

Greylag Geese *Anser anser* depart earlier in spring: an analysis of goose migration from western France over the years 1980–2005

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Abstract

France is located on the Atlantic flyway of the Northwest European Greylag Goose *Anser anser* population, between its Nordic breeding grounds (Sweden and Norway) and its southernmost wintering sites in Spain. Large numbers of geese pass over France during autumn and spring, particularly in west-central France which is on the birds' main migration route to Spain. Analysis of the phenology of spring migration over 26 years (1980–2005) in west-central France showed that spring migration occurs between January and mid-April, with the main movements occurring between the end of January and mid-March, peaking in mid-February. The date on which the first migratory flights were observed each year, and also the median migration dates, both demonstrated an increasingly early start of the migration period over the 26-year period. Whereas in the 1980s migration began at the beginning of February, now the first birds are seen as early as mid January. This is consistent with studies of neck-banded birds re-sighted along the flyway, which found that the geese have been arriving earlier on the breeding grounds. The temporal changes in spring migration in France may be attributable to one or a combination of factors, such as changes in wintering conditions in Spain, a succession of mild winters along the flyway, climate change permitting an early onset of the breeding season in the Nordic areas and, perhaps, a higher proportion of birds wintering further north in the Netherlands.

Key words: France, Greylag Goose, phenology, spring migration, temporal changes.

The Northwest European Greylag Goose population has increased substantially in numbers in recent decades (Nilsson *et al.* 1999), and the total population size is now estimated at 500,000 birds (Wetlands International 2006). As in most other northwest European countries, numbers wintering in France are now higher than at the beginning of the 1980s, with a peak of 14,610 geese recorded in January 2003 (Deceuninck *et al.* 2004), and a long-term (1987–2008) increase at the 88 wetlands most important for waterfowl in France (Fouquet *et al.* 2005; Fouquet *et al.* unpubl. data). Marking of birds with neck-bands has described two sub-populations within the Northwest European Greylag Goose population: the Norwegian and the Swedish sub-populations. The migration patterns of these two sub-populations are well documented (Andersson *et al.* 2001). There are also demographic differences between the two groups, with the Norwegian birds showing a 10% decline in adult survival from 1986–2002 (Pistorius *et al.* 2006a), whereas in Sweden juvenile survival has increased and adult survival appears to be relatively constant (Pistorius *et al.* 2007). France is on the flyway of geese from both sub-populations wintering in Spain (Nilsson *et al.* 1999; Nilsson 2006), albeit that migration patterns have changed and the main wintering grounds are now in the Netherlands rather than in Spain (Nilsson 2006).

Greylag Geese wintering in France occur in four main areas: the Lac du Der-Chantecoq, the Camargue-Viguerat, Baie de l'Aiguillon–Pointe d'Arçay and the Lacs de l'Aube (Deceuninck *et al.* 2009; Fig. 1). An earlier study of the phenology of Greylag

Goose migration over France found that autumn migration may occur from the beginning of September, but was mainly from early October to mid-December, with several waves of birds flying successively towards Spain (Fouquet 1991). The first noticeable flights took place during mid-October, followed by a second phase around mid-November. These two main migration periods were mainly of birds from the Swedish sub-population. Other movements at the end of November and the beginning of December were found to be of Norwegian birds (Fouquet 1991; Persson 1993; Anderson *et al.* 2001). In the years 1979–1989, spring migration was generally observed from the first days of February, or from the end of January in some years (Fouquet 1991). At this time, peak migration was recorded from mid-February to mid-March (Fouquet 1991; Triplet & Lecomte 1996).

Changes in migration, wintering and breeding patterns have been recorded for several Palaearctic goose species in recent years (Anderson *et al.* 2001; Madsen 2001; Kuijken *et al.* 2005; Nilsson 2006; Pistorius *et al.* 2006b; Van Impe 2008; Tombre *et al.* 2008). For example, the timing of autumn and spring migration has changed for the Greylag Geese in the south of Sweden (Nilsson 2006): birds now return to their breeding areas in Scania about 20 days earlier than they did 20 years ago. The same has been observed for the Norwegian sub-population which, in spring, migrates earlier from their staging grounds in the Netherlands to breeding sites in Norway (Pistorius *et al.* 2006b). The present study therefore aims to provide an update on the

chronology of Greylag Goose spring migration over western France, by testing trends in the date on which the first migratory flights were observed, and also assessing any changes in the median migration date, over the years 1980–2005.

