

**CASTLEBANNY WIND FARM:
ASSESSMENT OF POTENTIAL
INTERACTIONS BETWEEN GREYLAG
GOOSE MIGRATION ROUTES AND THE
CASTLEBANNY WIND FARM SITE**

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**REPORT NUMBER: 1623-F5
STATUS OF REPORT: Revision 1
DATE OF REPORT: 18 January 2021**

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APPENDIX

I am grateful to Olivia Crowe (BirdWatch Ireland), Alan Lauder (Irish Greylag Study Group) and Paul Walsh for providing information on Greylag Goose population trends, distribution patterns and movements in Ireland.

1. INTRODUCTION

During the winter vantage point survey a single observation was made of Greylag Goose flying over the study area. As the study area is on a potential migration route between known Greylag Goose wintering sites, a desk review was carried out to investigate the potential for regular movements of this species across the study area.

2. METHODS

This review included:

- A literature review of information about Greylag Goose migratory behaviour, movement patterns and site fidelity.
- Review of count data for the relevant Greylag Goose wintering sites in Ireland.
- Consultations with people involved in counting and monitoring Greylag Goose in Ireland (Olivia Crowe, BirdWatch Ireland; Alan Lauder, Irish Greylag Study Group; and Paul Walsh, I-WeBS counter for the River Suir Lower site).
- A reconnaissance visit to the River Suir Lower site on 11th February 2017.

The results of this review were used to set parameters (based on conservative assumptions) for a quantitative assessment of the potential collision risk to Greylag Goose migrating over the Castlebanny Wind Farm site.

3. GREYLAG GOOSE POPULATIONS, DISTRIBUTION AND MOVEMENT PATTERNS

3.1. GREYLAG GOOSE POPULATIONS IN IRELAND

Greylag Goose is a winter visitor to Ireland, while there are also resident feral populations of the species.

The Greylag Goose wintering population are birds from the Icelandic breeding population, which is a separate population from the populations that breed in Europe. Icelandic Greylag Goose are monitored annually, with the most recent population estimate of 95,403 in 2015 (Mitchell, 2016). They mainly winter in Scotland, but there are eight regular wintering areas in northern and eastern Ireland (Figure 1). In 2007/08, an all-Ireland survey estimated a total wintering population of 4,761 (Boland and Crowe, 2008).

Feral populations of Greylag Goose are quite widespread in Ireland, although most are small in size. The largest feral populations occur in Northern Ireland. In 2008, the all-Ireland feral population was estimated as 1,555 birds (Boland and Crowe, 2008).

3.2. GREYLAG GOOSE SITES RELEVANT TO THE STUDY AREA

Nine Greylag Goose were observed flying SW over the study area at a height of 80-100 m on 20th December 2016. The flightline of these birds is very closely aligned to a potential migration route between the Icelandic Greylag Goose wintering sites at Poulaphuca Reservoir in Wicklow and the River Suir Lower in Kilkenny/Waterford (Figure 2). A potential migration route between the River Suir Lower and another Greylag Goose wintering site at the North Wicklow Coastal Marshes also passes just to the south of the study area (Figure 2). There are no known feral flocks of Greylag Goose documented from the vicinity of the study area. The nearest significant feral flocks are at Cahore Marshes and Lady's Island Lake/Tacumshin Lake in Wexford (Boland and Crowe, 2008). However, small groups of feral birds may occur at sites that are not routinely monitored.

The Greylag Goose wintering at the River Suir Lower site use several different areas (Figure 3). The following information is based on information supplied by Paul Walsh (pers. comm.), supplemented by information from Boland and Crowe (2008). The main traditional site used to be fields at Coolfinn Marshes on the western bank close to Portlaw. However, during the 1980s and 1990s there was a move to fields at Derrigal Marshes (just to the south) and Portnascully (adjacent to the southern end of Derrigal Marshes on the eastern bank). The geese can also use fields at

Tibberaghny on the Kilkenny side near Piltown. The geese roost on the River Suir adjacent to these areas. Small numbers may also move to Tramore Backstrand (around 18 km to the south-east). In 2007/08, a new flock of 156 Greylag Goose were found on the River Barrow close to its confluence with the River Suir. It is not clear whether this flock was part of/connected to the River Suir Lower population, although it is within 20 km of the latter site, and 15-20 km is given as the core foraging range of Greylag Goose populations (Scottish Natural Heritage, 2016a). However, the geese were recorded roosting at night on the River Barrow, indicating that they were not making daily movements to/from the River Suir Lower sites. The current status of this site is not known.

