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Monitoring Forsmark

Bird monitoring in Forsmark 2010

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Abstract

This report summarizes the monitoring of selected listed (Swedish Red List and/or the EU Birds Directive) breeding birds in Forsmark 2002–2010. Monitoring of eleven listed species was conducted in the regional model area, including the candidate area in 2010 in the same way as in earlier years.

The results from the monitoring in 2010 differed somewhat from results gathered in earlier years. Most monitored species have increased in local numbers during the study years, and from most years continued increases have been reported. Between 2009 and 2010 most species (seven, 64% of the monitored ones) instead decreased in numbers. Only one species (honey buzzard) increased in numbers between the years and in this case this was probably more a result of small moves by certain pairs so that they this year had parts reaching into the regional model area, while in 2009 their territories were outside of this. No dramatic changes in bird numbers were however recorded and all the studied species show stable or increasing local populations over the study period.

Number of Black-throated diver pairs was normal and breeding success was good this year. The breeding success of divers has improved considerably over the studied period and the patterns recorded in Forsmark closely follow recorded patterns at the national level.

Honey buzzards and ospreys occurred in good numbers, above the average for the whole period, and breeding success was better than in 2009. Even if breeding success of honey buzzards is not monitored in any detail, there were still signs of at least a few successful breedings in the area this year. Breeding success of ospreys was below average, but still within the normal variation for most years. The local white-tailed eagles had a poor breeding season and no young at all were produced within the study area.

All three grouse species (black grouse, capercaillie and hazelhen) decreased in numbers between 2009 and 2010. Note however that the large amounts of snow during the early parts of the season prevented capercaillie and hazelhen monitoring of any larger areas. Despite a probably lower numbers of capercaillies present in the whole area the species was still present within the candidate area also in this year. Black grouse and hazelhen decreased both in the candidate area and in the remaining parts of the regional model area.

The ural owls had an average season, although the number of resident pairs decreased from seven to six. The pair living closest to the candidate area could not be found in 2010, but all other pairs were present in their normal territories. Four pairs produced eight large young, which is a little bit over the average for the whole period.

Both wryneck and lesser spotted woodpecker numbers decreased between 2009 and 2010. While numbers of occupied wryneck territories were still at a high level, the number of occupied woodpecker territories was the lowest recorded since 2006. Red-backed shrikes decreased slightly in numbers, and most markedly so within the candidate area.

Sammanfattning

Denna rapport sammanfattar övervakningen av bestånden av häckande fåglar i Forsmark 2002–2010. Under 2010 genomfördes inventering av elva utvalda listade arter (upptagna i Svenska rödlistan och/eller EU:s Fågeldirektiv) inom regionala modellområdet, inklusive kandidatområdet, på samma sätt som under tidigare år.

Resultaten från 2010 års övervakning skiljer sig något från de mönster som registrerats under tidigare år. Flertalet arter har ökat i antal inom området under undersöknings-perioden och från de flesta år har fortsatta ökningar kunnat rapporteras. 2010 noterades istället minskningar för inte mindre än sju arter (64 % av de följda arterna) jämfört med 2009. Endast en art (bivråk) ökade i antal mellan 2009 och 2010, och i det fallet handlade det om en mindre omfördelning av reviren, snarare än en ökning av antalet fåglar i området och dess omgivningar. Inga dramatiska förändringar skedde dock i bestånden hos någon av de studerade arterna, och sett över hela studieperioden uppvisar fortfarande samtliga arter stabila eller ökande lokala populationer.

Storlommarna uppträdde i normala antal och häckningsframgången var god. Artens häckningsframgång har förbättrats under de år som övervakningen pågått och mönstren som noterats i Forsmark följer snarast storskaliga nationella mönster än lokala sådana.

Bivråk och fiskgjuse förekom i goda antal, något över medel för alla studerade år och häckningsframgången var bättre än under året innan. Även om bivråkarnas häckning inte följs i detalj, fanns tecken på att åtminstone några lyckade häckningar genomfördes i området. Fiskgjusarnas häckningsframgång var under medel för studieåren men ändå inom det normala intervallet för flertalet år. De lokala havsörnarna, däremot, hade en dålig häckningssäsong och inte en enda flygfärdig unge kom på vingarna inom studieområdet.

Alla tre skogshönsen (orre, tjäder, järpe) minskade i antal mellan 2009 och 2010, men de stora snömängderna under säsongens inledning gjorde att mindre ytor än normalt kunde inventeras för både tjäder och järpe, varför resultaten inte riktigt blev heltäckande. Trots ett troligen generellt sett minskat antal tjädrar i hela undersökningsområdet noterades arten även detta år inom kandidatområdet. Antalet orrar och järpar minskade både i det regionala modellområdet och i kandidatområdet.

Slagugglorna hade ett medelår, även om antalet revirhävdande par minskade med ett par från 2009. Paret med revir närmast kandidatområdet kunde inte återfinnas under 2010, men övriga par fanns på plats i sina normala revir. Fyra par fick ut totalt åtta ungar vilket är något över medel för hela studieperioden.

Både göktyta och mindre hackspett minskade i antal från 2009 till 2010, men medan antalet bebodda revir av göktyta trots detta var på en hög nivå sett i ett längre perspektiv, var antalet bebodda mindre hackspettrevir det lägsta sedan 2006. Antalet törnskator minskade något, främst i kandidatområde.

Contents

1 Introduction

This document reports the results from the bird monitoring in Forsmark for 2010. The bird surveys started in 2002 and have now been going on for nine years. For some of the species presented here good data are available from 2003 onwards, allowing comparisons during an eight-year period. The aim of this report is to continue to follow the population development of certain listed bird species (according to the Swedish Red List and/or the EU Birds Directive) in the Forsmark area after the now finished site investigations. The surveys were made according to activity plan AP PF 400-09-006. The project has been conducted by the Department of Animal Ecology, Lund University. The report covers the whole regional model area, including the candidate area.

Original data from the reported activity are stored in the primary database Sicada, where they are traceable by the Activity Plan number (AP PF 400-09-006). Only data in SKB´s databases are accepted for further interpretation and modelling. The data presented in this report are regarded as copies of the original data. Data in the databases may be revised, if needed. Such revisions will not necessarily result in a revision of the P-report, although the normal procedure is that major data revisions entail a revision of the P-report. Minor data revisions are normally presented as supplements, available at www.skb.se.

2 Objective and scope

The site investigations in Forsmark started in 2002 and finished in 2007. SKB has from the start of the investigations aimed at monitoring the effects from all the ongoing activities on the bird fauna in the area. This in order to ensure that the site investigations were carried out in such a way that disturbances to the fauna, especially sensitive and vulnerable species, could be held at a minimum level (without hindering the essential parts of site investigations).

Forsmark is an area rich in birds, holding high densities of both common species and more rare ones /Green 2003, 2004, 2005, 2006, 2007, 2008a, 2008b, 2009/ such as species listed in the Swedish Red List /Gärdenfors 2010/ and European Union´s Birds directive 79/409/EEG: Annex 1, (http://www.naturvardsverket.se). It is inevitable that site investigations as those conducted by SKB affect the bird fauna in some way. The initial idea was that the investigations were not only likely to affect the specific sites where drilling was made or new roads were constructed. In addition to these direct impacts, involving small, but none the less direct losses of available areas for birds (both directly in a pure physical sense and indirectly through high, long-lasting levels of disturbance), the general level of human activity in the area was greatly increased with more traffic on the roads, more people out in the landscape measuring and sampling different objects etc. In Forsmark this meant a quite dramatic change from the pre-site investigation period, as the area then had a rather low level of human disturbance.

