Final Report

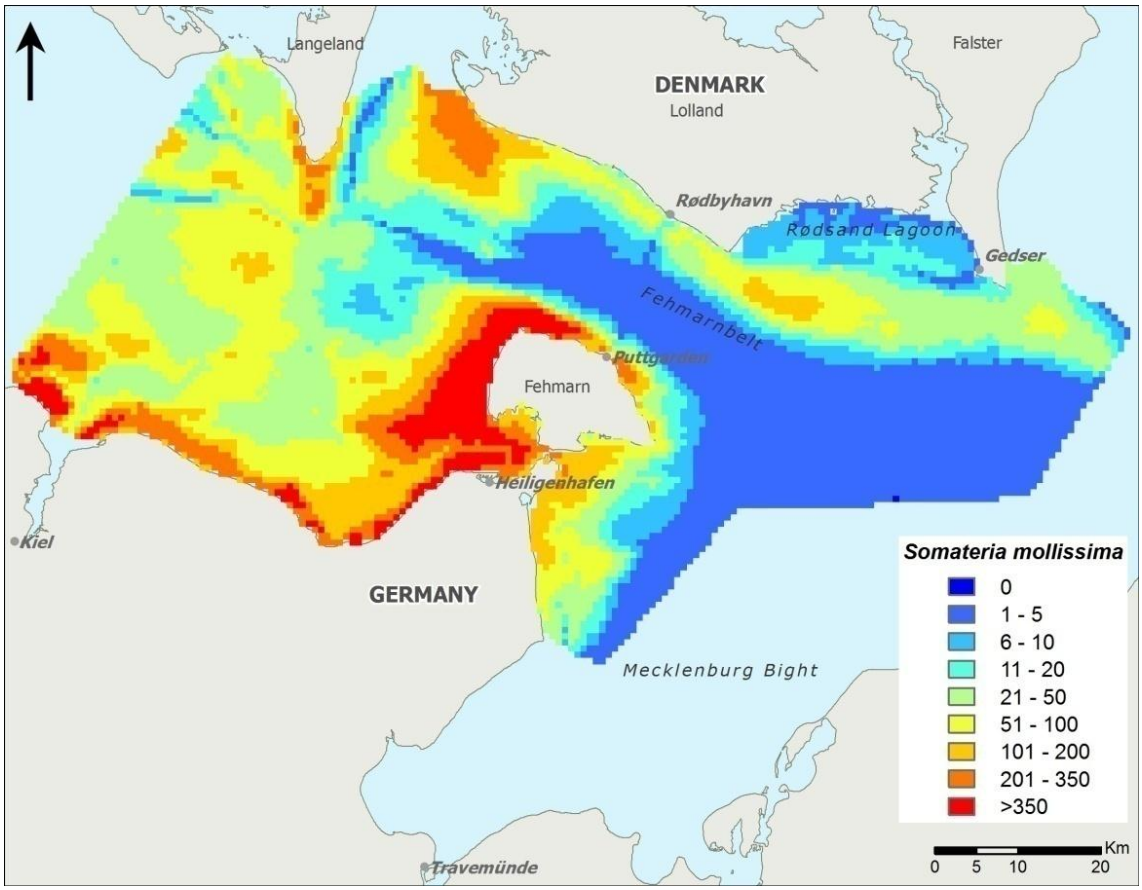
FEHMARNBELT FIXED LINK
BIRD SERVICES (FEBI)

Bird Investigations in Fehmarnbelt - Baseline

Waterbirds in Fehmarnbelt

E3TR0011 Volume II – Appendix IV

The breeding and non-breeding ranges of the waterbird populations utilising the Fehmarnbelt



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Note to the reader:
In this report the time for start of construction is artificially set to 1 October 2014 for the tunnel and 1 January 2015 for the bridge alternative. In the Danish EIA (VVM) and the German EIA (UVS/LBP) absolute year references are not used. Instead the time references are relative to start of construction works. In the VVM the same time reference is used for tunnel and bridge, i.e. year 0 corresponds to 2014/start of tunnel construction; year 1 corresponds to 2015/start of bridge construction etc. In the UVS/LBP individual time references are used for tunnel and bridge, i.e. for tunnel construction year 1 is equivalent to 2014 (construction starts 1 October in year 1) and for bridge construction year 1 is equivalent to 2015 (construction starts 1st January).