The Greylag Goose wintering at Poulaphouca Reservoir mainly use fields at Threecastles to the northeast of Blessington Bridge and roost on the adjacent section of the reservoir, while they may also use fields at Mountseskin in Co. Dublin around 8 km to the north-east, and formerly roosted near Ballymore Eustace, around 5 km to the south-west (Boland and Crowe, 2008). The Greylag Goose wintering at the North Wicklow Coastal Marshes mainly use fields between Newcastle and Killoughter, and also use other areas along the coastal strip, including fields near Leabeg (around 4 km to the north) and Broad Lough (around 5 km to the south), while they also occasionally roost at Vartry Reservoir around 10 km to the west (Boland and Crowe, 2008).

The peak winter counts at the River Suir Lower, Poulaphouca Reservoir and North Wicklow Coastal Marshes sites are shown in Table 3.1 below. These show considerable fluctuations in numbers. However, a large part of these fluctuations probably reflect the difficulty of getting accurate counts due to the mobile nature of the flocks. In the case of the River Suir Lower site, the I-WeBS counter has noted that the “counts can be a bit erratic because of “missing’ birds” (Paul Walsh, pers. comm.), while during the site reconnaissance visit made for this assessment it was noted that counting the geese at this site can be difficult due to birds being hidden by dips in the fields. It is probably safe to assume that the winters with very low reported numbers reflect issues with coverage. Taking this into account, the numbers at the River Suir Lower seem to be typically in the range 200-300 birds, with 100-200 at Poulaphouca Reservoir and 300-400 at the North Wicklow Coastal Marshes. On 11th February 2017, a count of 220-230 Greylag Goose was made at Coolfinn/Derrigal Marshes in the River Suir Lower, during the site reconnaissance visit made for this assessment.

Table 3.1. Peak winter counts.

Season	River Suir Lower	Poulaphouca Reservoir	North Wicklow Coastal Marshes
2005/06	273*	464*	256*
2006/07	313*	100*	316*
2007/08	84*	144*	150*
2008/09	210*	170*	370*
2009/10	288*	92*	361*
2010/11	320	nc	293
2011/12	564	158	285
2012/13	376	152	59*
2013/14	59**	nc	325
2014/15	nc	nc	200*

* Count marked as poor quality counts in the Site Summary Table.

** Count assessed as likely to be a poor quality count in this report.

Data were supplied by the Irish Wetland Bird Survey (I-WeBS), a joint scheme of BirdWatch Ireland and the National Parks and Wildlife Service of the Department of Arts, Heritage & the Gaeltacht.

3.3. ARRIVAL AND DEPARTURE

Icelandic Greylag Goose wintering birds begin to arrive in late October, with numbers peaking in November or December, while the return migration occurs in March and early April (Crowe, 2005).

However, there is little information available on the arrival and departure dates at the wintering sites relevant to this assessment.

At Coolfinn, according to the I-WeBS counter, “numbers of Greylags are often small, or sometimes birds may not have even arrived, on the recommended [for I-WeBS counts] mid-November dates in a typical year”, while “feedback I get from a local man living opposite Tibberaghny suggests that they generally arrive sometime during November” (Paul Walsh, pers. comm.). According to the farmer who owns the main fields used by the geese at Derrigal, the geese usually depart *en masse* in the first week of April. At Poulaphouca Reservoir, the geese generally arrive in early to mid-November and depart in late March-early April (Alan Lauder, pers. comm.).

3.4. MOVEMENT PATTERNS

Swann et al. (2005) analysed resighting data on colour-marked Greylag Goose to assess within-winter movement patterns of Icelandic Greylag Goose wintering in northern Britain. They found that the geese were initially highly mobile after they arrived in Scotland in October and November, but that their mobility decreased as the winter progressed, and that, in spring, the majority of birds departed for Iceland directly from their final wintering areas. Swann and Brockway (2005) analysed resighting data to assess site fidelity of Icelandic Greylag Goose wintering in Britain and concluded that “most Greylag Geese are faithful to a region from one winter to the next”. These two studies indicate that many Icelandic Greylag Goose make long distance movements after arriving in Britain each winter, moving from their initial arrival area to subsequent wintering areas, and, for some birds, moving back to staging areas before departing. However, the studies do not indicate that Icelandic Greylag Goose make large numbers of repeat (back and forth) long distance movements between two distant wintering areas within one winter.

