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Breeding and overland flight of red-throated divers *Gavia stellata* at Smøla, Norway, in relation to the Smøla wind farm

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Norwegian Institute for Nature Research

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Smøla windfarm (photo Kjetil Bevanger)

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Abstract

Halley, D.J. & Hopshaug, P. 2007. Breeding and overland flight of red-throated divers *Gavia stellata* at Smøla, Norway, in relation to the Smøla wind farm. – NINA Report 297. 32 pp.

This report surveys the distribution and breeding success of red-throated divers *Gavia stellata* on the island of Smøla, Norway in the breeding seasons 1999-2004 inclusive, and 2007. During this period, a large windfarm was constructed in the northwestern portion of the island in two stages. Stage 1, 20 2MW turbines, was constructed between September 2001 and September 2002; stage 2, 48 2.3MW turbines, between October 2003 and October 2005.

A total of twenty three breeding sites were found, up to twenty of which were used in any given year, though more typically 10-13 pairs would breed each year. Overall fledging success was 0.42 chicks/pair/year, similar to other coastal breeding populations. Whole-island breeding success in 2007, the first post-construction year for which we have data, was 0.15 chicks/pair; however, strong fluctuations in breeding success between years are normal in this species and it seems unlikely that the windfarm was a factor in this result as all breeding sites in 2007 were some distance away.

Three red-throated diver breeding locations were noted within the windfarm area prior to construction, none of which have been used in years following construction of the stage in which each breeding site lies. It is unclear if this is due to the presence of the wind turbines in themselves, increased disturbance due to easier human access to the area, and/or lingering effects of the extreme disturbance concomitant with construction.

Although 46 hours and 20 minutes of structured observations were made within the windfarm area, and many more of unstructured observations by all scientists working in the windfarm area throughout the breeding season, not a single red-throated diver was observed to fly through the windfarm area, suggesting strong avoidance. At least four pairs breed in central areas of the island where the coast on the far side of the turbine arrays is, albeit by a small margin, the closest potential feeding habitat.

The turbine arrays were checked regularly using a specially trained dog for birdstrike casualties. Although many such birds were found, mainly sea eagles *Haliaeetus albicilla*, grouse *Lagopus lagopus*, and waders, no red-throated diver corpses were recovered. Taken with the lack of observations of red-throated divers breeding in, or flying through, the windfarm area, this suggests that the risk of direct mortality from collisions at this location is very low.

Further monitoring may include surveys early in the breeding season to determine if red-throated divers visit the wind farm area at that time, and so might resume breeding now that the construction phase and attendant disturbance is at an end; and focussed observations of the direction of feeding flights to and from the breeding sites on the central mire of the island, to determine whether these birds are simply preferring other feeding areas to those on the coast off the wind farm, or actively avoiding flight directions which would take them through the turbine arrays.

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Sammendrag

Halley, D.J. & Hopshaug, P. 2007. Breeding and overland flight of red-throated divers *Gavia stellata* at Smøla, Norway, in relation to the Smøla wind farm.– NINA Rapport 297. 32 s.

Denne rapporten beskriver utbredelsen og hekkesuksess hos smålom *Gavia stellata* på Smøla, Norge, i hekkesesongene 1999-2004 samt 2007. I løpet av denne perioden, ble et stort vindkraftanlegg bygget i den nordvestre delen av øya i to trinn. Trinn 1, 20 2MW turbiner, ble bygget mellom september 2001 og september 2002; trinn 2, 48 2,3MW turbiner, mellom oktober 2003 og oktober 2005.

23 hekkeplasser ble funnet i alt, hvorav opptil 20 ble brukt i ett enkelt år, mens 10-13 hekkende par var mer typisk. Produktiviteten totalt var 0,42 unger/par/år, som tilsvarer nivået i andre kysthekkende bestander. Produktiviteten i 2007, det første år etter anlegget ble bygget hvor vi har data, var 0,15 unger/par. Store variasjoner mellom år i produktivitet er vanlig hos arten, og det er lite sannsynlig at vindkraftanlegget var en faktor i dette resultat siden at alle hekkelokaliteter i 2007 var ganske fjernt fra anlegget.

Tre hekkeplasser ble funnet innen vindkraftanleggets areal før utbyggingen, men ingen av disse ble brukt i årene etter utbyggingen. Det er uklart om vindmøllene i seg selv er ansvarlig for dette, eller om økt forstyrrelse pga lettere adgang til området, og/eller langvarige effekter av den kraftige forstyrrelsen i byggefasen har virket inn,.

I løpet av 46 timer og 20 minutter av strukturerte observasjoner innen vindkraftanlegget, og mange flere timer ustrukturete observasjoner av alle forskere som arbeidet i området i løpet av hekkesesongen, ble ikke en eneste smålom sett i flukt innen anleggsområdet. Dette antyder sterk unngåelse av området. Minst 4 par hekker i sentrale områder av øya, der kysten på motsatt side av anlegget er det nærmeste potensielle beitehabitat.

Anlegget ble overvåket regelmessig med bruk av spesielt opplærte hunder for å finne fugler og flaggermus drept i kollisjoner med vindmøllene. Mens mange funn ble gjort, hovedsakelig av havørn *Haliaeetus albicilla*, lirype *Lagopus lagopus*, og vadefugler, ble ingen smålom funnet. I tillegg til mangel på smålom som hekker i, eller flyr gjennom, anlegget, tyder dette på at risikoen for direkte mortalitet av dette anlegget er svært lav.

Videre overvåking kan inkludere oversikt tidlig i hekkesesongen for å finne ut om smålom besøker vindkraftanlegget i perioden, for så muligens å gjenoppta hekking nå når byggefasen med tilhørende forstyrrelse er slutt. Videre bør observasjoner av retningen av matflukter til og fra hekkesteder på øyas sentrale myrer gjennomføres. Dette kan vise om fuglene reelt foretrekker andre beitesteder framfor de på kysten ved vindkraftanlegget, eller om de aktivt unngår ruter som går gjennom anlegget.

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Contents

1 Introduction

The red-throated diver *Gavia stellata* is a medium sized aquatic bird (length 53-60cm, wingspan 106-116cm; 1370-1900g summer weight), strongly adapted to an aquatic and piscivorous diet. While living outside the breeding season in shallow inshore salt water, the species characteristically breeds on small to tiny, shallow, freshwater pools. At this time it flies to the sea or, less commonly, to larger freshwater bodies to find food both for itself and its chicks (Cramp 1977).