For eleven selected listed species (Swedish Red List and the EU:s Birds Directive) the objective of the monitoring is to follow the population development in the whole regional model area. In addition to looking at overall numbers for these species, the programme aims at investigating breeding success when this is possible.

After the site investigations were terminated in 2007, SKB has proceeded with the plans for locating a geological repository for spent nuclear fuel in the Forsmark area. It was decided that the bird monitoring should continue for the time being in order to have background data for evaluating possible consequences on the bird fauna of such a repository.

Within the bird surveys, the Forsmark area has been divided in two parts:

The regional model area (area of possible large-scale effects). In Forsmark the land area of the regional model area is about 60 km^2. This area is shown by a thick broken line in Figure 2-1.

The candidate area. A smaller area which was the core area of the site investigations. The size of the area in Forsmark is about 10 km^2. The candidate area is shown with a thick unbroken line in Figure 2-1.

Direct impacts from activities within the site investigations were only likely to occur in the candidate area and the close surroundings of this, while indirect effects could be possible also in the regional model area. For some species however, the regional model area mainly functions as a reference area to the candidate area.

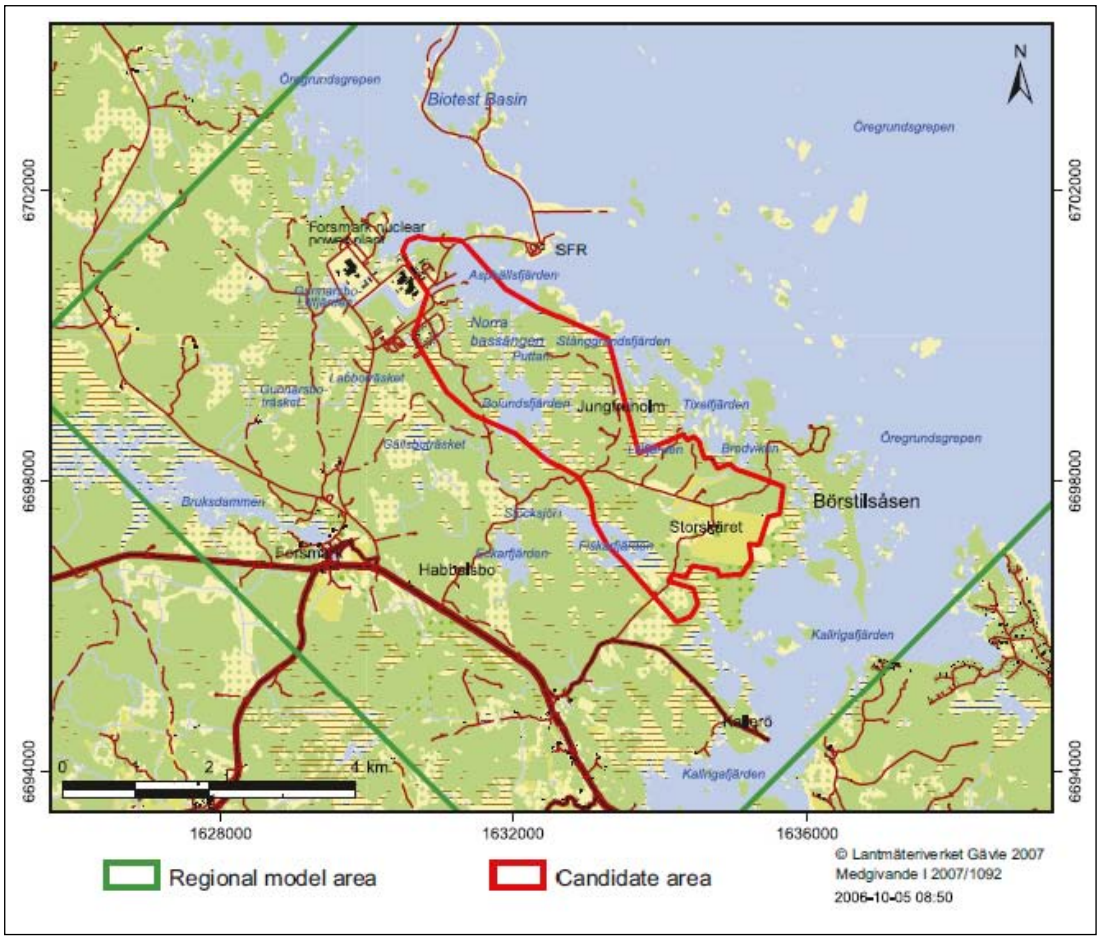

Figure 2-1. *Map of the survey area in Forsmark. The regional model area is shown with a green line and the candidate area is illustrated with a pale red line.*

3 Equipment

3.1 Description of equipment

The following equipment was used when conducting the bird surveys.

- GPS (Garmin GPS 60).
- Binoculars and telescope.
- Field maps showing each day's work.
- Note books and paper forms.
- Vehicles for transport to and from the study area.
- Cell phone (safety equipment when working alone in the field).

4 Methods

The methods used are described in detail in activity plan AP PF 400-09-006. An overview of the methods used for monitoring purposes is presented below.

4.1 Listed species (Swedish red list; EU Birds directive Annex 1)

The species occurring in Forsmark and included in the Swedish Red List and/or the EU:s Birds Directive are shown in Appendix 1. Starting from 2004, a selection of these species is monitored on a yearly basis. During 2002–2003, all listed species were monitored, although the project was still in the exploratory phase then, resulting in that all species did not receive proper coverage in the very first year. The species in question are shown in Table 4-1. Selection of monitoring species was made according to a set of different criteria. A species was included for further monitoring if one or more of the following criteria was met: **i)** Forsmark is a vital area for the species in a larger (e.g. national) perspective; **ii)** The species in question is suspected to be sensitive to disturbances and thus possibly affected in a negative way by the site investigations;
iii) The species showed a negative population trend at the national level at the start of the site investigations (but not necessarily in Forsmark); **iv)** Forsmark holds high densities of the species. These species were monitored in 2010 by visiting known nesting places/territories used in 2002–2009, combined with visits to habitats suspected to possibly hold the species in question. Visits to nest sites/territories/suitable habitats were made during relevant periods, when presence of the birds is expected to be easy to detect. Detailed monitoring of breeding results was made for some species, i.e. black-throated diver, white-tailed eagle, osprey and ural owl. All observations of the selected listed species were registered with data on bird species, number of birds, position (from GPS or recorded on field maps) and date during the field work.

4.2 Execution

The monitoring field work in 2010 was carried out during the period 2010-03-24 – 2010-07-30. All organised field work apart from the eagle work was carried out by Martin Green. Alf Sevastik and Peter Hunger assisted with additional information on bird observations in the area during the relevant period. The white-tailed eagle work was carried out within the ongoing national project concerning this species by Björn Helander, Swedish Museum of Natural History, Stockholm. Organisation, data handling, analysis work and interpretations were carried out by Martin Green, Dep. of Animal Ecology, Lund University.

Table 4-1. Listed species (Swedish Red List and/or EU: Birds Directive) selected for monitoring in Forsmark in 2004–2010.