In Ireland, the majority of birds appear to arrive initially at Lough Swilly/Lough Foyle, where peak counts occur in November, before moving on to other sites (Boland and Crowe, 2008). There is little information on the pattern of the return migration in Ireland, but recent resightings of neck-banded birds have shown movements in spring from Poulaphouca Reservoir to Dundalk Bay, Lough Neagh and Lough Foyle/Lough Swilly.

Movement patterns within the River Suir Lower, Poulaphouca Reservoir and the North Wicklow Coastal Marshes wintering areas are discussed above (Section 3.2). There is known to be some movement between the Poulaphouca Reservoir and the North Wicklow Coastal Marshes areas, and hard weather movements have been noted (Alan Lauder, pers. comm.), but very little is known about movement patterns between the Wicklow wintering areas and the River Suir Lower.

There has been one resighting of a neck-banded bird showing movement from Poulaphouca Reservoir to Coolfinn. This bird was originally ringed at Poulaphouca Reservoir on 11/03/2016, and was resighted at Lough Neagh on 28/03/2016, before being resighted at Coolfinn on 7th January 2017. A neck-banded bird was also noted during the site reconnaissance visit made for this assessment on 11th February 2017, but was too distant to allow the neck collar to be read. The resighting provides evidence of interchange between the Poulaphouca Reservoir and Coolfinn wintering populations, but does not confirm movement between the populations within the same winter.

In Figure 4 the monthly patterns of Icelandic Greylag Goose counts are compared between the North Wicklow Coastal Marshes, Poulaphouca Reservoir and the River Suir Lower. There is no evidence from these comparisons of significant movements from the Wicklow sites to the River Suir Lower: i.e., there is no pattern of decrease in numbers at the Wicklow sites concurrent with increase at the River Suir Lower. However, the usefulness of these comparisons are significantly affected by the amount of missing counts (months when one or more site was not counted), and the likely degree of error in the counts (months with very low counts are likely to reflect issues with coverage, rather than true low numbers; see above).

3.5. FLIGHT HEIGHTS

There is little information on typical flight heights of migratory Icelandic Greylag Goose. Patterson et al. (2012) report flight heights of Icelandic Greylag Goose moving between feeding areas and commuting to/from roost sites in Scotland. Around two-thirds of the flights were at heights of 50-150 m, with 20% of flights (and 34% of birds) at heights of over 150 m. They note that the flights at heights of over 150 m were likely to be birds “on long-distance flights, rather than on local foraging flights”. Patterson (2015) reported flight heights of the related Pink-footed Goose on long distance flights between Scottish sites around 80 km apart. The median flight height was 268 m and only 17% of flights were at heights of less than 150 m. This contrasted with short distance flights where the median flight height was 123 m and 58% of flights were at heights of less than 150 m.

4. ASSESSMENT OF POTENTIAL COLLISION RISK

4.1. POTENTIAL MOVEMENT PATTERNS ACROSS THE WIND FARM SITE

The available evidence indicates that there is likely to be some movement between the Wicklow wintering sites and the River Suir Lower. Such movement is most likely to occur in early winter, involving birds moving from Wicklow to the River Suir Lower. However, comparison of the seasonal pattern of numbers at the River Suir Lower and the Wicklow sites indicates that some of the birds at the River Suir Lower arrive directly there without stopping off in Wicklow, as counts of up to 100 geese can occur at the River Suir Lower in November (Figure 4). There is also a possibility of some additional return movement in late winter, although the majority of birds at the River Suir Lower probably depart directly for Iceland. However, based on the review of movement patterns in the British population (see above), multiple back-and-forth movements between the River Suir Lower and the Wicklow sites within one winter seem unlikely. Therefore, at most, birds may make two transits per winter between Wicklow and the River Suir Lower, but this is only likely to apply to a minority of the River Suir Lower wintering population.