1 APPENDIX IV: THE BREEDING AND NON-BREEDING RANGES OF THE WATERBIRD POPULATIONS UTILISING THE FEHMARNBELT

1.1 Summary

Five to seven million individuals of more than 30 species of waterbirds exploit the southern Baltic Sea including Fehmarnbelt (FB) during the winter season and much higher numbers are expected if including the breeding populations as well as staging birds during the migration periods. For several species entire populations are depending on this region for successful completion of their yearly cycle (Delany and Scott 2002) stressing the high level of importance for waterbirds.

However, knowledge on the origins of populations utilising FB at different time periods throughout the year is limited. A simple way to increase our knowledge is to make use of the large amount of information already available from the ringing activities conducted throughout Europe. Ringing birds as a scientific method is more than 100 years old and have supplied the main basis of our current knowledge on bird migration. Ringing data consist of geographical positions of ringing and recovery sites of individual birds providing us with detailed information on whereabouts of specific bird populations throughout their yearly cycle.

The aim of this report is to assess which populations of waterbird species utilise FB in the different seasons of the year and determine main wintering areas of populations breeding within FB area. Thus, this study will supplement the other activities performed by FEBI bird services by supplying basic biogeographical and migratory ecological knowledge of the populations registered as breeding, wintering or migrating through the region. Overall this assessment will highlight which waterbird populations that potentially will be affected by the construction of a future Fehmarnbelt link.

On the basis of more than 13,000 ringed birds, we report on the origins of waterbirds for which Fehmarnbelt is important during the breeding, migration or non-breeding periods. We present detailed ring recovery maps on 31 species. For each of these species, we present a ring recovery map for each of the four main seasons (winter: Dec-Feb, spring: Mar-May, summer: Jun-Aug, autumn: Sep-Nov) hereby showing when and where birds utilising FB are going to or coming from. The ringing data included here covers a long time period starting in 1911 to present included both sides of FB.

Additionally we have included satellite tracks on 4 species (made available from other FEBI activities: see FEBI (2013)) as well as information from literature searches on more than 29 additional species and one species group (long-distance migratory waders, Scolopacidae) from which no ringing data were available.

We show that FB is a stop-over site as well as moulting and wintering area for many different populations of a large number of waterbird species breeding mainly in the Nordic countries, the Baltic countries and Russia. Additionally, birds originating from central Europe for example Germany, Poland and The Netherlands are also utilising FB during the non-breeding season. Overall, results are summarised in Table 1.

Birds breeding in the FB are either residents (e.g. Mute Swan) or move towards south-east for wintering grounds in western Europe (e.g. Northern Shoveler, Eurasian Oystercatcher), with few long-distance migrants moving to southern Europe (e.g. Greylag Goose, Common Coot), northern Africa (e.g. Ringed Plover, Moorhen, Northern Lapwing) or even sub-Saharan Africa (e.g. Garganey, Lesser Black-backed Gull, Common Tern).

A group of species perform long-distance movements from far northern, north-eastern and eastern breeding areas using FB as stop-over site or wintering area. These are mostly geese and ducks but also a large group of waders. A large proportion of the populations on migration continue after staging towards west and southwest to spend the winter in Great Britain, The Netherlands, France and the Iberian Peninsula. Breeding birds from closer areas like the Scandinavian Peninsula wintering in FB are represented by for example Great Cormorant, Grey Heron, Mute Swan and Greylag Goose.

The group of gulls and terns (*Larus* and *Sterna*) shows diverse patterns in accordance with their species-specific migration strategies. Some are mostly residents or only moving shorter distances (Herring Gull) while others are long-distance migrants (Lesser Black-backed Gull, the species of terns (*Sterna*)). During winter FB hosts Scandinavian and Russian populations of the gulls (*Larus*) for example Herring Gull and Greater Black-backed Gull.

Coots from the Baltic region winter in FB while local breeders move further south to winter in western European countries. Local breeding Moorhens migrate south or stay in small numbers. Finally, FB is an important stop-over site for local breeding waders as well as other species of waders on migration from Arctic and sub-Arctic breeding areas.