English name	Swedish name
Black-throated Diver	Storlom
Honey Buzzard	Bivråk
White-tailed Eagle	Havsörn
Osprey	Fiskgjuse
Black Grouse	Orre
Capercaillie	Tjäder
Hazelhen	Järpe
Ural Owl	Slaguggla
Wryneck	Göktyta
Lesser spotted Woodpecker	Mindre hackspett
Red-backed shrike	Törnskata

4.3 Data handling

In the field all registered birds of the selected species were recorded in notebooks with data on species, number of individuals and position together with additional data on bird behaviour and circumstances where such data were relevant. Observations were registered with as exact position as possible individually taken directly from the GPS in the field. Positions for selected listed species have the same resolution as the GPS-system. After each days field work the data were transferred to pre-made paper forms. Data were then entered into an Excel-file from paper forms whereupon the file was cross-checked against the field notes by the project leader. This base-file with data on species, numbers and positions can then be used for different GIS applications, for evaluating bird densities and further calculations.

4.4 Analyses and interpretations

For most species the actual numbers of recorded territories/nests/pairs are reported and shown in figures. For hazelhen and red-backed shrike, however, population change is shown in the form of a chain-index. The reason for not using the recorded number of territories directly in this case is that the monitored areas have not remained exactly the same during the years. To come around this problem, but still be able to compare the population development in an easily understandable way, a chain index is constructed. The chain index is created by comparing *areas checked equally well* in two following years and calculating the change in percent between these two. Then the procedure is repeated for the next two following years and the new change (in percent) is added/subtracted to/from the figure. In the red-backed shrike case the calculation was made as follows (in this case with the regional model area, excluding the candidate area as an example).

- Index for the start year is set to 1. This is the basis for all future comparisons.
- In our first year with a reasonable coverage of shrikes in Forsmark (2003), 27 occupied territories were recorded. Of these, 14 were in areas covered equally well also in the following year (index calculations can only be made when at least two years of data are collected, since it is made in a back-wards calculating mode).
- In 2004, our second year of good coverage, 41 occupied territories were recorded. Of these, 20 were in parts checked equally well in 2003.
- The index for 2004 is calculated as: ((20–14)/14) + 1 = 1.43. Interpreted as a 43% increase in numbers between 2003 and 2004.
- All the 41 recorded territories in 2004 were in areas covered equally well also in 2005.
- 48 occupied territories were recorded in these parts in 2005.
- The index for 2005 is then calculated as: ((48–41)/41) + 1.43 = 1.60. Interpreted as a 17% increase in numbers between 2004 and 2005 (and a 60% increase from 2003 to 2005).
- And so on.

For statistical tests of trend data the Spearman rank correlation test /Sokal and Rohlf 1995/ was used. This test is a non-parametric correlation test where one simply tests whether a variable y (number of bird pairs in most of our cases) has changed in a significant direction (upwards or downwards) in relation to variable x (year in this case). Statistical results presented are the correlation coefficient $\mathbf{r_s}$ which varies between –1 and 1. A value of 0 means that there is no correlation at all, the higher the value of $\mathbf{r_s}$, the stronger the positive correlation (increase in this case), the lower the value of $\mathbf{r_s}$, the stronger the negative correlation (decrease in this case). **p** is the probability that the true result is actually different from the obtained result, or to put it in other words, the probability to find the significant result by random. **N** is the number of data points entered into the correlation. Hence, a high or low $\mathbf{r_s}$ value (close to 1 or –1) means that there is a strong correlation and will yield a low **p**-value. Non-parametric tests were used to avoid assumptions about data distributions. All tests were performed in the software PASW Statistics 18 (SPSS Inc.).

4.5 Nonconformities

The activity was performed according to the plans and there were no important nonconformities. The large amount of snow during the early parts of the season did however prevent some more detailed surveys of capercaillies and hazelhens.

5 Results

Data from this survey are stored in the SKB GIS database and are traceable by the Activity plan number AP PF 400-09-006. The use of the data is restricted since it concerns sensitive species.

English names of the birds are used throughout the results section. Swedish names are given in the species headlines (for listed species). A complete list of English, Latin and Swedish names for all listed bird species possibly breeding in Forsmark during 2002–2010 is given in Appendix 1.

5.1 Listed species

The following section gives a summary of the population development during the last seven to nine years for some of the species listed as endangered, threatened or vulnerable according to the Swedish Red List /Gärdenfors 2010/, and/or species listed in the European Unions' Birds Directive Annex 1 (79/409/EEG) within the regional model area in Forsmark. For some of these species, breeding results have also been monitored and are hence reported.

The text about the breeding results of white-tailed eagles in Forsmark and surrounding reference areas is written by Björn Helander, Swedish Museum of Natural History, Stockholm.

Black-throated Diver *Gavia arctica* Storlom (EU Annex 1)

The stability in diver numbers around Forsmark continues (see Figure 5-1) and five pairs were recorded in 2010. This is just slightly below the average number of pairs in the area for all earlier years (5.6 pairs/year). There is no statistically significant trend in diver numbers over the period (Spearman rank correlation: $r_s = 0.09$, $p = 0.82$, $N = 9$). Three pairs were found in lakes and two pairs along the coast in 2010, which means that one of the normally used coastal territories was vacant in this year.

Three pairs bred successfully and together raised four large young, giving a breeding success of 0.80 large young per resident pair. This is well above the average for all study years (0.52 large young/pair), but in the same order as the average since 2005 (0.77 large young/pair). Two successful pairs were found in lakes and one along the coast.

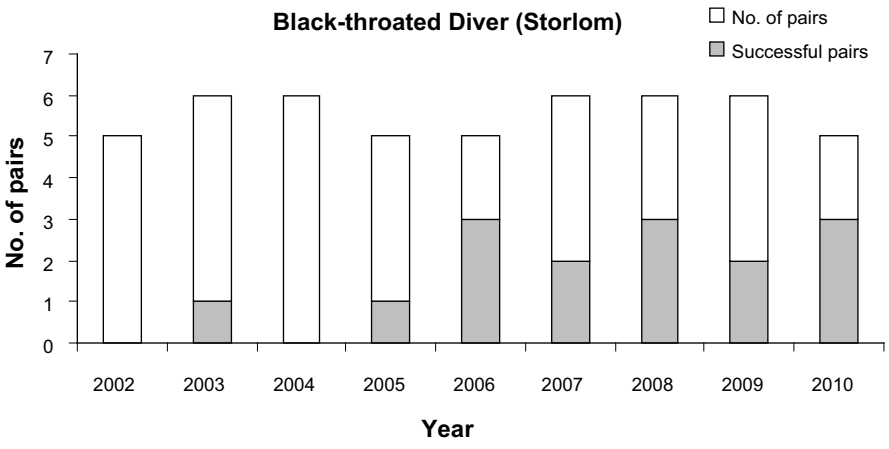

Figure 5-1. *Number of resident pairs of black-throated divers in Forsmark 2002–2010. Shading shows the number of successful pairs. Minimum numbers are shown, total numbers of pairs in 2005 might have been seven and there might have been four successful pairs in 2006.*

The number of successful breeding attempts per year has increased significantly between 2002 and 2010 (Spearman rank correlation: $r_s = 0.81$, $p = 0.009$, $N = 9$) and so has the number of produced large young per year (Spearman rank correlation: $r_s = 0.70$, $p = 0.037$, $N = 9$). The reason behind this pattern is still unknown and we can only conclude that present breeding success of divers in Forsmark is good (see below).