Part of the wind farm site is (just) within the potential core foraging range of the River Suir Lower wintering population (15-20 km; Scottish Natural Heritage, 2016a). However, there are no likely foraging or roosting sites within, or close to the wind farm site. The flightlines to the sites where there are suspected linkages to the River Suir Lower (the River Barrow and Tramore Backstrand) would not pass anywhere near the wind farm site (Figure 3). Therefore, there is no potential for regular commuting flights by Greylag Goose to take place over the wind farm site.

4.2. COLLISION RISK ASSESSMENT

A worst-case scenario assessment of the potential collision risk has been made, using the following assumptions:

- The size of the River Suir Lower population has been assumed to be 300 birds.
- 50% of the River Suir Lower population is presumed to arrive/depart via Poulaphouca Reservoir, so there are 300 transits between Poulaphouca Reservoir and the River Suir Lower per winter.
- All the geese migrating between Poulaphouca Reservoir and the River Suir Lower are assumed to pass through the Castlebanny wind farm site at collision risk height.
- Any collision mortality is assumed to be additive to existing background mortality levels in the population.

These assumptions are conservative as they are likely to overestimate the degree of movement between Poulaphouca Reservoir and the River Suir Lower, and some of the birds moving between these two areas may pass to the north or south of the Castlebanny wind farm site, or may pass over the site above the collision risk height.

The calculations of the potential collision risk, based on these assumptions, are shown in Table 4.1. This shows that, even under these very conservative assumptions, the collision risk is only

0.02 collisions per year, which would equate to one collision every 48 years. This annual collision rate would cause an increase in the annual mortality rate of 0.03% (Table 4.1).

A threshold level of a 1% in the annual mortality rate, is widely used to assess the significance of predicted collision risks (Percival, 2003). The projected increase in the annual mortality rate of 0.03% calculated above is over 30 times lower than this threshold (Table 4.2). As discussed above, the assumptions used for these calculations were very conservative. Therefore, the actual increase in the annual mortality rate that would be likely to occur would be even smaller. Therefore, the potential for the proposed wind farm development to cause significant collision risks to Icelandic Greylag Goose migrating between Poulaphouca Reservoir and the River Suir Lower can be discounted.

Table 4.1. Worst-case scenario calculations of potential collision risk to Icelandic Greylag Goose migrating over the wind farm site.

Parameter	Description	Source/ calculation	Value
w	Width of the windfarm perpendicular to the migration route	Source 1	4,511 m
d	Rotor diameter	Source 2	155 m
n	Number of turbines	Source 3	21
y	Altitudinal range of turbines	Source 4	53 m
a _{RW}	Risk window	w*(d+y)	937,644 m ²
a _T	Rotor swept area	π*(d/2) ² *n	396,253 m ²
t _{RSW}	Number of transits through the rotor swept area each year	t* a _T /a _{RW}	127
p	Probability of collision per transit through rotor swept area	Source 5	0.07
r	Avoidance rate	Source 6	0.998
c	Collisions per year	t _{RSW} *p*(1-r)	0.02

Source 1: measured from the turbine layout map.

Source 2: maximum proposed rotor diameter, as supplied by the client.

Source 3: number of turbines shown on the turbine layout map.

Source 4: measured from the turbine layout map, and weighted by the number of turbines in each 10 m altitudinal band.

Source 5: from the collision risk model for the Castlebanny Wind Farm (Gittings, 2020).

Source 6: Scottish Natural Heritage (2016b).

Table 4.2. Calculation of the increase in annual mortality rate due to the worst-case scenario projected level of collision mortality to Icelandic Greylag Goose migrating over the wind farm site.

Parameter	Description	Source/ calculation	Value
G _{Jpop}	Size of the River Suir Lower Greylag Goose population	see text	300
G _{Jsurv}	Annual Greylag Goose survival rate	Source 1	0.77
G _{Jmort(back)}	Annual background mortality of River Suir Lower Greylag Goose population	G _{Jpop} * (1-G _{Jsurv})	69
G _{Jmort(coll)}	Annual mortality of River Suir Lower Greylag Goose population from collisions with the wind turbines	see Table 4.1	0.02
G _{JΔmort}	Increase in annual mortality rate due to collisions	G _{Jmort(coll)} / G _{Jmort(back)}	0.03%

Source 1: Average of annual adult and juvenile survival rates (0.83 and 0.53, respectively; www.bto.org/about-birds/birdfacts), weighted by proportion of juveniles in population (0.225, estimated by eye from Figure 6 in Mitchell, 2016).