Red-throated divers are strong and fast fliers, but with a high wing loading which means that they are unmanoeverable in the air. The species typically flies swiftly and directly at heights vulnerable to collision with wind turbines (Davis 1971; Norberg & Norberg 1971; Garthe & Hüppop 2004), in the breeding season between breeding pools and feeding areas several times a day – on average, seven times a day per dependent chick in Sweden (Eriksson *et al* 1990); 11 times a day overall in British Columbia (Reimchen & Douglas 1984). In addition, the species is of conservation concern and has a high adult survival rate (0.85, Hemmingsson & Eriksson 2002) combined with low breeding productivity. This combination of characteristics suggests both a potential vulnerability to collision with wind turbines, and that such vulnerability is more likely to have consequences for the conservation of the species. Taking all these factors into account, Garthe & Huppop (2004) rated red-throated divers as 2nd of 26 species in a SSI (species sensitivity index) to wind turbine collisions, after black-throated divers. However, direct evidence is currently lacking.

This study was planned to 1) identify breeding pairs within and around the Smøla wind farm site; 2) collect information on the productivity of these pairs and 3) make informal observations and recordings of red-throated diver flight paths, approximate flight heights, and general behaviour in relation to the wind turbines. The study is a component of the wider NINA "*Pre- and post-construction studies of conflicts between birds and wind turbines in coastal Norway*" project (financed primarily by the Norwegian Research Council RENERGI programme), and was funded by AMEC Wind Energy Limited under contract no. 6116-SC-043.

2 Study area

The Smøla wind farm is located in the western part of the island of Smøla, on the west coast of Norway at 63^{0}23'N, 8^{0}00'E (Figure 1). It consists of 20 2MW turbines (Stage 1), constructed between September 2001 and September 2002, and 48 2.3MW turbines (Stage 2), constructed between October 2003 and October 2005, along with service roads, transformer house, transmission cables, etc (Figure 2). The island is roughly circular, about 16-19km in diameter. Topography is on the large scale flat or uneven but of low relief, 44m a.s.l. at the highest point, and averaging about 30m a.s.l. in the interior. On the small scale the landscape is mainly rough and rocky moorland on the periphery and in western regions, with extensive areas of blanket bog in the centre and east of the interior (see frontispiece). Small tarns and pools on which red-throated divers can potentially breed are common in the moorland areas, and abundant in the blanket bog areas. Daylength in the breeding season is in effect 24 hours; lowest light intensity levels are light to medium twilight depending on the weather conditions.

Figure 1. Location of Smøla windfarm.

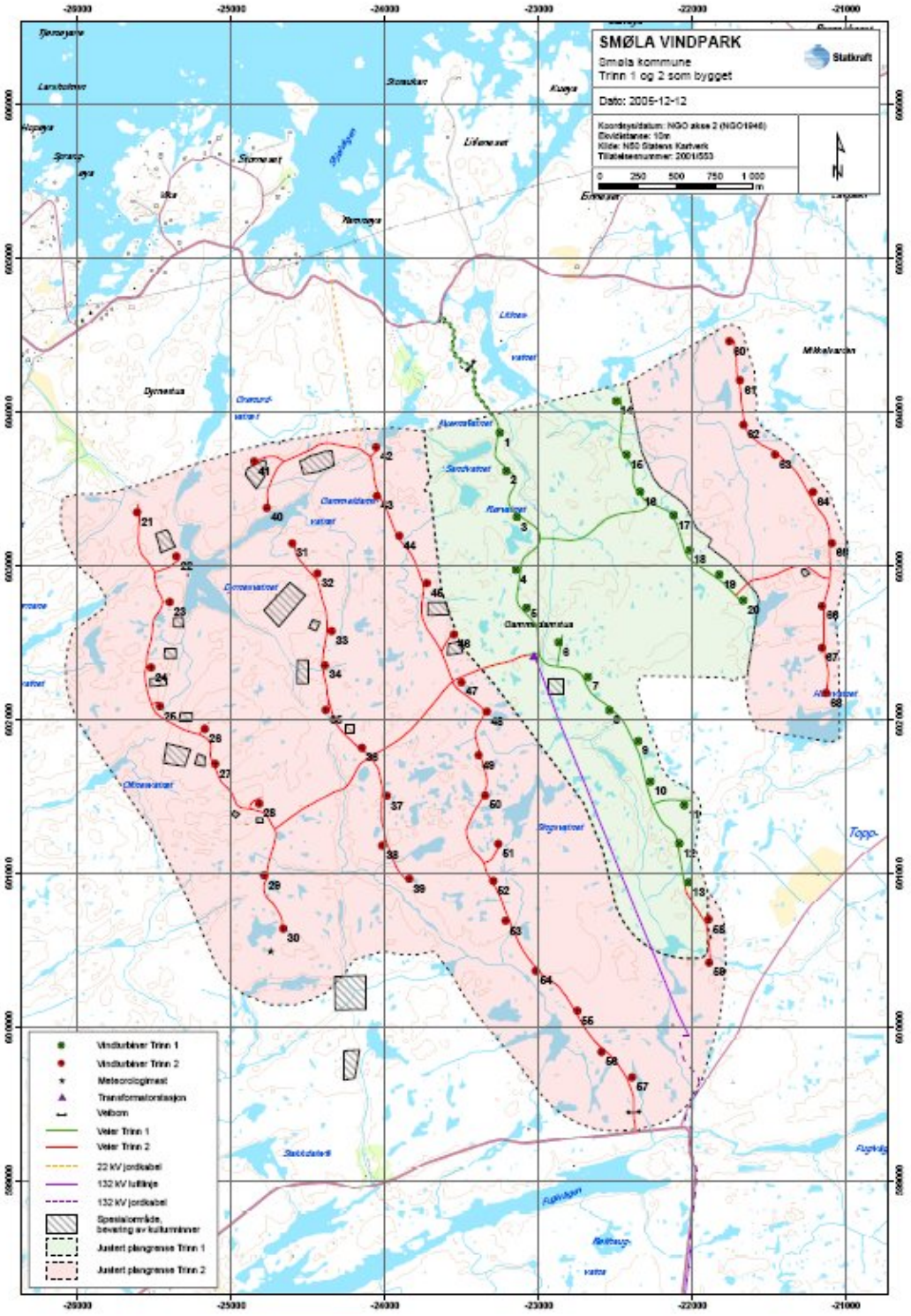

Figure 2. Map of Smøla windfarm. The green area represents Stage 1, constructed from September 2001 – September 2002; the red area represents Stage 2, constructed from October 2003 – October 2005. Red and green lines represent access roads, and the thick purple line an overhead transmission cable. Hatched areas are archaeological sites.