1.2 Introduction

The southern Baltic Sea including the Fehmarnbelt region (FB) is characterised by its high number of birds staging during migration, migrating through the region or spending a large part of the year as wintering or breeding birds. Five to seven million individuals of 30 species has been estimated to exploit these areas during winter and much higher numbers are expected if including staging birds during the migration period (Laursen et al. 1997; Petersen 2006). For several species entire populations are depending on this region for successful completion of their yearly cycle (Delany and Scott 2002) stressing the high level of importance for waterbirds.

It is a challenge to follow and keep track of such a large mix of birds belonging to different species and different populations of the same species. Migrating birds are especially difficult to follow because of the relatively large distances they move over short time periods. Therefore, knowledge on the origins of populations utilising FB at different time periods throughout the year is limited.

A simple way to increase knowledge and determine the populations most likely to be affected by a future fixed link across FB is to make use of the large amount of information available from the ringing activities conducted throughout Europe, providing us with detailed information on whereabouts of specific bird populations throughout their yearly cycle.

The aim of this report is to assess which populations of waterbird species utilise FB in the different seasons of the year and determine main wintering areas of populations breeding in FB. This study will supplement the other activities performed by FEBI bird services by supplying basic biogeographical and migratory ecological knowledge of the populations registered as breeding, wintering or migrating through the region. Overall this assessment will highlight which waterbird populations that potentially will be affected by the construction of a future Fehmarnbelt link.

1.3 Methods

1.3.1 Approach

Ringing birds as a scientific method is more than 100 years old and have supplied the main basis of our current knowledge on bird migration. Ringing data consist of geographical positions of ringing and recovery sites of individual birds. Collecting such information over a long time period and from a large number of birds will ultimately supply information on the whereabouts of bird population on both a spatial and temporal scale. Ring-recoveries are mostly achieved from a dead bird revealing two geographical positions, i.e. the position of ringing and recovery, respectively. Besides, recoveries of dead birds, the data included in the present study also include ring-readings of birds re-trapped whereby the ring number has been reported. The number of ring-recoveries varies over time and between species (see e.g. Bønløkke et al. 2006 for details). Ringing data are regarded as of very high quality with regard to species identification and geographical position of the birds.

In the present study, we used ringing data made available from Zoological Museum in Copenhagen, Denmark and Ringing Center Helgoland, Germany. These two institutions collect and maintain all available ringing data recourses for the areas of interest. The Danish data cover information from the Danish side of the Fehmarnbelt (54.50N-11.00E; 54.80N-12.00E, *decimal degrees*) constituting 7,750 records covering the years 1911-2008. The German data are reported from Ostholstein - (54.00N-10.70E; 54.50N-11.40E *decimal degrees*) with 5,688 records in total from the period 1928-2008.The amount of information on each species varied from zero to 1,111 records (Herring Gull, *Larus argentatus*). When combining this ring-recovery data from Denmark and northern Germany, information on 31 species were available.

We added general information from the Danish (Bønløkke et al. 2006), Norwegian (Bakken et al. 2003) and Swedish (Fransson and Pettersson 2001) ringing atlases. Additionally, we have included the information from the FEBI telemetry studies (FEBI 2013) to increase the data material on four important waterbird species.

Finally, we present species-specific information from the scientific literature on breeding and wintering areas of 29 species and one species group (long-distance migratory waders, Scolopacidae) known to occur in large numbers within the FB region but where no ring-recovery data are available.

1.3.2 Ring recovery maps

From the species-specific ring-recovery data we are presenting species maps giving an overview of ringing and recovery records made within FB indicated on each map by a rectangular box. The species maps contain four separate frames each showing records made within FB in a given season. The type of record outside the area is indicated by a circle (ringing) or square (recovery), while the season of the record outside the area is indicated by the symbol colour (blue = winter, green = spring, red = summer and yellow = autumn). The total number of records that the species maps are based on is given as the N-value. In the Result section, we are describing the ring-recovery patterns of each species in detail. As supplement to the ringing data, we have included data from FEBI telemetry studies on Common Scoter *Melanitta nigra*, Common Eider *Somateria mollissima*, Long-tailed Duck *Clangula hyemalis* and Tufted Duck *Aythya fuligula* (FEBI 2013).