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Figure 1. Locations of Icelandic Greylag Goose wintering areas in Ireland.

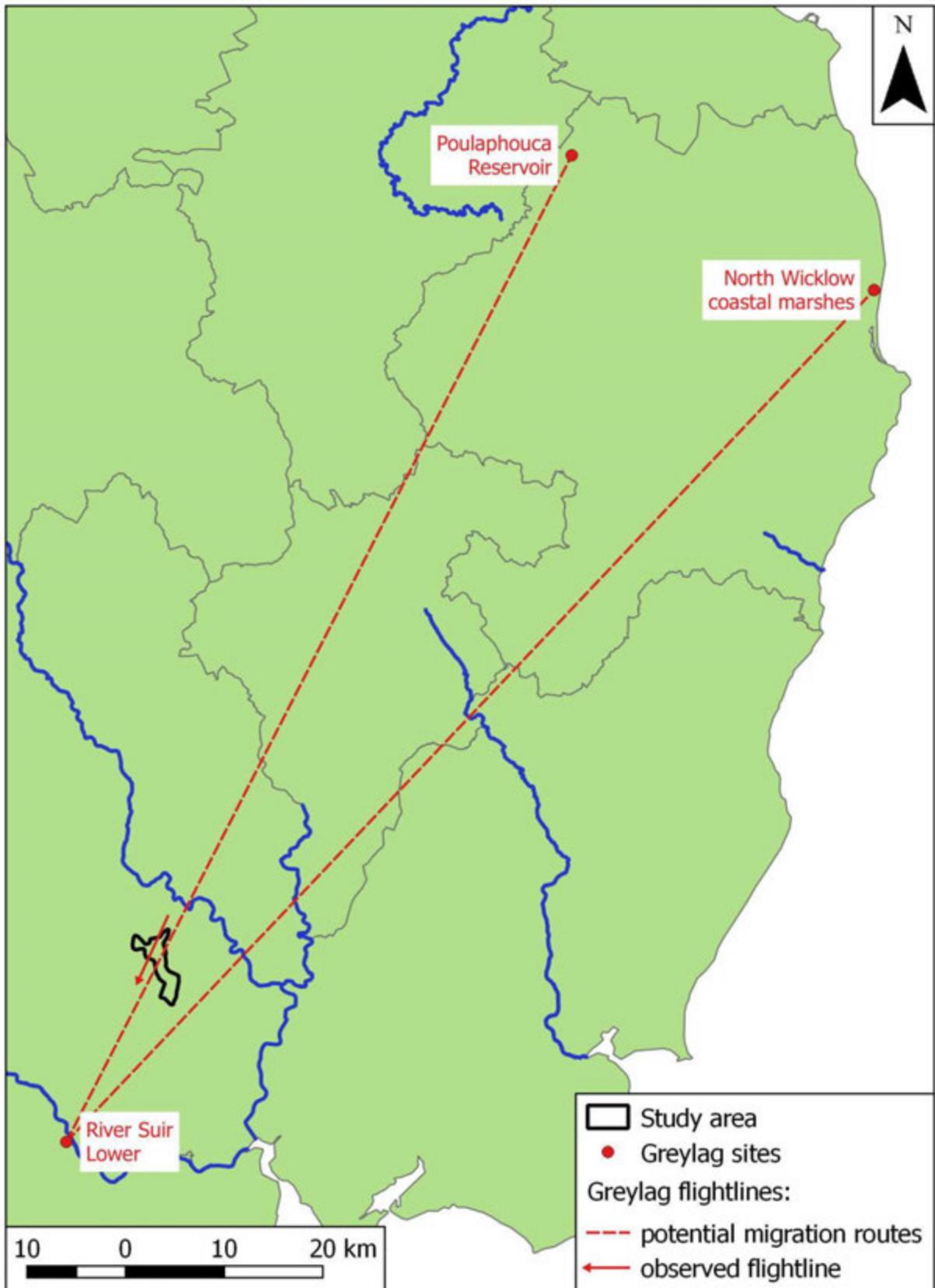


Figure 2. Potential migration routes between the Wicklow and Waterford/Kilkenny Icelandic Greylag Goose wintering sites.