3 Methods

Breeding sites were studied by two complete surveys of the island, conducted during the middle incubation period (the time at which most breeding pairs will be detected, and when there is least risk of causing abandonment of a breeding attempt through disturbance), and in the fledgling period to find late-breeding pairs and to check on the success of pairs detected in the earlier period. Breeding sites were recorded using GPS and breeding status was categorised according to standard Norwegian breeding atlas codes (Appendix 1).

Both frequency of entering turbine arrays and small variations in avoidance rates of turbines by birds strongly affect the predicted frequency of turbine blade strikes (Chamberlain et al 2006). Watches were therefore made for flights of red-throated divers within and near the wind farm area during systematic investigations of breeding bird densities in May and June 2007. All sightings of red-throated divers were to be recorded, including height, direction, and mapping of flight lines in relation to wind turbines on 1:25000 maps incorporated in the recording sheets. A total of 46 hours and 20 minutes of structured observations were carried out in this way. In addition, all sightings of red-throated divers within or near the turbine arrays by any of the researchers involved in other aspects of the overall programme, were to be reported.

Data on breeding in years prior to 2007 was available for the years 1999-2004 inclusive, as a result of amateur studies of the species by P. Hopshaug. This period covers from before the beginning of turbine construction, to the first breeding season after the beginning of construction of Phase 2 of the wind farm. Methods were the same as for 2007, but coverage was less intense, so that pairs would have been more likely to be missed in 1999-2004. However, breeding red-throated divers are relatively easy to locate, so we do not believe that breeding numbers were greatly underrepresented earlier in the period, except for 1999, the first year of study.

4 Results

4.1 Number of breeding pairs

A total of 23 different breeding pairs were located on Smøla island, of which 3 bred inside the current wind park area (1 pair in Stage 1, 2 pairs in Stage 2). Records for each site and year are given in Appendix 1.

	Number of breeding pairs
1999	7
2000	10
2001	20
2002	12
2003	9
2004	10
2007	13

Table 1. Number of breeding pairs of red-throated divers on Smøla by year

Table 1 indicates the numbers of breeding pairs (ie, where ‘probable breeding’ or ‘confirmed breeding’ occurred, see Appendix 1). Numbers fluctuated considerably from year to year, probably mainly reflecting variations in the number of nonbreeding pairs or of early failures from year to year. The locations of breeding pairs in each year, and the stage of development of the windfarm, are given in figure 3.

4.2 Breeding pairs in the Smøla windfarm area

Three pairs bred or attempted to breed within the future wind park area in years prior to its construction (Figure 3).

Pair 10 were present in the breeding season at Toppmyra West, in 2000, though breeding was not confirmed. The birds were not seen in subsequent years. The site lies within Stage 1 of Smøla wind farm (construction commencing September 2001).

Pair 12 bred at Singsvatnet tarn in 2000, where the pair were observed alarm calling in a way that indicates young in the vicinity. In 2001, a pair was present on Singsvatnet in the breeding season but breeding was not confirmed. The site lies within the Stage 2 area of the windfarm (construction commenced October 2003)

Pair 11 Singsmyra attempted to breed every year 1999-2002 inclusive. In 1999 the pair fledged 2 chicks; in 2000 the pair laid one egg but breeding failed at that stage. In 2001 and 2002 the pair built a nest but no eggs were seen; birds have not been present in later years. The site lies within the Stage 2 area of the windfarm (construction commenced in October 2003).

In 2000, 3 of 10 pairs which attempted to breed did so within the future windfarm area; in 2001, 2 of 20. No pairs have been found breeding within either stage of the windfarm area during or subsequent to their construction. The nearest breeding pairs to the windfarm in 2007 were c. 2km from the windfarm perimeter.

4.3 Observations of red-throated divers flying through the wind park area in 2007

Although 46 hours and 20 minutes of structured observations were made within the wind farm in May-June, not a single red-throated diver was observed flying through the area. No casual observations were reported by other fieldworkers active in the windfarm area throughout the breeding season.

4.4 Collisions with wind turbines

Bird and bat casualties in collisions with wind turbines on Smøla were regularly checked for (outwith this study) using specially trained sniffer dogs. A considerable number of casualties have been reported, of a number of species, principally white-tailed eagles *Haliaeetus albicilla*, willow grouse *Lagopus lagopus*, and wader species. No red-throated divers have been reported.

4.4 Breeding success

Of 69 breeding attempts recorded in 1999-2004 and 2007, 27 (39%) failed before eggs were laid; 15 (22%) laid one egg but failed at that stage; 4 (6%) laid two eggs which failed at that stage; 17 (24%) produced one chick; and 6 (9%) produced two chicks. Overall breeding success was thus 0.42 chicks/pair. This is similar to values reported from Shetland, a similar coastal breeding location (0.45 chicks/pair, Gomersall 1986).

In 2007, the first post-construction year for which data is available, of 13 breeding attempts, 7 (54%) failed before eggs were laid; 3 laid one egg but failed at that stage; one laid two eggs which failed at that stage; and two produced one chick. Overall breeding success was 0.15 chicks/pair. However, breeding success fluctuates strongly from year to year in this species (Bundy 1976; Eberl & Picman 1993; Gomersall 1986); see discussion.

5 Discussion

Only a minority of the breeding population, 3 breeding locations out of the 23 known on Smøla, are within the windfarm area. This limits the strength of conclusions which can be drawn from the data.

None of the 3 locations have been used as breeding sites by red-throated divers after construction of the phase of the windfarm in which they lie commenced. As the data shows, individual sites do come into and out of use in different years, and it is possible therefore that this is a result of random variations; however, the species is known to be highly vulnerable as a breeder to human disturbance (Cramp 1977; Gomersall 1986). In addition to the wind turbines themselves and associated maintenance traffic (which is frequent, *pers. obs.*), the access roads permit much more frequent access to the area, previously almost unvisited outside the hunting season in autumn, by the public for dog walking and other recreational use. It would certainly be unsafe to conclude from the data that wind farm construction has not had a negative effect on the breeding of red-throated divers within the wind farm area.

A considerable surprise in our fieldwork was the apparent complete absence of red-throated divers flying through the windfarm area in 2007 (the only year for which we have data). While many pairs bred at sites where the natural flight lines to sea would not take them over the windfarm area, four of the thirteen pairs breeding that year did so at Toppmyra, a blanket bog in the central part of the island, where the sea on the far side of the windfarm was at a similar distance to the sea in other directions (indeed, for three of the four pairs by a slight margin the closest open coast, ie excluding narrow inlets). Moreover, the coast adjacent to the windfarm is shallow water of the type generally preferred by foraging divers. It is a significant possibility, therefore, that birds were actively avoiding the entire windfarm area, though the data is insufficient to establish this with certainty. Eider duck *Somateria molissima*, which have a similar wing loading and flight style to red-throated divers, and also migrating geese, are known to strongly avoid entering the perimeters of marine windfarms off Denmark (Desholm & Kahlert 2005; Desholm 2006; Larsen & Guillemette 2007).