Methods

Study area

Observations of Greylag Goose spring migration were made in three départements (*i.e.* administrative regions of France) in west-central France: Vendée (6,720 km²), Deux-Sèvres (5,999 km²) and Vienne (5,520 km²), on the main Atlantic flyway for Greylag Geese migrating to and from Spain (Fig. 1)

Data collection and analyses

The spring migration data were observations made of migrating flocks of birds, flying northwards at adequate altitude (≥ 100 m) and consistent speed. Over a 26-year period (1980–2005), these data were recorded annually from January–May by a network of 150–200 birdwatchers from the Game and Wildlife National Agency (ONCFS), departmental hunting associations (Fédérations Départementales des Chasseurs), as well as by members and staff of bird-watching and conservation non-governmental organisations. Observers were asked to record any single migrating flock of geese seen during other fieldwork duties and to report the data to the ONCFS staff, who collated the sightings.

Major wetlands

- ❶ Lac du Der-Chantecoq
- ❷ Lacs de l'Aube
- ❸ Camargue
- ❹ Baie de l'Aiguillon

Study area



Figure 1. Main flyway for the northwest European Greylag Goose population over west France.

For each flock, the observer recorded the number of birds in flight, the date of observation, precise location, direction of flight, and the exact time of the observation. The timing of the sighting was used to ensure that the same flight seen by several observers was included only once in the analysis. The number of observers increased during the study period, but has stabilised at about 150 individuals from 2000 onwards (M. Fouquet unpubl. data). Observation effort could not be measured, because observers were not recording goose flocks under a precise protocol, but did so while they were in the field for other purposes. The numbers of birds counted therefore

could not be used to determine any trends in the total number of geese migrating over France during the 1980–2005 study period.

The total number of birds seen in flight and the total number of flocks flying over was calculated for each year. The proportion of the annual total (for both birds and flights) seen per 10-day period from 1 January each year was used to calculate the average percentage ($\pm$ s.e.) of birds and flights recorded per 10-day period from 1980–2005 (Fig. 2). Linear regression analysis was used to assess whether the date of the first recorded flights and the median date of passage (calculated as the date by