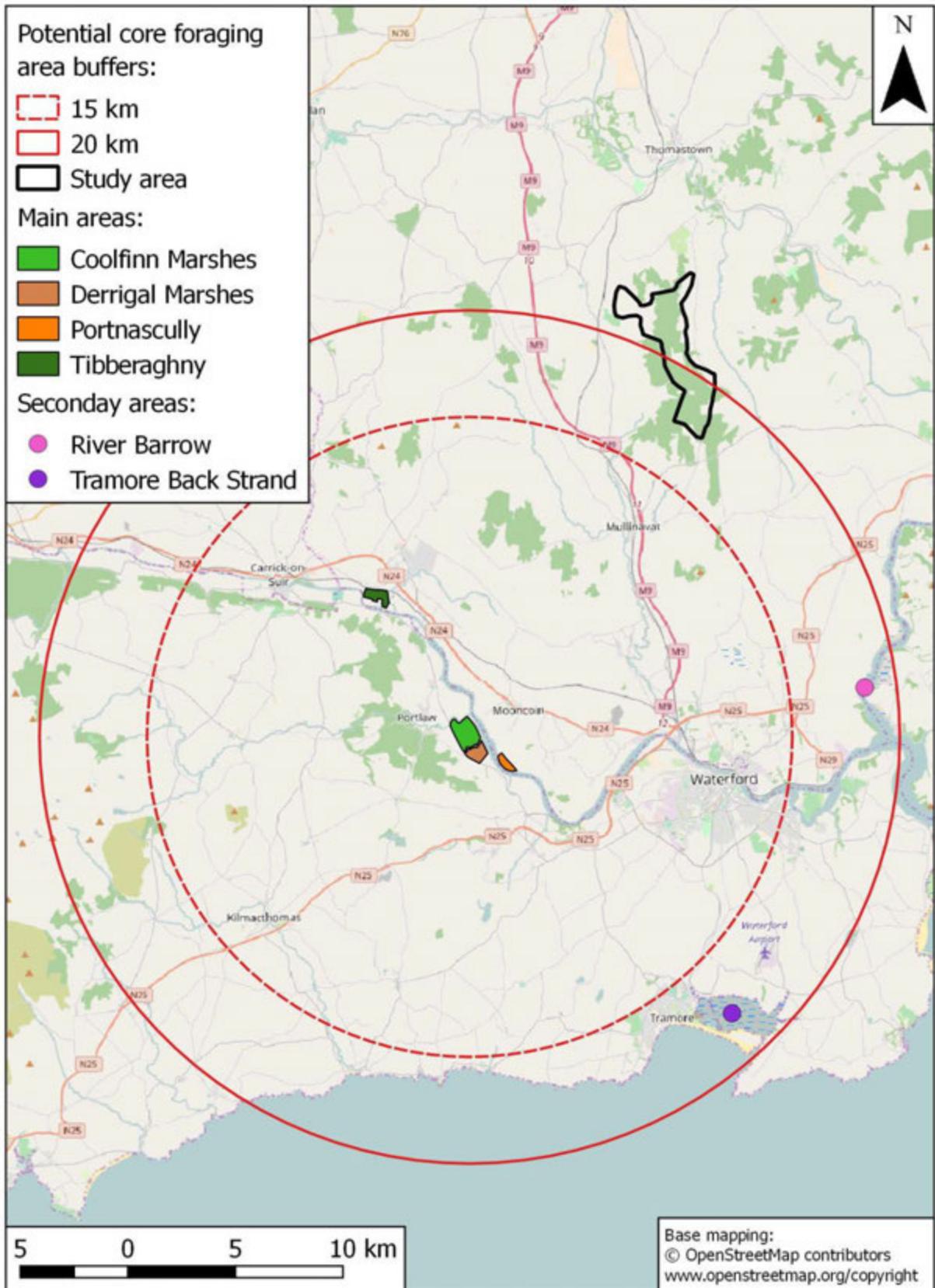


Figure 3. Potential core foraging range of, and areas used by, the River Suir Lower Icelandic Greylag Goose population.

