  $F_{1,12} = 16.8$ ,  $r^2 = 0.59$ ,  $P = 0.001$ , Fig. 4C–D).

Lesser Spotted Woodpeckers captured and

ringed at Lista Bird Observatory were almost exclusively young birds. In total, 98% were in their first year, 1% was classified as in the first year or older, and 1% were in their second year or older ( $n = 99$ ). Of totally 86 birds that were sexed, 42 were males and 44 females. A binomial test including only first-year birds showed that the overall sex ratio did not differ from unity (40 males/44 females;  $P = 0.74$ ).

#### 4. Discussion

We have shown that fluctuations in autumn numbers of Lesser Spotted Woodpeckers at Lista are synchronous with fluctuations in breeding-popu-

lation size across a rather large area of Scandinavia. These results thus suggest that migrating Lesser Spotted Woodpeckers at Lista may originate from a large geographical area which is not necessarily located east of Norway as previously suggested by Bakken *et al.* (2006).

Annual changes in numbers of Lesser Spotted Woodpeckers caught at Lista were positively correlated with changes in breeding-population indices from Agder, where Lista is located, and from Sweden. Considering the poor knowledge of migratory habits in Scandinavian Lesser Spotted Woodpeckers, we believe these findings are important by indicating source populations of birds migrating along the coast of southern Norway. The strong correlation between numbers caught at Lista and breeding-population indices in Agder appears particularly interesting. This relationship supports the hypothesis that at least some migrating Lesser Spotted Woodpeckers have a local origin. Yet, we could not exclude the possibility that migrating Lesser Spotted Woodpeckers at Lista in autumn come from other regions or even outside of Fennoscandia. Moreover, since our results are simply correlative they do not demonstrate a definite connection between populations. A population of Lesser Spotted Woodpeckers from which we had no data may be the origin of migrating Lesser Spotted Woodpeckers at Lista and such a population could, in theory, be situated far away.

Given that population indices from Agder and Møre og Romsdal were largely based on unstandardized reports of voluntary bird watchers, one might question the robustness of the respective data sets. For instance, there is a risk that these population indices to some extent reflect variable observer coverage rather than real variation in the number of birds, or that some Lesser Spotted Woodpecker individuals have been reported more than once in the same year. We would expect such factors to add random noise to the data sets, which would potentially obscure relationships and thus have masked correlations between population indices from Møre og Romsdal and Lista. The fact that we actually found a positive relationship between population indices from Agder and Lista despite the potential methodological problems should strengthen the conclusion about this relationship.

The two Swedish data sets which describe the

population size during breeding season did not yield consistent results with respect to correlations with the Lista data. A possible reason for this inconsistency may be found in methodological differences in how the data had been collected. In contrast to the summer point counts where locations were chosen by observers, the fixed-route method produces more randomised data from the whole country and all kinds of habitats. The latter method should therefore provide population indices which are more representative for the general national situation and not only for areas with high observer density or priority.

A single recovery of a Swedish-ringed Lesser Spotted Woodpecker at Lista (Lista Bird Observatory, unpubl. data) demonstrates that some Swedish birds do migrate along the coast of Norway. However, the percentage of birds being long-distance migrants and where the migrating woodpeckers end their journeys remain unknown. Ways of obtaining reliable data on woodpecker movements are through, for example, increased ringing activity, radio/satellite tracking and stable-isotope techniques. Hence, we encourage ringing of especially juvenile Lesser Spotted Woodpeckers in or at the nest, since these birds are most likely to migrate and, if recovered, would give precise information about movements in different populations. A useful method for ringing Lesser Spotted Woodpecker nestlings is described by Wiktander *et al.* (1994).