The results from Forsmark can be compared with recently published general results for the whole country /Eriksson 2010/. Breeding success in Forsmark 2002–2010 (0.52 large young/pair) was slightly higher than, but in the same order as, national breeding success 1994–2008 (0.40–0.47 large young/pair). Average breeding success in Svealand 1994–2008 was 0.47 large young/pair. About a third of the breeding attempts were successful in Sweden as a whole. The corresponding proportion in Forsmark 2002–2010 was 30%. The national trend in breeding success was decreasing 1994–2008, but as in Forsmark it has been increasing since 2002. Interestingly, 2002 stands out as a very poor breeding season both in Forsmark and in the whole of Sweden.

The absence of trends in diver numbers in Forsmark during the last nine years is in accordance with the pattern on the national level for the last ten years. The Swedish population of black-throated divers has remained stable during this time /Lindström et al. 2010/.

Honey Buzzard *Pernis apivorus* Bivråk (Sw. Red List; EU Annex 1)

Nine honey buzzard territories were recorded within the regional model area in 2010, see Figure 5-2, at the upper level of normal interval for the last years. Exact numbers in any year will differ, since in some years territories and nest sites will be situated within the area, whereas in others they will be outside of this. Seen over all nine study years, numbers in Forsmark tended to increase, but not fully significantly so (Spearman rank correlation: $r_s = 0.66$, $p = 0.054$, $N = 9$). As explained earlier (see /Green 2008a, 2008b, 2009/) estimated number of pairs in the first years of the site investigation period were probably underestimated, and the conclusion is that numbers have remained stable during 2002–2010. This is also supported by that there is absolutely no significant change in numbers during the years with good coverage of honey buzzards in the area (2004–2010, $r_s = 0.24$, $p = 0.61$, $N = 7$).

As usual, breeding success was not monitored in 2010, but unlike last year when no signs of successful breedings were registered, such observations were made this year. At least two pairs were feeding young in late July 2010.

The honey buzzard is now classified as ‘Vulnerable’ (sårbar) in the Swedish Red List. Earlier it was classified as ‘Endangered’ (starkt hotad). The national population declined heavily in the 1970-ies and 1980-ies but has remained fairly stable in the last decades /Ottvall et al. 2008/.

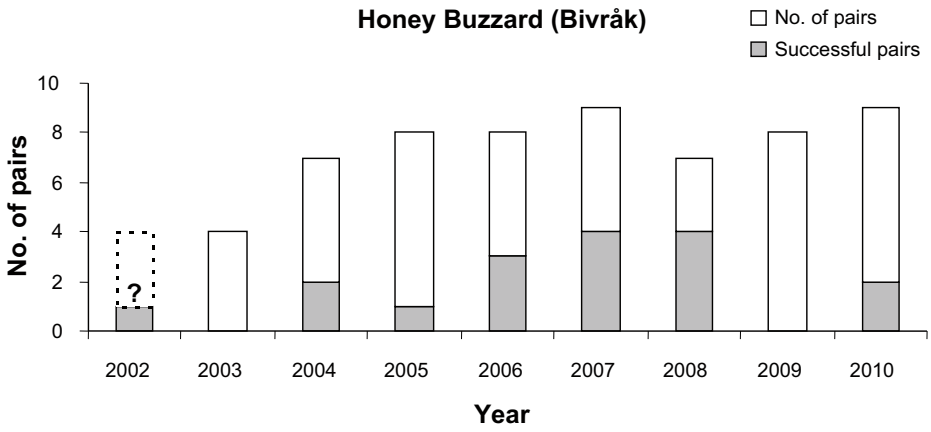

Figure 5-2. *Number of territorial pairs of honey buzzards within the regional model area in Forsmark 2002–2010. Shading shows number of successful pairs. The exact number of territorial pairs in 2002 is not known. An (at the time) well based estimate is shown.*

White-tailed eagle *Haliaeetus albicilla* Havsörn (Sw. Red List; EU Annex 1)

The year 2010 was a bad one for white-tailed sea eagles in the Forsmark area. For the first time over the study period, one of the territorial pairs could not be found in the area and none of the breeding attempts of the pairs present were successful. 2010 was a comparable poor year for sea eagles also in the surrounding reference areas, although not as much as in Forsmark, see Table 5-1. The harsh winter with lots of snow present in the nests at the onset of breeding and at the time of egg-laying may have played an important role in the overall poor reproduction in the region this year. There seems to be a clear tendency for a decrease in breeding success over the study period both in the Forsmark and in the reference areas.

Osprey *Pandion haliaetus* Fiskgjuse (EU Annex 1)

The osprey is another species that has had a very stable population around Forsmark during the last few years, see Figure 5-3. Eight pairs were recorded in 2010 as in most other years during the study period and very close to the average (7.4 pairs/year). There is no significant trend in population size in Forsmark over the years (Spearman rank correlation: $r_s = 0.41$, $p = 0.27$, $N = 9$).

Breeding output bounced back to normal levels after the very low level in 2009, see Figure 5-4. In 2010 five pairs produced seven large young (0.88 large young/territorial pair). This is still below the average for all study years (1.15 large young/territorial pair) but within the range for a 'normal year'. There is no significant trend in number of successful pairs (Spearman rank correlation: $r_s = –0.06$, $p = 0.88$, $N = 9$) or in the numbers of produced young (Spearman rank correlation: $r_s = –0.34$, $p = 0.41$, $N = 8$) over the years covered.

Table 5-1. Per cent successfully breeding pairs of white-tailed eagles in 1998–2001 and 2002–2010 in Forsmark and two reference areas north and south of Forsmark, respectively (N = number of checked territorial pairs).

Area	1998–2001	2002	2003	2004	2005	2006	2002–2006	2007	2008	2009	2010	2007–2010	N
Forsmark area	85	25	33	50	75	25	42	50	50	75	0	44	48
Reference area S	79	100	80	100	83	50	83	80	60	80	33	63	69
Reference area N	72	83	71	86	29	29	59	33	60	33	40	42	68

(Report by Björn Helander, Swedish Museum of Natural History, Stockholm)

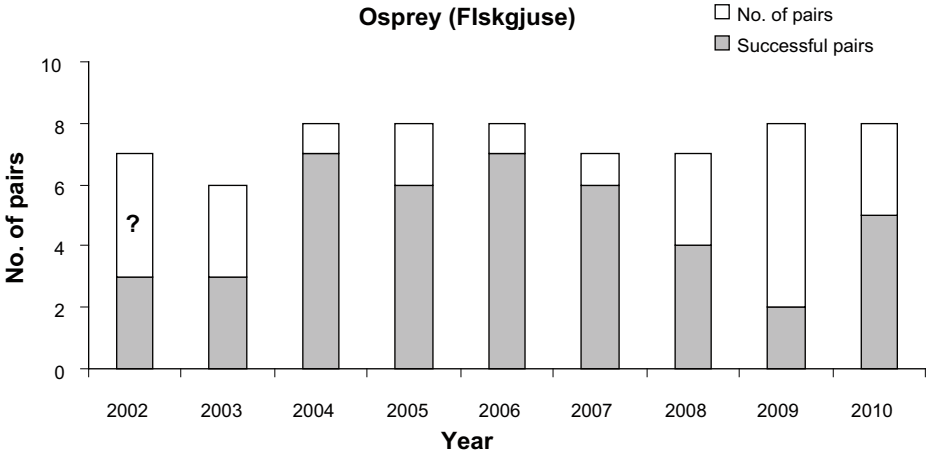

Figure 5-3. *Number of nesting attempts (territorial pairs) of ospreys in Forsmark 2002–2010. Number of successful nests (shaded parts) are shown as well. The exact number of territorial pairs in 2002 is not known. A well based estimate is shown.*