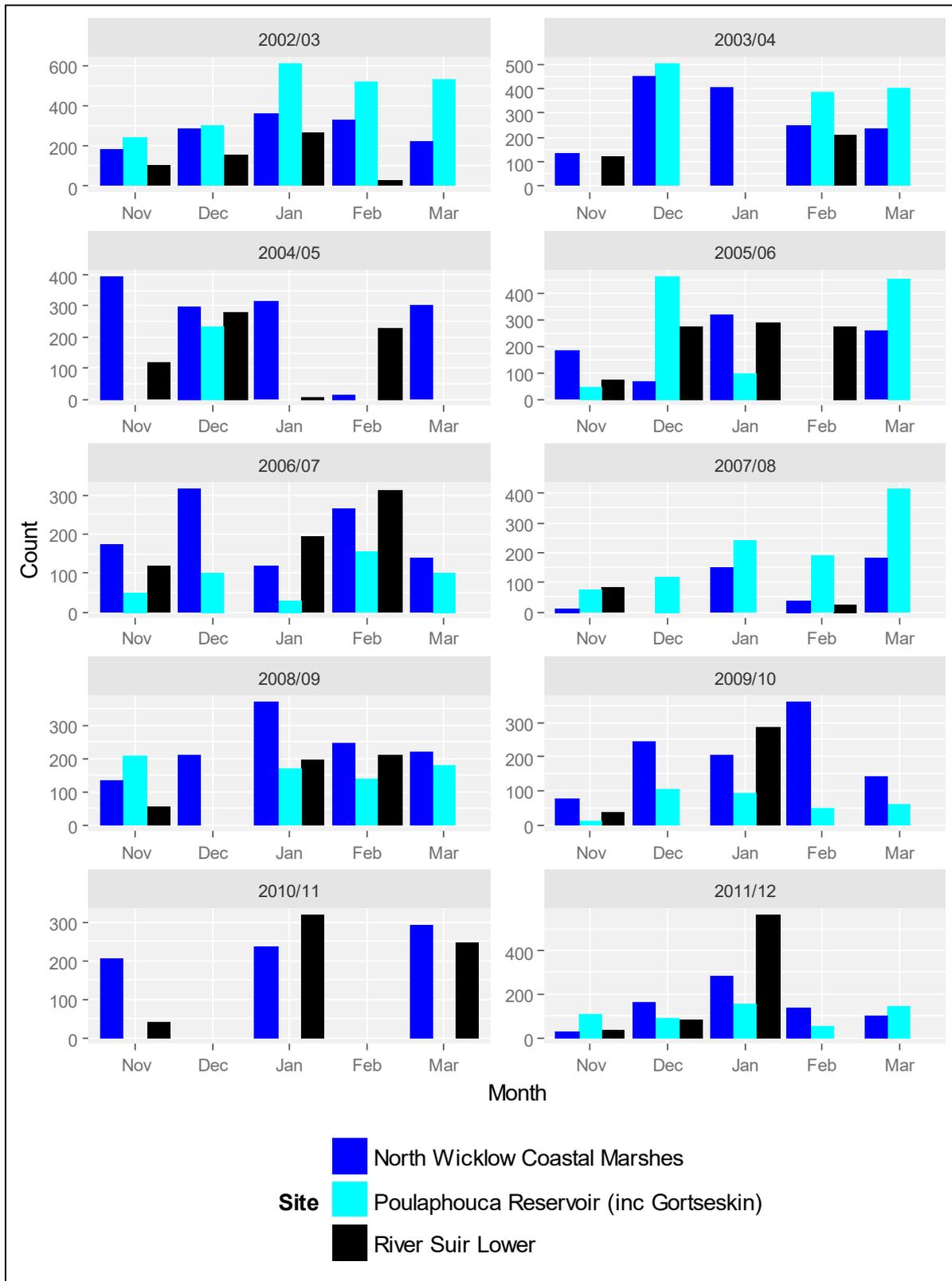


Figure 4. Monthly patterns of Icelandic Greylag Goose counts at the North Wicklow Coastal Marshes, Poulaphouca Reservoir and the River Suir Lower, 2002/03-2011/12.¹

¹ Data were supplied by the Irish Wetland Bird Survey (I-WeBS), a joint scheme of BirdWatch Ireland and the National Parks and Wildlife Service of the Department of Arts, Heritage & the Gaeltacht.