Breeding success of the Smøla population appears to be within the normal range for the species; similar levels on Shetland were considered sufficient to maintain the population there (Gomersall 1986). Success in 2007 was poor; however, variation between years is often high, and as none of the pairs bred within the windfarm area, or even overflew it, it seems implausible that the presence of the windfarm has affected breeding success among these pairs.

Assuming the wind farm was responsible for causing the three breeding sites there to go out of use, as seems most probable, it is also unclear whether this has had any effect on the breeding population on Smøla as a whole. Breeding sites on Smøla appear to be superabundant, with very many more apparently suitable pools and tarns available than are actually used. In any year, a considerable number of sites where breeding has occurred in the past are not apparently in use. It therefore seems unlikely that this windfarm is limiting the red-throated diver population locally.

6 Conclusions

The data available to date warrant only tentative conclusions. They suggest, though do not prove, that the wind farm area has been rendered unsuitable as breeding habitat by the construction of the wind farm. While this is a negative development, it may be compensated for to some degree by the lowered collision risk this implies. Birds breeding within the windfarm perimeter would necessarily be more exposed to collision risk, and alternative breeding sites

elsewhere on the island appear to be superabundant and could be taken into use as alternatives. Assuming this is the case, the population as a whole may not be negatively affected by this factor so long as further development (of various kinds) does not reduce the availability of nesting sites below the other population limiting factors currently operating on the breeding population.

Further monitoring of the breeding situation within the windfarm area, especially early in the breeding season to establish whether birds prospect the area and are disturbed away by the increased human traffic in the area, or that the area is totally avoided from the outset, would be useful to increase our understanding of the mechanisms and risks in this area. It is also possible that abandonment of the area was due primarily to the high disturbance levels of the construction phase, and that the sites may be reoccupied in coming years

The complete avoidance of the windfarm area by red-throated divers in flight implies a near-zero risk of collision mortality in the breeding season. However, it is unclear from current data whether breeding pairs are actively avoiding the windfarm, or whether this is a result of pairs preferring to feed at locations which do not take them through the windfarm in transit flights, for other reasons. Feeding flight observations of the (in 2007) four pairs located in the Toppmyran (central) area of the island in 2007 would be instructive in this regard, as suitable feeding habitat is located at about the same distance in all directions from these sites (the island is roughly circular in form; Figure 3). If birds consistently fly to feed in a single direction from these sites this may imply a feeding site preference; if they fly in all directions except northwest (ie, through the windfarm), this would strongly suggest avoidance behaviour. Collateral evidence could be collected by studies of the inshore habitats around the island and of the piscivorous seabirds feeding there. In particular, do nonbreeding birds use the inshore coast nearest the windfarm for foraging to a similar, greater, or lesser extent than other areas? This would help to solve the question whether the observed lack of flights through the windfarm area is due to active avoidance, or to other factors such as poorer adjacent feeding habitat.