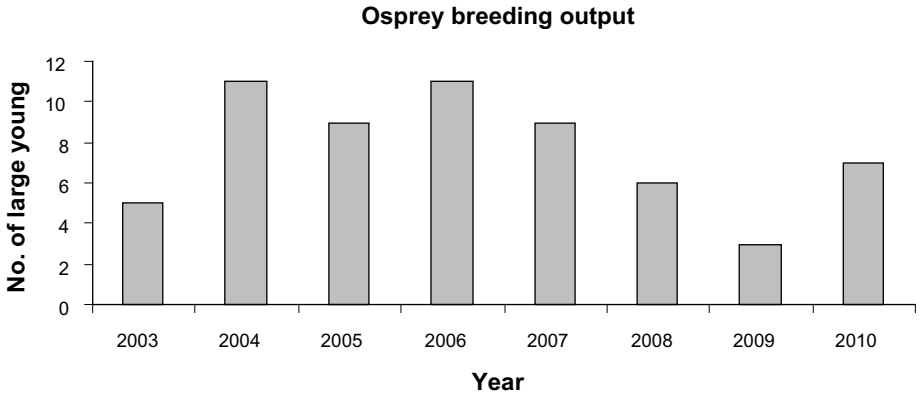

Figure 5-4. *Number of large young of ospreys produced in Forsmark 2003–2010. Number of large young per breeding attempt was 0.83 in 2003, 1.38 in 2004, 1.12 in 2005, 1.38 in 2006, 1.29 in 2007, 0.86 in 2008, 0.38 in 2009 and 0.88 in 2010.*

The seemingly stable osprey population around Forsmark corresponds well with the national pattern of stability in numbers during the last ten years /Ottvall et al. 2008/.

Black grouse *Tetrao tetrix* Orre (EU Annex 1)

The number of black grouse continued to decrease for the second year in a row, see Figure 5-5. Twenty displaying males were recorded in 2010, meaning that numbers are now below the average for the whole study period (22 males/year). The continued decrease in 2010 also means that the there is not any statistically significant trend in black grouse numbers in the whole Forsmark area 2002–2010 (Spearman rank correlation: $r_s = 0.56$, $p = 0.12$, $N = 9$). There is however still a significant increase in numbers in the regional model area outside of the candidate area (Spearman rank correlation: $r_s = 0.84$, $p = 0.005$, $N = 9$), while no significant change has occurred within the candidate area (Spearman rank correlation: $r_s = –0.34$, $p = 0.36$, $N = 9$).

The probable reasons behind the found pattern have been explained before and remain the same. Black grouse is an early succession species, preferring open areas (i.e. clear-cuts when we are talking about areas affected by modern forestry). No new clear-cuts have been taken up within the candidate area since the site investigations started and many older clear-cuts are now covered by too high vegetation for being suitable for the birds. This is in contrast to the situation in parts of Forsmark outside of the candidate area, where new clear-cuts are taken up every winter. In other words, the suitable areas for black grouse have decreased within the candidate area, but increased in other parts

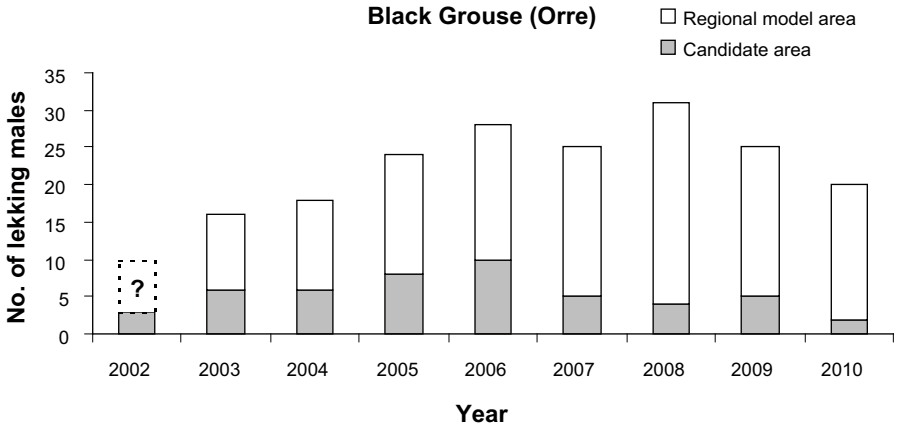

Figure 5-5. *The recorded number of lekking black grouse males in Forsmark 2002–2010. Shaded parts show the numbers within the candidate area. Exact number of lekking males in 2002 is not known. A well based estimate is shown.*

during the study years. The overall patterns found probably follow normal population dynamics found over a larger geographical scale. The patterns in Forsmark with an increase in numbers 2002–2008 followed by a decrease thereafter is exactly the same as has been found on the national level /Lindström et al. 2010/.

The number of multiple male leks (cf. /Green 2007, 2008a, 2008b, 2009/) as well as the number of males at such leks continued to decrease between 2009 and 2010 (Figure 5-6).

Capercaillie *Tetrao urogallus* Tjäder (EU Annex 1)

The large amount of snow present in late winter (late March) prevented any more covering survey of capercaillies this year. Instead only the central areas within and around the candidate area were covered. There, number of males at the central lek decreased somewhat and was now down at the same level as the previously lowest recorded level during the study period (three males 2004 and 2010, Figure 5-7). There is however no significant trend in numbers of males at this lek since 2003 (Spearman rank correlation: $r_s = –0.24$, $p = 0.58$, $N = 8$). The lek is situated outside, but close to, the candidate area and it is likely that there are birds connected to this lek that have home ranges extending into the candidate area. Within the candidate area, signs of both male and female presence were again recorded in 2010 (as in the last two years).

The northern lek, well outside of the candidate area, was not monitored in 2010, neither were home ranges within the whole regional model area.

Also capercaillie numbers in Forsmark closely follow the national patterns /Lindström et al. 2010/.

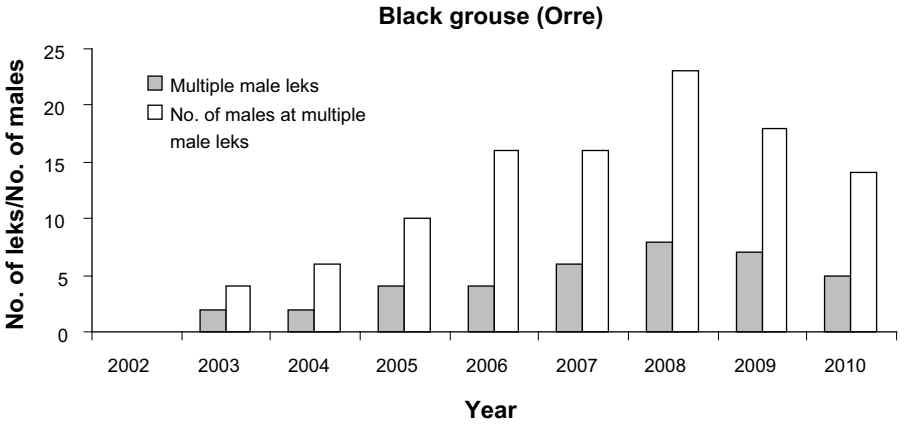

Figure 5-6. *The recorded number of lekking black grouse males in Forsmark 2002–2010 found at leks containing more than one male. Shaded bars show the number of such multiple male leks within the regional model area.*