1.3.3 Literature studies and observational data

For 29 regular or common visitors either migrating through the region or breeding/wintering in FB, ring-recovery data are not available. However, available literature such as bird migration atlases provides general information of population origins and movements. This information is compiled in the Results section 3.2. Numbers in parentheses in the main species text indicate the Wetlands International 1 % criterion (Wetlands International 2006). The 1 % criterion is the number of individuals observed that would constitute one percent of the species or subspecies total population. Observations are extracted by systematic searches in DOFbasen (www.dofbasen.dk) including the time period from 2000 to 2009. DOFbasen is a database where amateur and professional ornithologists can upload observations of birds in Denmark. The observations in the database are under continuous data quality evaluation.

1.4 Results

1.4.1 Species-specific ring recovery description

Great Cormorant *Phalacrocorax carbo* (N = 146, Appendix 4-1)

The Great Cormorant is migratory within our region. The Norwegian population disperse into the North Sea as well as the inner Danish waters and the southern Baltic Sea during winter (Bakken et al. 2003). Our ring recovery analysis shows that the Fehmarnbelt (FB) area is visited by breeding birds from Scandinavia and Finland during the non-breeding period. Some records indicate that breeding birds from north-western Europe (The Netherlands) may move northeast to utilise FB during the non-breeding season. FB breeders move south to e.g. The Netherlands and central Europe. The latter description is in agreement with Bønløkke et al. (2006) and Fransson and Pettersson (2001) showing that the Danish and Swedish breeding population winters further south with mean winter recovery positions in Switzerland and northern Italy, respectively.

Grey Heron *Ardea cinerea* (N = 78, Appendix 4-2)

The breeding population within this region is partial migrants. The populations utilising FB contain mostly birds from Denmark, southern Sweden and northern Germany. Generally, birds found in FB during the non-breeding season have been ringed in Denmark and southern Sweden during spring and summer, while birds ringed within the region during the breeding season have been recovered in central Germany. The Danish and Swedish breeding populations are regarded as migratory with mean winter recovery positions in The Netherlands and Belgium (Fransson and Pettersson 2001; Bønløkke et al. 2006). Norwegian birds have a more western winter distribution not reaching FB (Bakken et al. 2003).

Mute Swan *Cygnus olor* (N = 483, Appendix 4-3)

This resident, or in some parts of the region partial migrant, is a common breeding bird of north-western Europe. Wintering birds in FB originate from Germany, Poland, the Baltic countries and Sweden with a few records of birds from The Netherlands and England. This pattern is in agreement with Bønløkke et al. (2006). Fransson and Pettersson (2001) report that Swedish birds move to Denmark and the southern Baltic during cold winters. The latter is confirmed by Bakken et al. (2003) reporting that southward migration in Norwegian birds occurs during cold winters. In our ring recovery analysis we found no clear seasonal pattern of movement. This could potentially be caused by dispersing immature birds being recovered before they settled in an actual breeding area as Mute Swans spend 2-4 years away from the breeding area before the first breeding attempt (Cramp and Simmons 1977).

Greylag Goose *Anser anser* (N = 94, Appendix 4-4)

The Greylag Goose is a migratory bird within this region although the migration distances vary from north to south with northern populations generally moving longer distances (Cramp and Simmons 1977). Our study shows that wintering birds in FB originate from Denmark, Sweden, Norway, Germany, with a few additional records from north-western and central Europe. Birds ringed during the breeding season in FB have been recovered in France, southern Spain and Tunisia indicating that the local breeding birds travel here to winter. Wintering areas have most likely moved towards the northeast in accordance with continuously milder winter conditions (Bønløkke et al. 2006). Patterns presented here are in agreement with the Scandi-

navian ringing atlases (Fransson and Pettersson 2001; Bakken et al. 2003; Bønløkke et al. 2006).