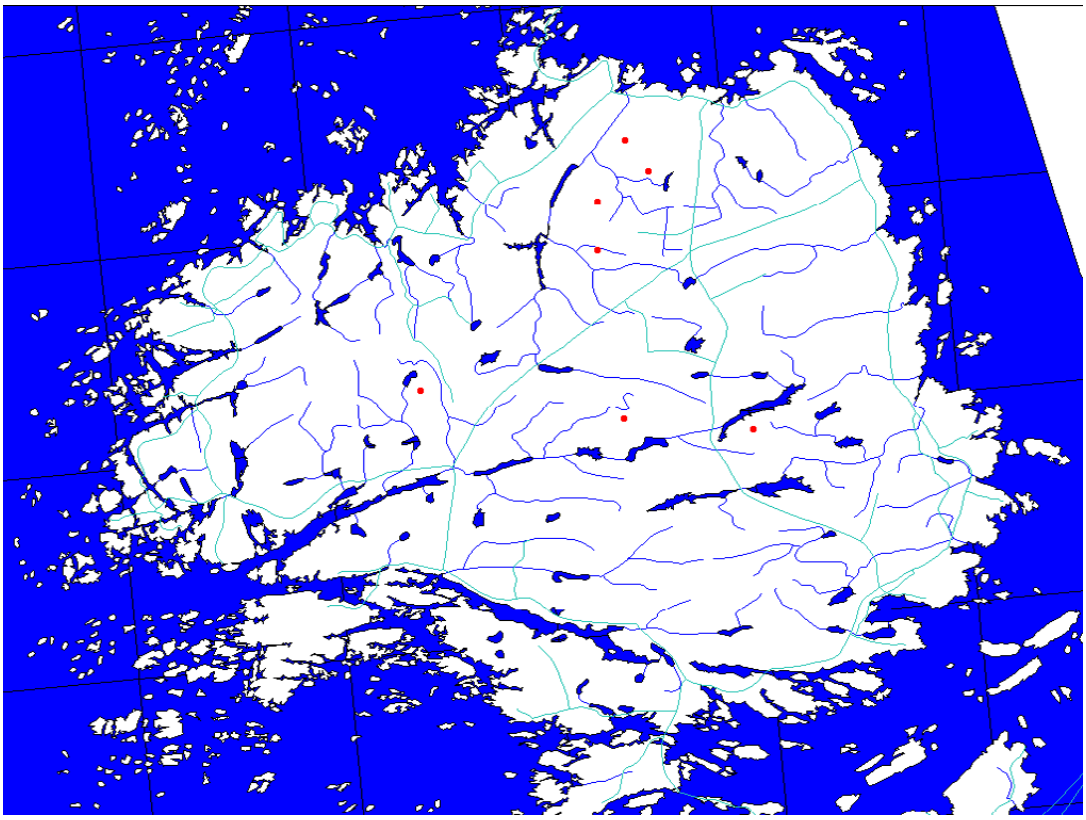

Figure 3a: Breeding pairs in 1999

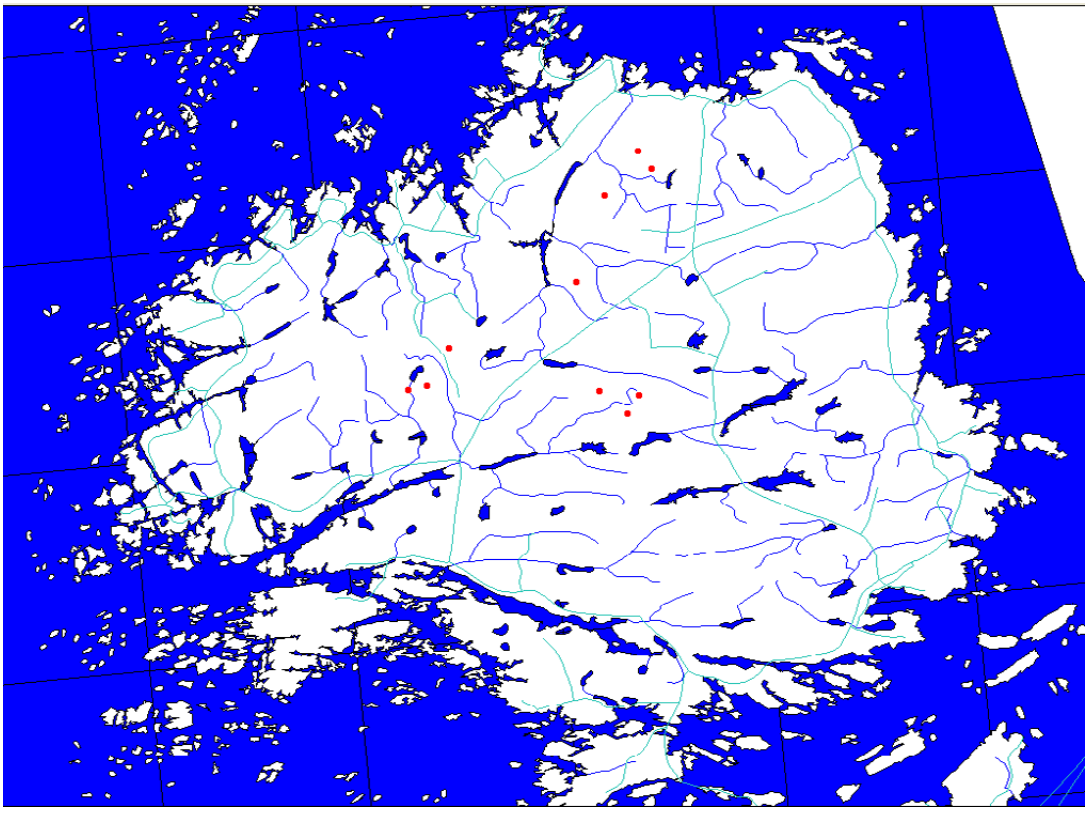

Figure 3b. Breeding pairs in 2000

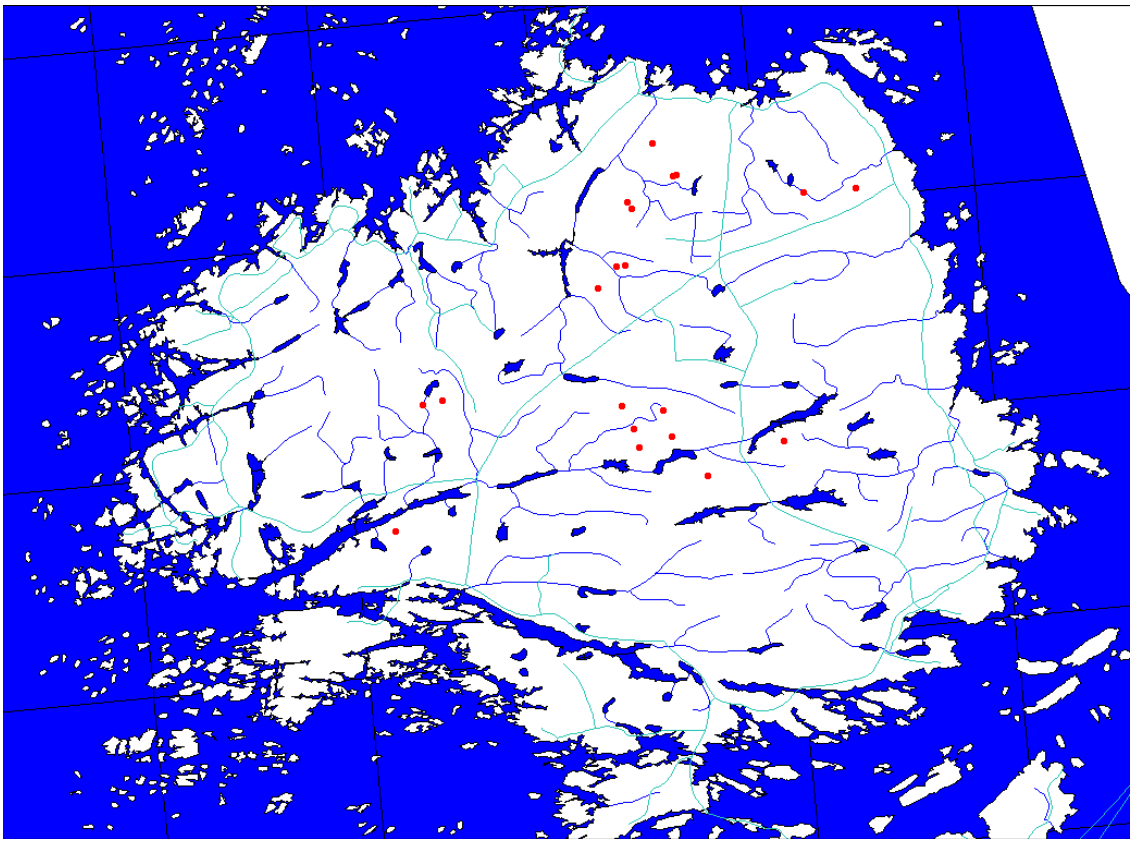

Figure 3c. Breeding pairs in 2001