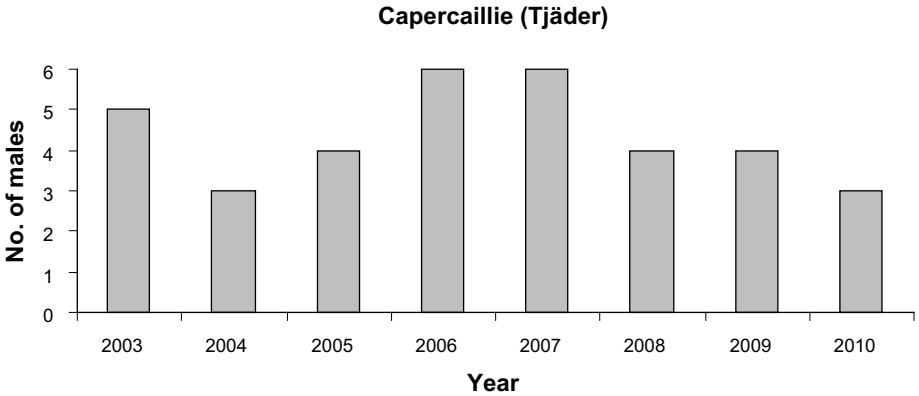

Figure 5-7. *The recorded number of capercaillie males in 'the central area' at Forsmark 2003–2010 (see text).*

Hazelhen *Bonasia bonasia* Järpe (EU Annex 1)

The large amounts of snow also prevented any more detailed monitoring of hazelhens over larger areas in 2010. Central parts of the candidate area and adjoining parts of the regional model area were covered, as well as some territories outside of this. This resulted in 14 territories with recorded hazelhen presence, a figure much lower than in a normal year when larger parts of the study area could be covered (average 2004–2009, 23 territories, range 20–26).

As a different number of sites (known territories or sites classified as suitable for hazelhens identified from vegetation maps) were visited in different years, population development for hazelhens is shown with an index (Figure 5-8). Note that the data set for index calculations is smaller than normal, but still sufficient for showing general patterns.

Numbers of hazelhens decreased between 2009 and 2010, both in the candidate area and in the regional model area outside of this. There are, however, still signs of a difference between the candidate area and other parts of the study area, with in general terms stable numbers in the first and a decrease in the latter. There is a just barely significant decrease in the regional model area (Spearman rank correlation: $r_s = –0.81$, $p = 0.05$, $N = 6$), while there is no significant change in the candidate area (Spearman rank correlation: $r_s = 0.41$, $p = 0.42$, $N = 6$). The difference between the different parts of the study area is probably related to differences in management, with no forestry activities within the candidate area during the study period.

National population development correspond well to the pattern recorded in Forsmark in later years /Lindström et al. 2010/.

Ural owl *Strix uralensis* Slaguggla (EU Annex 1)

Numbers of present ural owl pairs decreased to six from the peak level of seven recorded in 2009 (and 2006), see Figure 5-9. The number of pairs in 2010 however exceeded the average of 5.4 pairs/year in 2002–2009. There is a significant overall increase in ural owl numbers around Forsmark during the period (Spearman rank correlation: $r_s = 0.79$, $p = 0.01$, $N = 9$).

Ural owls had an average breeding year around Forsmark and four pairs produced eight large young (Figure 5-10). There are no trends in the number of successful pairs (Spearman rank correlation: $r_s = 0.27$, $p = 0.48$, $N = 9$), or in the number of produced large young (Spearman rank correlation: $r_s = 0.33$, $p = 0.39$, $N = 9$) during the study period.

The ‘lost pair’ in 2010 was the one living closest to the candidate area. Still, no territory has been recorded within the candidate area during the study years.

Ural owl numbers on the national level are now thought to have levelled out after a long-time increase, at least in the south-central parts where Forsmark is situated, during the last decades /Ottvall et al. 2008/.

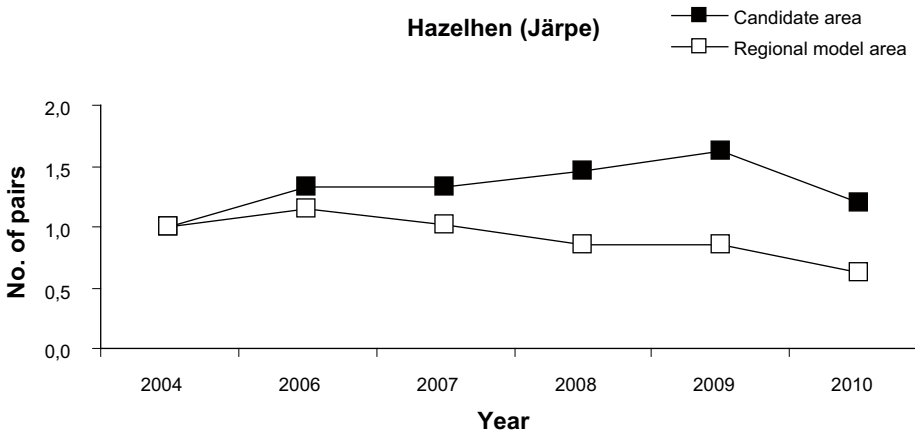

Figure 5-8. *Population development of hazelhens in Forsmark 2004–2010 shown as a chain index. Index for year 2004 is set to 1. See text for further explanations.*

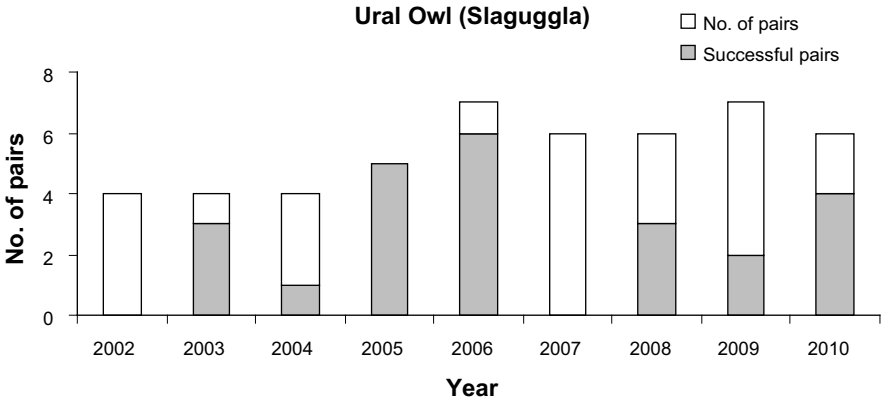

Figure 5-9. *Number of territorial pairs of ural owl within the regional model area in Forsmark 2002–2010. Shown is also the number of successful pairs (shaded).*

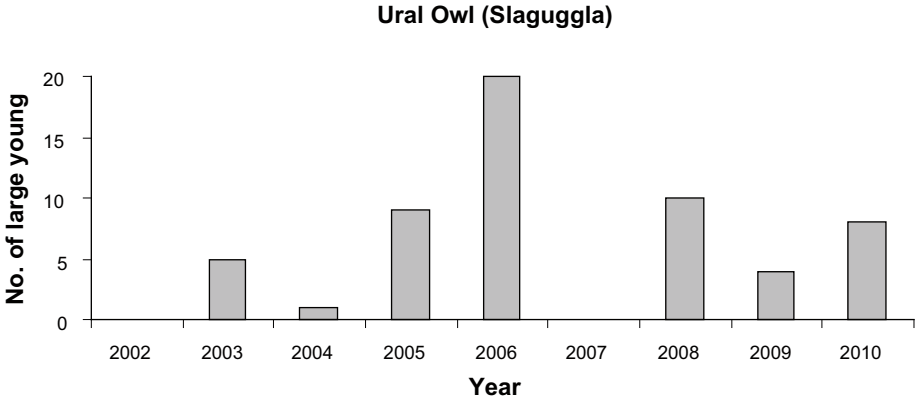

Figure 5-10. *Number of large ural owl young produced per year in Forsmark 2002–2010.*