Common Shelduck *Tadorna tadorna* (N = 27, Appendix 4-5)

The populations in north-western Europe are migratory. However, the harshness of the winter seems to determine how far south the birds move (Bønløkke et al. 2006). Although our data are limited it shows that birds found within FB during the non-breeding season have been ringed in north-western European waters: Denmark, northern Germany and The Netherlands. Local breeders seem to move towards southwest i.e. Great Britain and France. The additional records from Danish waters most likely consist of birds staging before the actual migration southward. Swedish breeding birds are utilising southern Baltic wetlands prior to moving on to the actual wintering area in the Wadden Sea (Fransson and Pettersson 2001). The Wadden Sea is the most important staging, moulting and wintering area in the region for this species. These general patterns are in agreement with the Danish and Swedish ringing atlases (Fransson and Pettersson 2001; Bønløkke et al. 2006).

Eurasian Wigeon *Anas penelope* (N = 51, Appendix 4-6)

This species is a rare breeding bird in our region (Cramp and Simmons 1977). However, the southern Baltic Sea is located on the migration route between the northern and eastern breeding areas of this species and the wintering areas in north-western Europe (Fransson and Pettersson 2001; Bønløkke et al. 2006). The recoveries of birds ringed within FB indicate that the area is visited during migration and during the winter period by populations breeding in eastern Siberia and Finland (and one summer record from Island). Many individuals continue after stop-over in FB to wintering areas in The Netherlands, Great Britain, France and Spain. Birds found during summer may consist of moulting males.

Common Teal *Anas crecca* (N = 255, Appendix 4-7)

The Common Teal is largely migratory within our region. FB is visited by populations from Sweden, Finland, the Baltic countries and western Russia during migration towards their main wintering areas in Great Britain, The Netherlands, France and Spain. Additionally, a few non-breeding season records are found in central Europe. Breeding birds from the southern Baltic region are found in similar areas as above. These patterns are in agreement with the Danish and Swedish ringing atlases (Fransson and Pettersson 2001; Bønløkke et al. 2006).

Mallard *Anas platyrhynchos* (N = 1074, Appendix 4-8)

The species is mostly resident within our region (Cramp and Simmons 1977; Bønløkke et al. 2006). However, a large number of birds ringed within FB reveal that breeding birds from Sweden, Finland, the Baltic countries, Russia and Poland are using FB during winter and as stop-over site on migration towards wintering areas in northern Germany, the Netherlands, Great Britain and France. A few winter recoveries from southern and eastern Europe indicate that some individuals utilising FB may follow other flyways then the general southwest-northeast pattern seen in this ring recovery analysis.

Northern Pintail *Anas acuta* (N = 55, Appendix 4-9)

The Northern Pintail is a non-breeding visitor within our region and regarded as all migratory (Cramp and Simmons 1977). The breeding areas of birds utilising FB are found towards north and east mainly in Finlandand in Russia east to the Ural Mountains. This pattern is supported by Bønløkke et al. (2006). These birds use FB as

stop-over site during migration towards wintering areas in western Europe (mostly the Benelux countries), Great Britain and Spain (with records even from Marokko), central and south-eastern Europe.

Garganey *Anas querquedula* (N = 8, Appendix 4-10)

We have limited data on this long-distance migrant with main wintering area in sub-Saharan Africa (Cramp and Simmons 1977). Breeding birds from north-western Europe including Denmark and Sweden migrate southwest to southeast to their wintering areas in tropical West Africa (Cramp and Simmons 1977; Fransson and Pettersson 2001; Bønløkke et al. 2006). The ring recovery maps from the present analysis indicate that birds ringed in FB most likely are both breeders and birds staging during migration at the time of capture because we found summer recoveries further north in the Baltic Sea.

Northern Shoveler *Anas clypeata* (N = 46, Appendix 4-11)

This species is migratory within our region (Cramp and Simmons 1977). Birds ringed during summer and autumn in FB are recovered around the southern Baltic Sea, Denmark and the Benelux countries during the summer indicating that these are the breeding areas of birds using FB during their life cycle. Furthermore, breeding birds in the Nordic countries and Russia stop-over in the southern Baltic (Fransson and Pettersson 2001; Bønløkke et al. 2006). Wintering areas of these birds are found in Great Britain, France and Spain with a single record as far south as Senegal in West Africa.