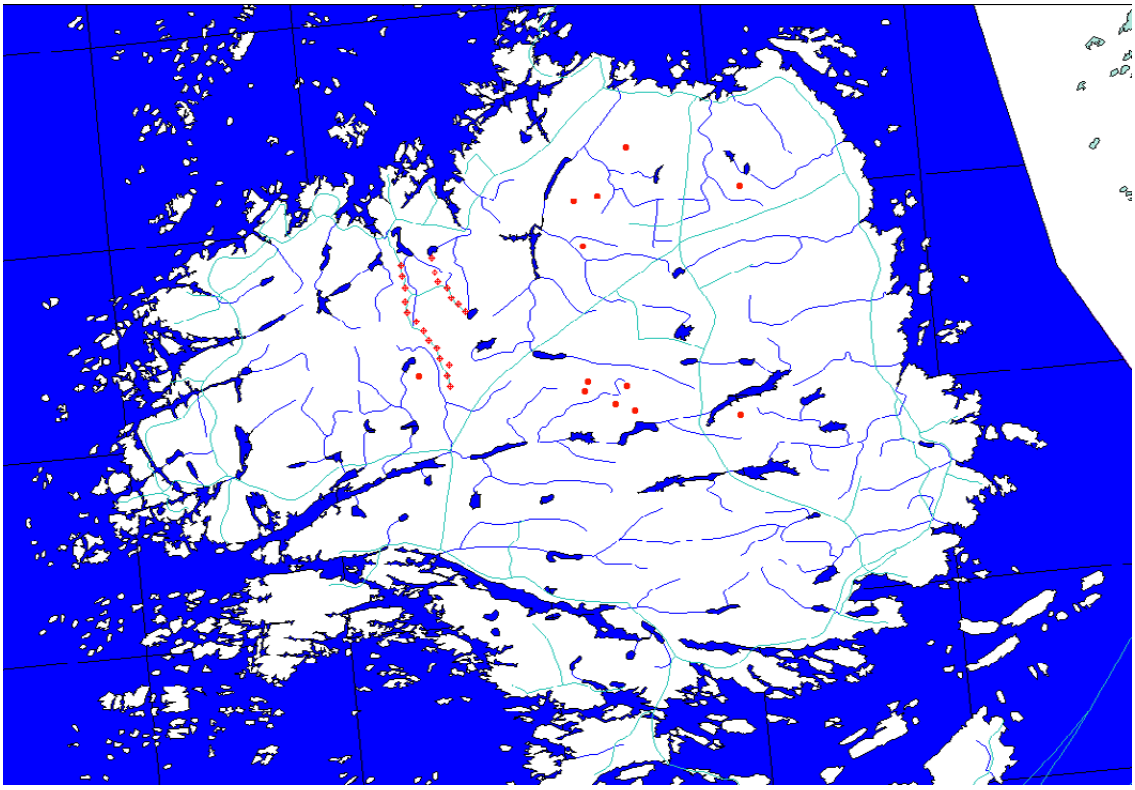

Figure 3d. Breeding pairs in 2002, and the positions of Smøla Phase 1 wind turbines

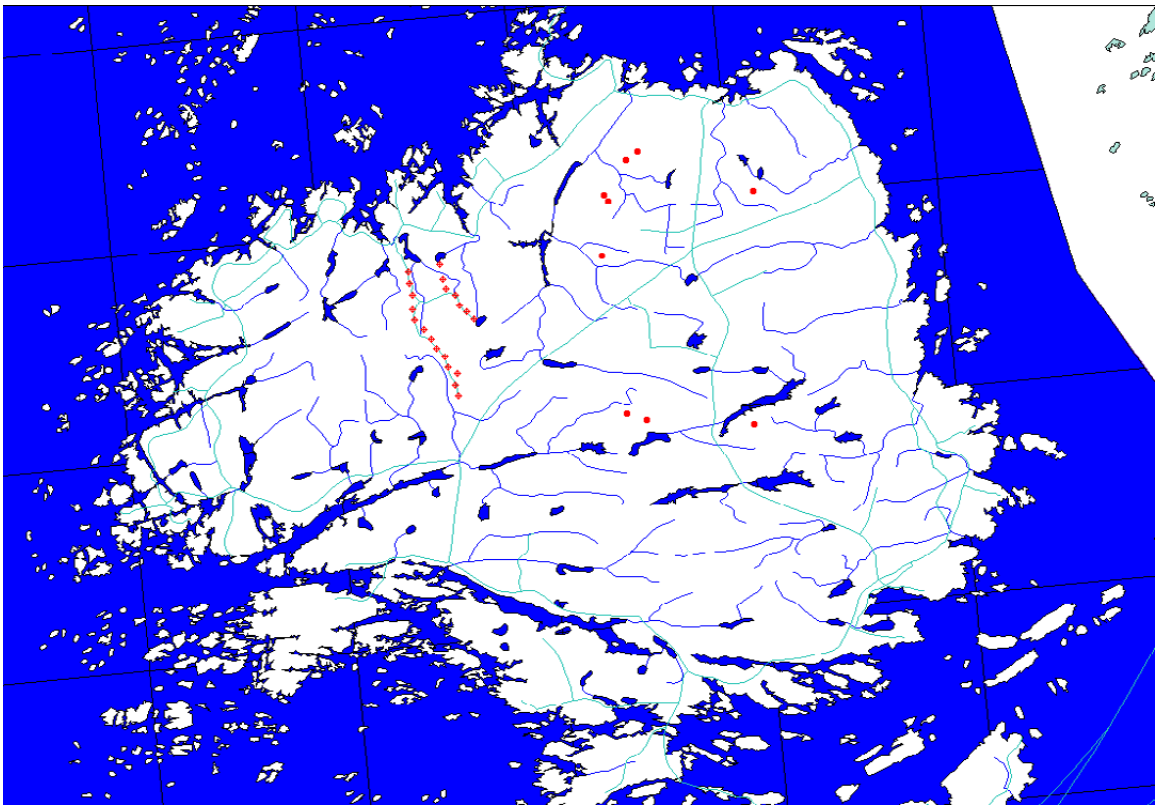

Figure 3e. Breeding pairs in 2003, and the positions of Smøla Phase 1 wind turbines