Wryneck *Jynx torquila* Göktyta (Sw. Red List)

Numbers of occupied wryneck territories decreased from 69 in 2009 to 52 in 2010 (Figure 5-11). Of these, eight were found in the candidate area and 44 in the remaining parts of the regional model area. Despite the decrease, numbers in 2010 were higher than the average for the whole study period (49) and the fourth highest recorded annual total during the eight study years. Total wryneck numbers have increased significantly during the study period (Spearman rank correlation: $r_s = 0.71$, $p = 0.047$, $N = 8$). Looking at the candidate and regional model area outside of this separately, indicates a tendency for a significant increase in the candidate area (Spearman rank correlation: $r_s = 0.66$, $p = 0.076$, $N = 8$) but no change in numbers for the regional model area outside of the candidate area (Spearman rank correlation: $r_s = 0.52$, $p = 0.18$, $N = 8$).

The wryneck is still classified as 'Near-Threatened' (missgynnad) in the Swedish Red List /Gärdenfors 2010/ although most signs (including the Forsmark data) show that numbers have increased from a really low level about fifteen years ago /Lindström et al. 2010/.

Lesser spotted woodpecker *Dendrocopus minor* Mindre hackspett (Sw. Red List)

After a more or less constant increase followed by stable numbers during earlier study years, lesser spotted woodpecker numbers in Forsmark decreased between 2009 and 2010, see Figure 5-12. Two occupied territories were recorded in the candidate area and fourteen in remaining parts of the regional model area in 2010.

Even after this decrease there is a significant increasing overall trend in numbers around Forsmark during 2003–2010 (Spearman rank correlation: $r_s = 0.81$, $p = 0.008$, $N = 8$ for the whole area) and for the regional model area excluding the candidate area (Spearman rank correlation: $r_s = 0.80$, $p = 0.016$, $N = 8$). There is however no statistical difference in numbers within the candidate area during the period (Spearman rank correlation: $r_s = 0.44$, $p = 0.27$, $N = 8$).

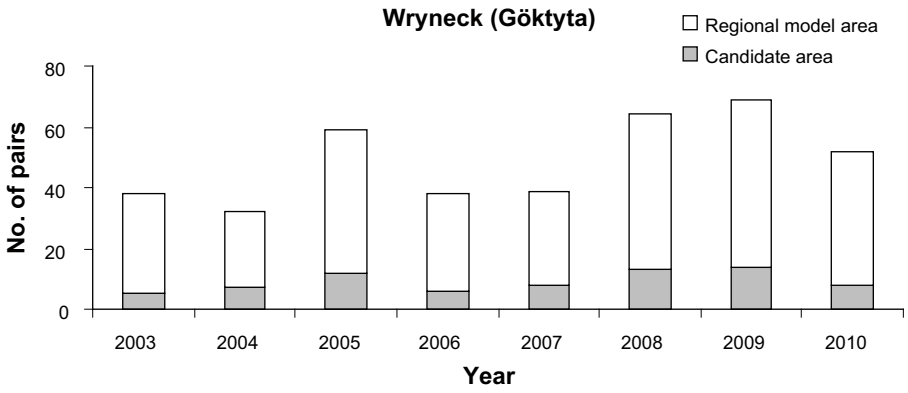

Figure 5-11. *Number of occupied wryneck territories in well monitored parts of Forsmark 2003–2010. Shading shows the number of occupied territories within the candidate area.*

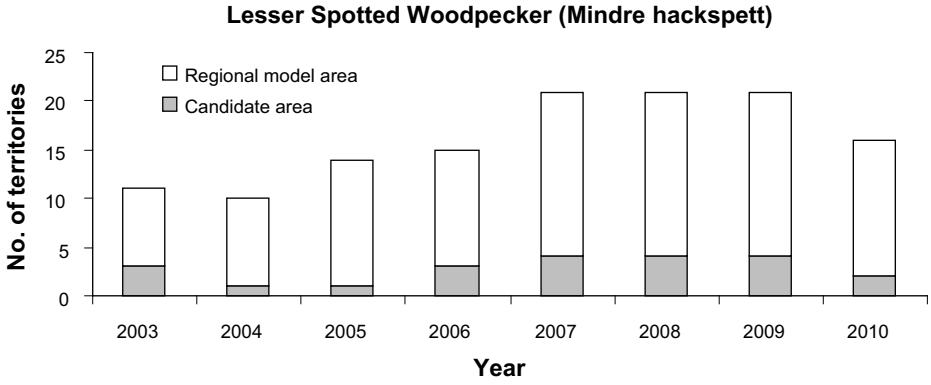

Figure 5-12. *Number of occupied territories of lesser spotted woodpeckers in areas monitored in all eight years 2003–2010 in Forsmark. Shading shows numbers of occupied territories in the candidate area.*

The lesser-spotted woodpecker is still classified as 'Near-Threatened' (missgynnad) in the Swedish Red List /Gärdenfors 2010/.

Red-backed shrike *Lanius collurio* Törnskata (EU Annex 1)

As in earlier reports, the population development of shrikes in Forsmark is shown below with an index (Figure 5-13). The figure should be read as there has been a 43% increase in red-backed shrike numbers within the candidate area between 2003 and 2010, and a 29% increase in the regional model area outside the candidate area. There is a statistically significant increase in the candidate area (Spearman rank correlation: $r_s = 0.71$, $p = 0.05$, $N = 8$) but not within the remaining parts of the regional model area (Spearman rank correlation: $r_s = –0.06$, $p = 0.89$, $N = 8$).

The red-backed shrike is no longer red-listed in Sweden /Gärdenfors 2010/.

General population changes of selected species

General population changes of selected listed species in Forsmark between 2009 and 2010 are illustrated in Table 5-2.

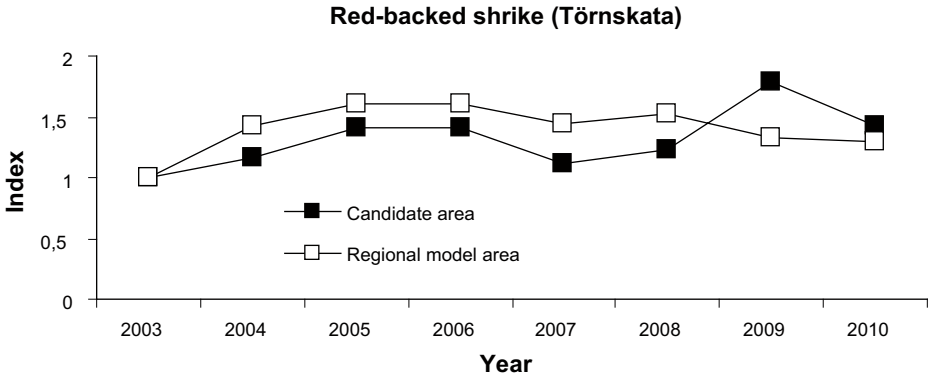

Figure 5-13. *Population development of red-backed shrikes in Forsmark 2003–2010 shown as a chain index. Index for year 2003 is set to 1. See text for further explanations.*

Table 5-2. General population changes of selected listed species in Forsmark between 2009 and 2010. A "+" means that the number of occupied territories has increased, a "–" means that it has decreased, a "0" that there is no major change and "?" denotes that the situation is unclear. Breeding output 2010 in general terms is shown for divers, raptors and owls.