Common Pochard *Aythya ferina* (N = 159, Appendix 4-12)

Our ring recovery analysis confirms that the species is mainly migratory within the FB region (Cramp and Simmons 1977). Birds wintering in FB move to breed in the Baltic countries, eastern Europe as well as eastern and central Russia. Some birds visiting FB during migration stop-over as well as FB breeding birds moves west and south-west for wintering grounds in north-western Europe, United Kingdom, France and the Iberian Peninsula. These patterns are in agreement with the Danish and Swedish ringing atlases (Fransson and Pettersson 2001; Bønløkke et al. 2006).

Tufted Duck *Aythya fuligula* (N = 743, Appendix 4-13)

Our ringing data show that this species is a partial migrant (Cramp and Simmons 1977) with some winter records as far south as the Iberian Peninsula as well as some birds seemingly wintering in FB. Furthermore, it is indicated that birds visiting FB move towards breeding areas on inland localities in Sweden, Finland and even to Russia east of the Ural Mountains. Ringing atlases confirm this (Fransson and Pettersson 2001; Bønløkke et al. 2006) and during the FEBI studies this was furthermore confirmed by a ring recovery from Russia 3,000 km east/north-east of FB and satellite tracking of one individual to its possible breeding area in eastern Russia (Figure 1.1 and FEBI 2013). The wintering areas are besides FB, north-western European waters coastal as well as inland.

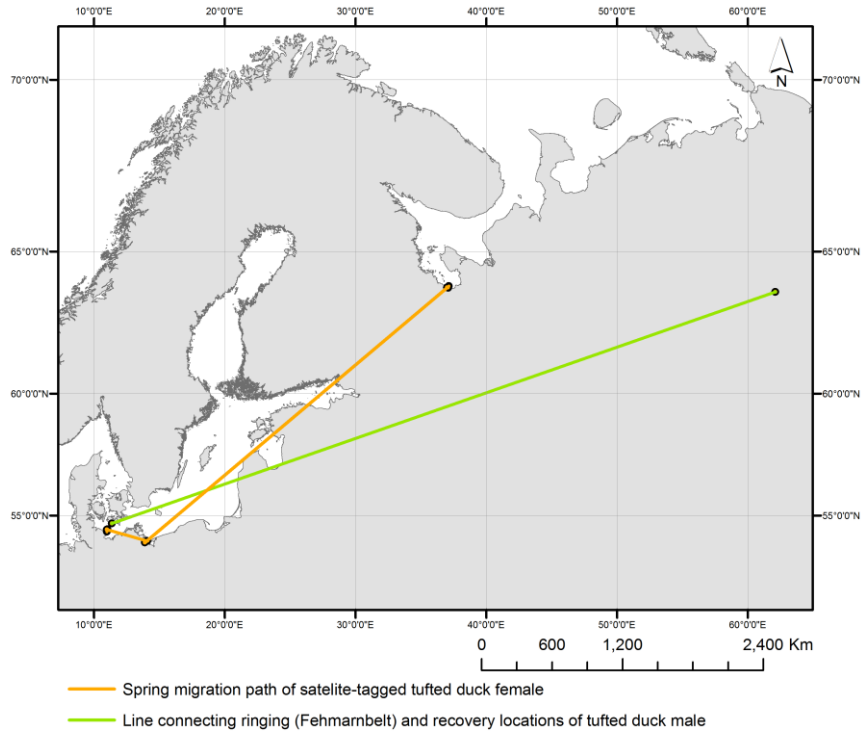

Figure 1.1 *Tracking and ring recovery of Tufted Ducks. Orange line connects positions from satellite tracking of one Tufted Duck tagged in 2010 (see FEBI (2013) for details on method). Green line: connecting ringing and recovery locations of a Tufted Duck male ringed in Hirsbosøerne near Rødbyhavn on 24 February 2009 and shot in Khanty-Mansi, Russia on 23 May 2009.*

Greater Scaup *Aythya marila* (N = 21, Appendix 4-14)

The Greater Scaup is only found in FB as a non-breeding visitor. Birds utilising the FB region originate from breeding areas in Russia extending east of the Ural Mountains. This pattern seen in only 21 individuals is confirmed by Bønløkke et al. (2006) and it is in agreement with the Danish and Swedish ringing atlases (Fransson and Pettersson 2001; Bønløkke et al. 2006).