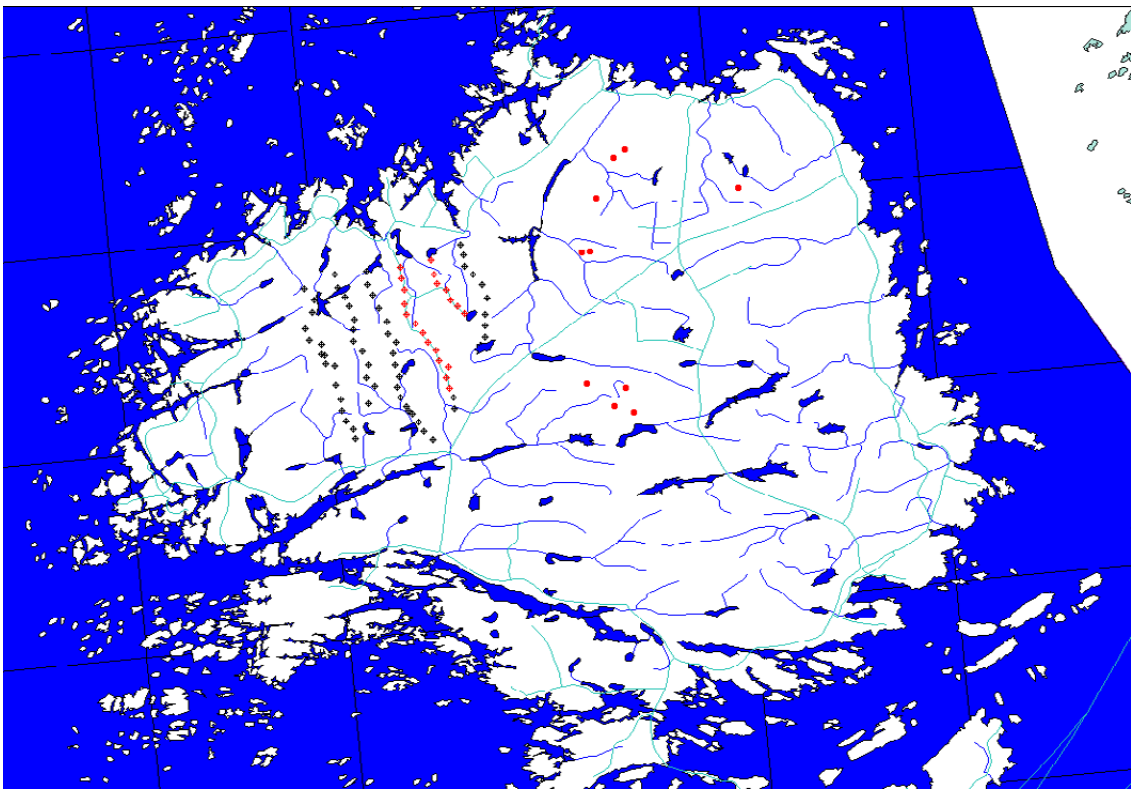

Figure 3f. Breeding pairs in 2004, and the positions of Smøla Phase 1 (red) and 2 (black) turbines

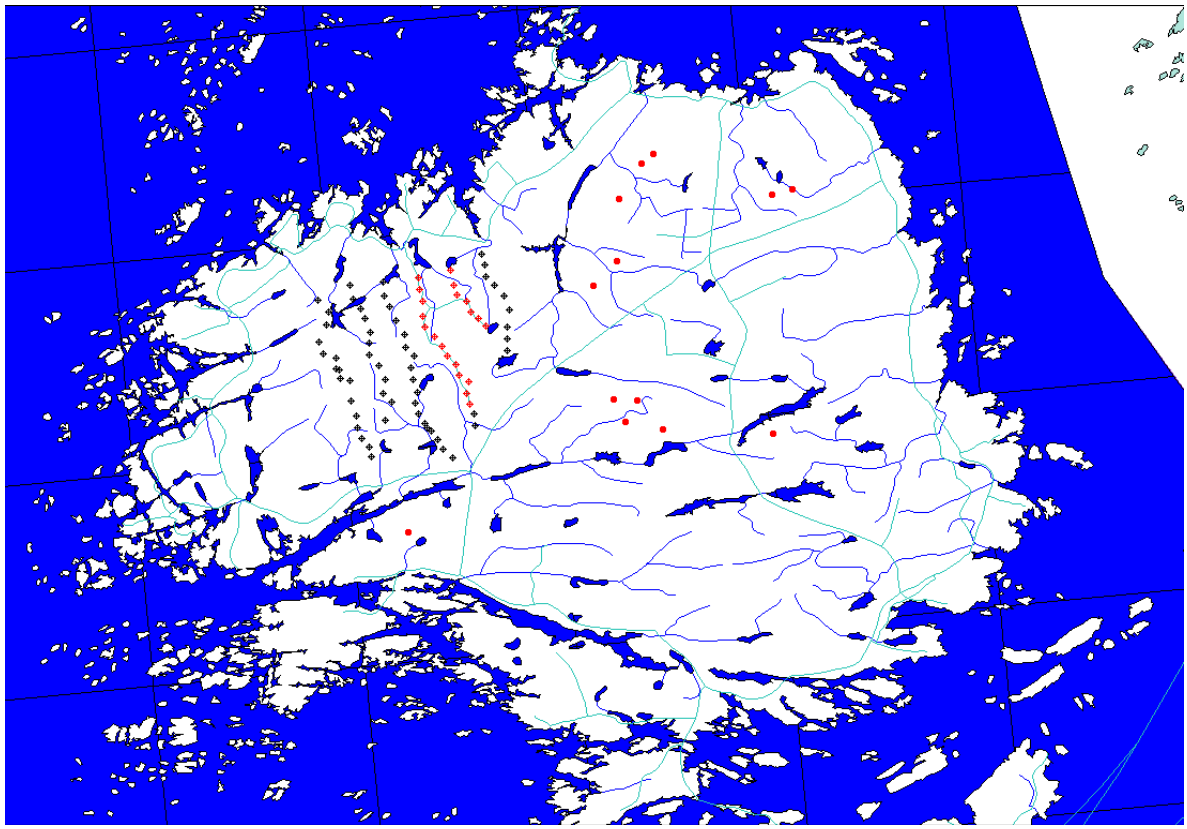

Figure 3g. Breeding pairs in 2007, and the positions of Smøla Phase 1 (red) and 2 (black) turbines

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Appendix 1: Breeding atlas survey codes

	KEY
A	Species observed in breeding season but no indication of breeding
B	Possible breeding
C	Probable breeding
D	Confirmed breeding

A1	Species observed in breeding season without indication of breeding
B2	Species observed in breeding season in possible breeding habitat
B3	Singing male heard in breeding season
C4	Pair observed in breeding season in breeding habitat
C5	Apparent permanent occupation of nesting territory.
C6	Lek
C7	Visit to presumed nest site
C8	Excited behaviour or alarm calling from an adult bird indicating nest or young in vicinity
C9	Brood patch on captured bird
C10	Nest building, including formation of nest scrape
D11	Distraction display
D12	Nest used same season or eggshell from same season
D13	Downy young observed
D14	Adult bird arriving or leaving nest in way indicating nest in use
D15	Bird carrying food for young observed, or bird with dropping in bill
D16	Nest with egg or incubating bird
D17	Nest with young seen or heard

Appendix 2: Breeding data for red-throated divers on Smøla, 1998-2004 & 2007

Pair.nr	Place	Locality nr.	Year	Early check Atlas code	Final check Atlas code	
1	Årvoksberget	1	1998			
			1999		D13	1 pull.
			2000		0	
			2001		D12	Eggshell
			2002		0	
			2003		0	
			2004		0	
			2007	0	0	
1	Årvoksberget	2	1998			
			1999		0	
			2000		D13	1 pull.
			2001		0	
			2002		D13	1 pull.
			2003		D12	Eggshell
			2004		D13	1 pull.
			2007	D12	D12	Eggshell
2	Moldtjønna	3	1998			
			1999		C8	
			2000		D13	2 Pull.
			2001		C8	
			2002		0	
			2003		0	
			2004		0	
			2007	0	0	
2	Moldtjønna	28	1998			
			1999			
			2000		0	
			2001		C10	empty nest
			2002		0	
			2003		0	
			2004		0	
			2007	0	0	
3	Vetta (nord)	4	1998			
			1999		D13	1 egg + 1 pull.