Species	Regional model area	Candidate area	Whole area	Breeding output 2010
Black-throated Diver	–	0	0	Good
Honey Buzzard	+	0	+	Decent
White-tailed Eagle			–	Very poor
Osprey	0	0	0	Moderate
Black grouse	–	–	–	
Capercaillie	–?	0	–?	
Hazelhen	–	–	–	
Ural owl	–	0	–	Average
Wryneck	–	–	–	
Lesser Spotted Woodpecker	–	–	–	
Red-backed shrike	–	–	–	

6 Discussion and conclusions

2010 stands out as a bit different compared to earlier years of the bird monitoring in Forsmark. The general pattern up until 2009 has been that local populations of monitored species have increased in numbers and that new increases have been recorded almost every year. This is of course not a pattern that can continue forever and the general decreases, seven out of eleven species, between 2009 and 2010 may just be an expected result after several years of continuing increase. The interesting question is then why so many species decreased in numbers between 2009 and 2010. Are there any general patterns? Is there anything that hints at that the area as such that it suddenly would be of less quality for birds?

The second question can probably be answered with a firm no. There were no obvious changes in habitats or in the levels of human presence in the area compared to earlier years. If anything, general human presence has probably been lower in many parts since the site investigations ended in 2007, so also in 2010.

There is one external factor that may have affected resident species, the ones spending the whole year within the area, and that is the severity of the winter and the amount of snow. The winter 2009–2010 was a cold one, the coldest one during the study years and also the coldest one for quite a while. At weather stations in the closest cities (Gävle and Uppsala) the consistent periods of sub-zero temperatures this winter were the longest since the winter 1969–1970. The average temperatures in both cities were about three centigrades below the average values. The period with snow cover this winter was the longest since 1984–1985 (www.smhi.se).

With such circumstances it is easy to understand that this may have affected local birds in a negative way. A cold, snow-rich winter means that costs for staying alive will be higher, at the same time as finding food may get more difficult. In the end, survival is expected to be lower in cold winters compared to mild ones, and this may have been the case for at least four of the seven species (the grouse species and lesser spotted woodpecker) showing declines in numbers between 2009 and 2010.

However, also some long-distance migrants such as wrynecks and red-backed shrikes decreased in numbers between these two years, and in these cases the Swedish winter weather cannot be the driving force behind the declines. These species spend the winter in tropical Africa, far from snow and cold.

Hence the conclusion must be that the most likely explanation is that for some species the cold winter may be one of the factors behind the declines, but for others there must be other explanations. Poor breeding output in the year before may be one of these factors. June 2009 was very wet and rainy and there are many signs of that breeding success of at least some species was severely hampered in this year (see /Green 2009/).

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Appendix 1

Listed bird species in Forsmark

Table A-1. List of all listed (Swedish Red List, SRL, and EU Birds Directive Annex 1, EU) bird species, possibly breeding in Forsmark and recorded during 2002–2010. The listing follows the updated version of the Red List /Gärdenfors 2010/.

English name	Swedish name	Latin name	Listing	Estimated population size (pairs/territories) in Forsmark (regional model area)
Whooper Swan	Sångsvan	Cygnus cygnus	EU	5
Pochard	Brunand	Aythya ferina	SRL	1
Common Eider*	Ejder*	Somateria mollissima*	SRL	144
Velvet Scoter	Svärta	Melanitta fusca	SRL	7
Hazelhen	Järpe	Bonasia bonasia	EU	30
Black Grouse	Orre	Tetrao tetrix	EU	25
Capercaillie	Tjäder	Tetrao urogallus	EU	11–13
Quail	Vaktel	Coturnix coturnix	SRL	1–3
Black-throated Diver	Storlom	Gavia arctica	EU	5
Slavonian Grebe	Svarthakedopping	Podiceps auritus	SRL, EU	0–1
Bittern	Rördrom	Botaurus stellaris	SRL, EU	3
Honey Buzzard	Bivråk	Pernis apivorus	SRL, EU	7–9
White-tailed Eagle	Havsörn	Haliaeetus albicilla	SRL, EU	4
Marsh Harrier	Brun kärrhök	Circus aeruginosus	EU	0–1
Osprey	Fiskgjuse	Pandion haliaetus	EU	8
Spotted Crake	Småfläckig sumphöna	Porzana porzana	SRL, EU	0–3
Corncrake	Kornknarr	Crex crex	SRL, EU	0–1
Crane	Trana	Grus grus	EU	30
Curlew	Storspov	Numenius arquata	SRL	3
Common Sandpiper*	Drillsnäppa*	Actitis hypoleucos*	SRL	29
Turnstone	Roskarl	Arenaria interpres	SRL	10
Herring Gull*	Gråtrut*	Larus argentatus*	SRL	272
Lesser Black-backed Gull	Silltrut	Larus fuscus	SRL	97
Common Tern	Fisktärna	Sterna hirundo	EU	95
Black Guillemot*	Tobisgrissla*	Cepphus grylle*	SRL	50
Arctic Tern	Silvertärna	Sterna paradisaea	EU	234
Pygmy Owl	Sparvuggla	Glaucidium passerinim	EU	15–20
Ural Owl	Slaguggla	Strix uralensis	EU	6
Tengmalms Owl	Pärluggla	Aegolius funereus	EU	0–2
Nightjar*	Nattskärra*	Caprimulgus europaeus*	SRL	1
Swift*	Tornseglare*	Apus apus*	SRL	200
Wryneck	Göktyta	Jynx toruilla	SRL	40–70
Grey-headed Woodpecker	Gråspett	Picus canus	EU	0–3
Black woodpecker	Spillkråka	Dryocopus martius	EU	12–14
Lesser Spotted Woodpecker	Mindre hackspett	Dendrocopus minor	SRL	16
Three-toed Woodpecker	Tretåig hackspett	Picoides tridactylus	SRL, EU	1–3
Wood Lark	Trädlärka	Lullula arborea	EU	2–3
Skylark	Sånglärka	Alauda arvensis	SRL	30
Grashopper Warbler	Gräshoppsångare	Locustella naevia*	SRL	1–2
River Warbler	Flodsångare	Locustella fluviatilis	SRL	0–1
Greenish Warbler	Lundsångare	Phylloscopus trochiloides	SRL	0–1
Red-breasted Flycatcher	Mindre flugsnappare	Ficedula parva	SRL, EU	5
Red-backed Shrike	Törnskata	Lanius collurio	SRL	80–100
Nutcracker	Nötkråka	Nucifraga caryocatactes	SRL	10
Linnet	Hämpling	Carduelis cannabina*	SRL	4
Scarlet Rosefinch	Rosenfink	Carpodacus erythrinus*	SRL	50
Ortolan Bunting**	Ortolansparv**	Emberiza hortulana**	SRL, EU	0**

* The species was added to the Swedish red list in 2010.

** Ortolan Buntings occurred at Storskäret up until 2004, but have not been observed during later years.