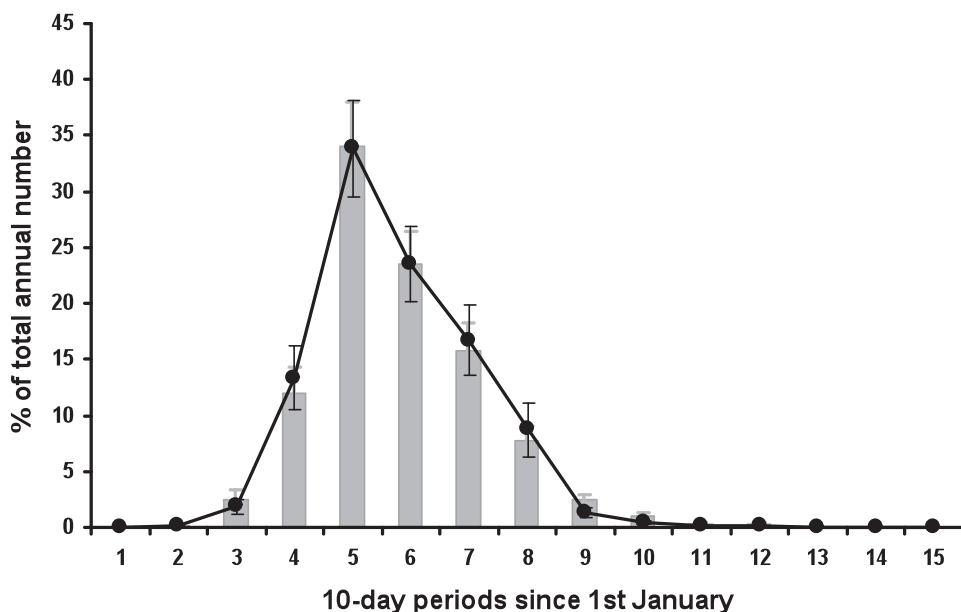


Figure 2. Average percentage of the total number of birds (black dots) and the number of flights (grey columns) recorded for Greylag Geese seen migrating over west-central France per 10-day period over the years 1980–2005. Vertical bars show standard errors. Sample size = 26 years' data per 10-day period except for the second 10-day period for goose flights (1 year's data missing) and the tenth and eleventh 10-day periods for bird numbers (1 year's data missing in each case).

which 50% of all flights had taken place) changed over the years.

Results

Chronology of spring migration

Spring migration occurred between January and May, with a main passage between the end of January and mid-March. The earliest record was on 9 January in 2005 and the latest was 10 May in 1993. The timing of the main spring passage varied between years, ranging from the end of January (earliest date being 31 January in 1994) to the beginning of March (latest date being 9 March in 1998), with peak migration occurring at around 20 February (the second 10-day period that month) (Fig. 2).

Date of the first flight and median migratory date

Annual variation in the date of the first flights and in the median migration dates recorded over the 26-year study both indicate that the Greylag Geese have migrated earlier in recent years, with a significant negative linear trend in both cases (date of first observation: $R^2_{24} = 0.746$, $P < 0.001$; median migration date: $R^2_{24} = 0.237$, $P < 0.001$; Fig. 3a,b). The first flights are now recorded around mid-January, whereas during the 1980s they were recorded in early February.

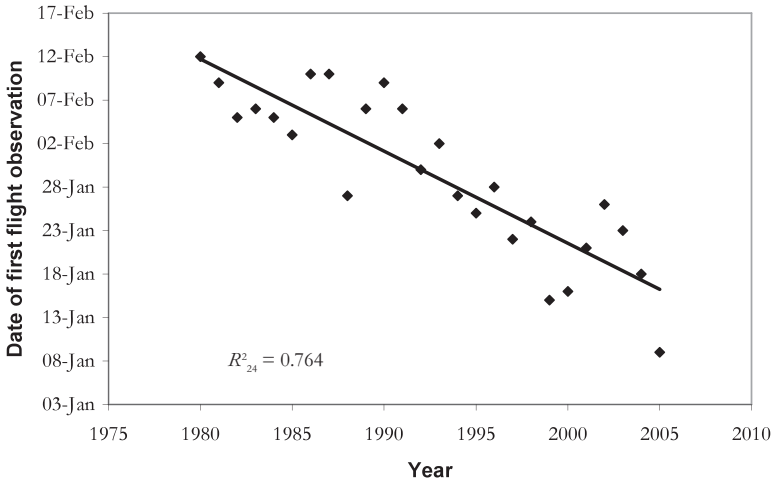
Discussion

This study demonstrates a temporal trend in the onset of Greylag Goose spring migration over west-central France. Birds now migrate more than two weeks earlier than they did in the 1980s. This pattern has

apparently persisted in recent years; in 2008 in the Charente-Maritime département, just to the south of the study area, > 90% of the Greylag Geese migrated before 10 February, with several flocks of birds seen flying each day from 21 January–8 February (Gendre & De Smet 2008). Re-sightings of marked birds along the flyway are consistent with these changes (L. Nilsson unpubl. data), and the geese are returning increasingly early to their breeding grounds in Sweden and Norway (Nilsson 2006; Pistorius *et al.* 2006b).