First-year individuals dominated in the Lista data (98%), but there was no bias with regard to sex. In some other bird groups, the relative proportion of juvenile birds on autumn migration reflects reproductive output in the preceding breeding season (Blomqvist *et al.* 2002). Accordingly, the dominance of young Lesser Spotted Woodpeckers could indicate that migratory movements are linked with reproductive output. A generally high breeding success would likely lead to an increased level of intraspecific competition forcing young and subordinate birds to leave their natal area. Another interesting detail in the present data is the lack of sex bias, which indicates that males and females in Lesser Spotted Woodpeckers are not differentially affected by the factors influencing migratory activities.

Standardized mist netting of migrating birds may be a useful way of monitoring population



changes in some species (e.g., Dunn *et al.* 1997, Peach *et al.* 1998). The significant positive correlation between the number of woodpeckers captured at Lista and the breeding-population indices in both Agder and Sweden suggest monitoring potential in Scandinavian Lesser Spotted Woodpeckers. Interestingly, there is an increasing trend in the number of individuals captured at Lista during the time period in question (Lislevand *et al.* 2009; see Fig. 2), apparently coinciding with recent increases in breeding populations in both Norway and Sweden (Ottvall *et al.* 2008, Lislevand *et al.* 2009). Nevertheless, given the large size of the potential source population of migratory Lesser Spotted Woodpeckers, standardized mist netting is not a perfect method for monitoring changes in specific populations. Consequently, there is a need for direct monitoring of populations, and more effort should be invested in projects specifically monitoring woodpeckers.

In conclusion, migrating Lesser Spotted Woodpeckers along the southern coast of Norway may come from a wide area in Scandinavia, including local regions. However, more ringing activity is required to improve our picture of the migratory behaviour of this species in Fennoscandia. Almost all individuals captured at Lista were first-year birds. Inter-annual fluctuations in the capture numbers thus likely reflect variation in reproductive output in the source populations.

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### **Pikkutikkamuutto Etelä-Norjan rannikolla: mistä yksilöt tulevat?**

Pikkutikka (*Dendrocopos minor*) on Fennoskandiassa osittaisuuttaja, jonka toisinaan syksyisin levittäytyy pesimäalueiden ulkopuolelle. Lajin muutosta Norjan rannikolla tiedetään vähän, mutta yksilöiden on otaksuttu saapuvan idän suunnasta. Selvitimme tätä hypoteesiä, sekä mahdollisuutta, että yksilöt olisivatkin paikallisista populaati-

oista, tutkimalla Listan lintuaseman rengastusaineistoja kolmen alueen pesimäpopulaatioindeksiin: Ruotsi, Møre-Romsdal ja Agder. Kaikkiaan 99 yksilöä rengastettiin syyskausina Listassa 1989–2008 (mediaani 3,5, vaihteluväli 0–19).

Emme havainneet Listassa pyydettyjen yksilöiden määrän korreloivan Møre-Romsdalin populaatioindeksin kanssa. Sitä vastoin Listan määrät korreloivat Agderin indeksin kanssa. Pesimäpopulaatioindeksejä kerättiin Ruotsista (1) pitkäaikaisista (1975–2009) kesäajan pistelaskennoista havainnoitsijoiden itse valitsevilla reiteillä, sekä (2) systemaattisesti koko Ruotsin alueelle sijoitettujen, pysyvien piste- ja linjalaskentareittien aineistojen (1998–2008) yhdistelmällä. Populaatiotrendit erosivat hieman aineistojen välillä: ensin mainittu viittasi vakaaseen populaatioon, jälkimmäinen indikoi kasvua. Vastaavasti ensimmäisen aineiston indeksit eivät korreloineet Listan määrien kanssa, mutta yhdistelmäaineiston indeksit korreloivat positiivisesti.

Tulokset viittaavat siihen, että Listassa syksyisin pyydettyjen, muuttavien pikkutikkojen alkuperä on laaja alue Skandinaviassa, mukaan lukien Listan lähialueet. Listan aineiston sukupuolijakauma ei ollut vino, mutta 98 % yksilöistä oli alle yksivuotiaita. Muuton intensiteetti riippunee siis lähdepopulaatioiden poikastuotosta.

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