Common Eider *Somateria mollissima* (N = 89, Appendix 4-15)

Overall, Common Eiders utilising FB during the non-breeding season mostly consist of breeding birds from the Baltic Sea with the highest concentration in south-western Finland and around Ålandøerne. Furthermore, birds ringed in the Wadden Sea during summer are likewise found in the FB during the winter. These birds spend the summer and early autumn in the Wadden Sea to moult after which they move into the southern Baltic and inner Danish waters including FB. This pattern is confirmed by Bønløkke et al. (2006) and Fransson and Pettersson (2001) as well as FEBI telemetry studies (Figure 1.2 and FEBI 2013).

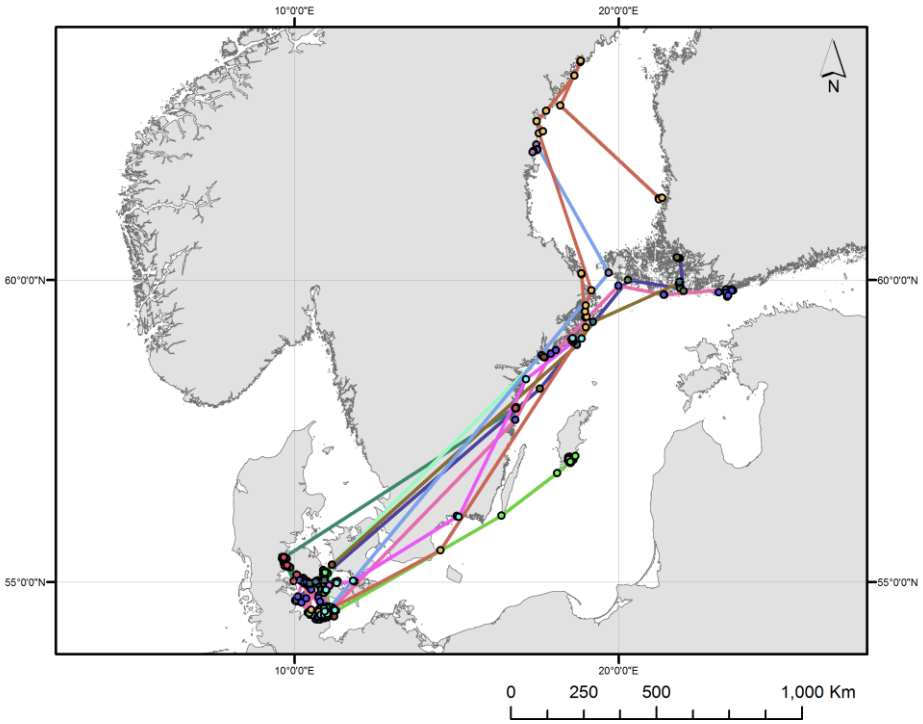

Figure 1.2 *Tracks of 10 Eiders tagged with satellite transmitters in October 2010 (see FEBI (2013) for details on methods) showing spring migration route and possible breeding areas.*

Red-breasted Merganser *Mergus serrator* (N = 8, Appendix 4-16)

This is a partial migrant with the majority of the breeding birds staying within our region during winter (Cramp and Simmons 1977; Bønløkke et al. 2006). Ring-recoveries indicate that birds recorded during the non-breeding season in FB are ringed throughout the Baltic Sea and the Gulf of Finland. Local breeders seem to remain in southern Baltic waters during winter. These patterns are in agreement with the Danish and Swedish ringing atlases (Fransson and Pettersson 2001; Bønløkke et al. 2006) with some evidence of Norwegian birds moving to the FB region during the non-breeding season (Bakken et al. 2003)

Moorhen *Gallinula chloropus* (N = 113, Appendix 4-17)

This species is migratory within our region (Cramp and Simmons 1980). Local breeding populations and birds using FB as stop-over site during migration spend the winter in the Benelux countries and France, and some few additional recoveries have been made in Great Britain, southern Spain and Morocco. There are some indications that breeding birds are recovered further south than birds ringed when staging on migration in FB, but data are limited. However, this is in agreement with the Danish and Swedish ringing atlases (Fransson and Pettersson 2001; Bønløkke et al. 2006).