Since the end of the 1990s, Greylag Geese wintering on the Netherlands–Belgium border in the Bas-Escault region have left their wintering sites by mid-February, whereas in earlier years spring migration did not commence until the second half of February (Benoy *et al.* 2005). Long-term changes in the goose departure patterns from Spain are less clear because of the different migration patterns for the two sub-populations wintering in the country. Birds of the Swedish sub-population wintering in Spain begin their spring migration from mid-January and re-sightings of individuals with neck-collars show that they reach the south of Sweden from early February onwards (Anderson *et al.* 2001). On the other hand, geese from the Norwegian sub-population leave Spain later in February. Aerial counts of birds in the Guadalquivir marismas from 1978–2005 showed a decrease of more than 50% of the number of birds between January (49,256 birds on average) and February (23,962 birds on average), with a significant decline in the National Park of Donana, partially linked to a redistribution of the birds to

(a)



(b)

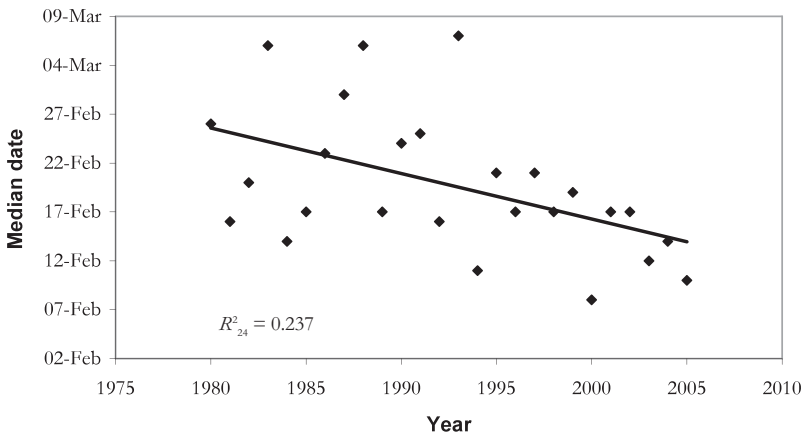


Figure 3. Long-term (26-year) trend in (a) the date of which the first flight was observed ($R^2_{24} = 0.764$, $P < 0.001$) and (b) the median migration date (taken as 50% of the observed flights completed) ($R^2_{24} = 0.237$, $P < 0.001$), for Greylag Goose spring migration over west-central France from 1980–2005.

areas in the northern part of the country such as Villafila, Laguna de la Nava, the Sierra Brava Reservoir and rice fields in the Extremadura region (Rendon *et al.* 2008; J.G. Navedo unpubl. data).

Several authors over the years, in particular Nilsson (2006), have shown that there has been a gradual shift in the winter distribution of Greylag Geese that breed in the south of Sweden (Scania). A higher

proportion of the geese remain throughout the winter in the Dutch Delta area and fewer birds migrate to Spain. Some geese now spend the winter on the German North Sea coast and in Sweden. Numbers wintering in the Netherlands have increased substantially, with 220,000–376,000 birds recorded during January counts between 2000–2005 (Wetlands International unpubl. data). Short-stopping or an overspill of birds from the Netherlands may perhaps explain the relative stability in the number of geese wintering in the France since 2003 (average of 14,000 birds in January, rising to 15,730 birds in 2006, Deceuninck *et al.* 2009), except in the Camargue where the wintering numbers have increased (Kayser *et al.* 2008), whilst numbers are declining in Spain.

Overall, like many other birds species including passerines (Sokolov *et al.* 1998) the Northwest European Greylag Goose population seems to migrate increasingly early in spring. As in most other cases (Crick 2004), this pattern is most probably related to the recent trend towards milder winters and earlier springs, and this has been demonstrated for the Norwegian-breeding Greylag Geese (Pistorius *et al.* 2006b). The temporal shift in the spring migration of geese across France and along the Atlantic flyway may also be attributed to other factors operating at different levels. These variables include the quality and quantity of food resources (particularly in Spain, where annual variation in the water levels at the Donana National Park may limit food availability; H. Lefranc unpubl. data), hunting disturbance and changing landuse patterns (Fox & Madsen 1997; Nilsson *et al.* 1999; Nilsson & Persson 2000). Given that

spring migration now takes place earlier in France, the question also arises as to whether the hunting season for geese in France (which has closed at the end of January since 2001) should be changed to adjust to the birds' migration patterns in accordance with Article 7 of EC Bird Directive 79/409, which states that migratory species should not be hunted during migration to their breeding grounds.

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