			2000		0	
			2001		0	
			2002		0	
			2003		0	
			2004		0	
			2007	0	0	
3	Vetta (nord)	5	1998			
			1999		0	
			2000		D13	1 pull.
			2001		D16	2 egg
			2002		0	
			2003		D13	2 pull
			2004		0	
			2007	C8	D13	1 pull.
3	Vetta (nord)	32	1998			
			1999			
			2000			
			2001			
			2002		D12	Eggshell
			2003		0	
			2004		0	
			2007	0	0	
4	Vetta (nord)	6	1998			
			1999		0	
			2000		0	
			2001		D12	1 egg (crushed)
			2002		D16	2 Eggs
			2003		D12	Eggshell
			2004		D13	1 pull
			2007	0	0	
5	Vetta (sør)	7	1998			
			1999		D13	1 pull
			2000		0	
			2001		0	
			2002		0	
			2003		0	
			2004		0	
			2007	0	0	
5	Vetta (sør)	8	1998		*	
			1999		*	

			2000		*	
			2001		D12	empty nest
			2002		0	
			2003		D13	2 pull
			2004		D12	Eggshell
			2007	C4	0	Pair in flight over locality
6	Vetta (sør)	9	1998			
			1999			
			2000			
			2001		0	
			2002		D13	1 pull
			2003		0	
			2004		0	
			2007	0	0	
6	Vetta (sør)	10	1998			
			1999			
			2000			
			2001		D12	Eggshell
			2002		0	
			2003		0	
			2004		C10	
			2007	0	0	
7	Hopasingsmyra	11	1998			
			1999			
			2000		D12	2 eggs (crushed)
			2001		0	
			2002		0	
			2003		0	
			2004		0	
			2007	0	0	
7	Hopasingsmyra	12	1998			
			1999			
			2000		0	
			2001		C10	empty nest
			2002		0	
			2003		0	
			2004		0	
			2007	0	0	
7	Hopasingsmyra	35	1998			
			1999			
			2000		0	

			2001		0	
			2002		0	
			2003		0	
			2004		0	
			2007	C8	D13	1 pull.
8	Ørntua (Nordvik n/ø)	26	1998			
			1999			
			2000			
			2001		B2	
			2002		0	
			2003			
			2004			
			2007			
9	Ørntua (Nordvik s/v)	31	1998			
			1999			
			2000			
			2001			
			2002		D13	1 pull
			2003		D13	1 pull
			2004		D16	1 egg + eggshell
			2007	C8	D16	2 egg
10	Toppmyra vest (Vindpark områ-det)	14	1998			
			1999		0	
			2000		B2	
			2001		0	
			2002		0	
			2003		0	
			2004		0	
			2007	0	0	
11	Singsmyra	15	1998			
			1999		D13	2 pull
			2000		D16	1 egg
			2001		C10	empty nest
			2002		C10	empty nest
			2003		0	
			2004		0	
			2007	0	0	

12	Singsvatnet (området)	16	1998			
			1999		0	
			2000		C8	
			2001		C4	
			2002		0	
			2003			
			2004		0	
			2007	0	0	
13	Toppmyra (øst)	17	1998			
			1999			
			2000		D13	2 pull
			2001		D16	2 egg
			2002		D12	empty nest
			2003		0	
			2004		D13	1 pull (dead)
			2007	C8	D12	Eggshell
14	Toppmyra (øst)	18	1998			
			1999			
			2000		D13	1 pull
			2001		C10	empty nest
			2002		D16	1 egg
			2003		0	
			2004		D12	tomt reir
			2007	0	0	
14	Toppmyra (øst)	34	1998			
			1999			
			2000			
			2001			
			2002			
			2003			
			2004			
			2007	D12	D12	empty nest
15	Kjyssvassmyra	19	1998			
			1999		D13	1 pull
			2000		D12	Eggshell
			2001		0	
			2002		D13	1 pull
			2003		D12	Eggshell
			2004		D14	empty nest
			2007	0	0	

15	Kjyssvassmyra	21	1998			
			1999		0	
			2000		0	
			2001		D13	2 pull
			2002		0	
			2003		0	
			2004		0	
			2007	C8	D12	Eggshell
16	Kjyssvassmyra	20	1998			
			1999		0	
			2000		0	
			2001		D13	2 pull.
			2002		D16	2 egg
			2003		C4	
			2004		D12	empty nest
			2007	C8	D13	1 pull.
17	Kjyssvassmyra (området)	22	1998			
			1999		0	
			2000		0	
			2001		C8	
			2002		0	
			2003		0	
			2004		0	
			2007	0	0	
18	Kjyssvassmyra (sør)	23	1998			
			1999			
			2000			
			2001		C7	
			2002		0	
			2003		0	
			2004			
			2007	0	0	
19	Storvatnet sør	24	1998			
			1999		C8	
			2000		0	
			2001		D12	Eggshell
			2002		C7	
			2003		D12	Eggshell
			2004		0	
			2007	C7	C7	Pair in locality

19	Storvatnet sør	30	1998			
			1999			
			2000			
			2001			
			2002		0	
			2003		0	
			2004		0	
			2007	0	0	
20	Røkmyra vest	25	1998			
			1999			
			2000		0	
			2001		C8	
			2002		0	
			2003			
			2004		0	
			2007	0		
20	Røkmyra vest	36	1998			
			1999			
			2000		0	
			2001		0	
			2002		0	
			2003			
			2004		0	
			2007	B2	0	Adult in locality
21	Toppmyra (øst)	29	1998			
			1999			
			2000			
			2001			
			2002		C10	empty nest
			2003		0	
			2004		0	
			2007	0	0	
22	Årvoksberget	33	1998			
			1999			
			2000			
			2001			
			2002			
			2003		C10	empty nest
			2004		C10	empty nest
			2007	0	C7	ad.pair in loc.(2 days)

23	Ørntua (Nordvik s/v)	27	1998			
			1999			
			2000			
			2001		C7	
			2002		0	
			2003		0	
			2004		0	
			2007	B2	0	Adult hid in locality

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