Common Coot *Fulica atra* (N = 252, Appendix 4-18)

Common Coots are present year round in our area but breeding populations are most likely partial migrants (Cramp and Simmons 1980). Different populations visit FB from the east with ringing and recovery localities found in Denmark, Sweden,

Finland, the Baltic countries and Poland. There are additional data indicating origins of birds from Ukraine potentially showing that birds from far eastern and south-eastern populations may move north-west to winter in the shallow waters in north-western Europe. Local breeding birds seem to be moving towards south-west wintering in the Benelux countries, France, Germany and even as far south as northern Italy and Spain. The larger data material in the national ringing atlases confirms these patterns. (Bønløkke et al. 2006; Fransson et al. 2008).

Eurasian Oystercatcher *Haematopus ostralegus* (N = 33, Appendix 4-19)

This species is a common breeding bird in the southern Baltic Sea and winters towards west and southwest. Our region is used by birds breeding in the southern Baltic Sea and by birds breeding further north (Cramp and Simmons 1983; Bønløkke et al. 2006). Birds ringed during the breeding season and during staging in FB have been recovered year round along the north-western European coastlines as far south as France indicating that FB is an important site during migration for this species.

Avocet *Recurvirostra avosetta* (N = 13, Appendix 4-20)

Avocet is a migratory breeding bird in FB. Birds ringed during the breeding season in FB show recoveries in Germany, The Netherlands, France and Spain. There are very few recoveries north of FB. Hence, information on northern breeding areas is limited. However, the few breeding positions indicate that FB is important for the Danish breeding population as a stop-over site during migration. Bønløkke et al. (2006) show that breeding birds from the southern Baltic Sea which is also the northern limit of the breeding range (Cramp and Simmons 1983) most likely pass FB during migration.

Ringed Plover *Charadrius hiaticula* (N = 41, Appendix 4-21)

Ringed Plover is a common breeding bird in FB. The population within FB is migratory and a rare winter visitor to northern Europe (Cramp and Simmons 1983). Few ringing data are found north of FB (e.g. Fransson and Pettersson 2001; Bønløkke et al. 2006). Our results indicate that it is mainly breeding birds from Scandinavia and Finland that use FB as stop-over site during migration. Furthermore, local breeders and birds on migration are found year round in Denmark, Great Britain, France, Spain and Morocco.

Northern Lapwing *Vanellus vanellus* (N = 35, Appendix 4-22)

This species is mostly migratory within FB. The limited data indicate that FB is used by breeding birds from Sweden and Finland during winter. This is confirmed by Fransson and Pettersson (2001). Local breeders as well as birds staging in FB migrate to wintering areas in western Europe, mostly Great Britain, France and the Iberian Peninsula. The mean winter locations (December and January) of Lapwings ringed in Denmark are found in southern France (Bønløkke et al. 2006).

Dunlin *Calidris alpina* (N = 184, Appendix 4-23)

The species is a rare breeding bird in Denmark and Germany but common on migration (Cramp and Simmons 1983). Birds ringed and recovered in FB are found towards north-east during the breeding season and towards south-west during the non-breeding season. Hence, FB is important as staging area for populations of *alpina* breeding in northern Russia, as well as the smaller *schinzii* population of the Baltic Sea, Norway and Finland (Bellebaum et al. 2008). The wintering areas for birds staging in FB are found in Great Britain, France and possibly also in central

southern Europe. Mean winter location (December to February) of birds ringed in Denmark and Sweden are found around the English Channel (Bønløkke et al. 2006; Fransson et al. 2008).

Common Sandpiper *Actitis hypoleucos* (N = 16, Appendix 4-24)

Although data are limited it is indicated that birds ringed on migration in FB are breeding in Sweden and northern Norway. FB is most likely also used by breeding birds from Finland (Bønløkke et al. 2006; Fransson et al. 2008). These migratory populations move southwest towards their non-breeding areas in West Africa (Cramp and Simmons 1983). The species is a rare breeding bird in Denmark and Germany but common during migration to and from northern and eastern breeding areas (www.dofbasen.dk). Bellebaum et al. (2008) state that Swedish populations stop-over in western Baltic Sea, whereas the Finnish and Russian populations migrate more directly south through the Baltic countries and Poland.

Black-headed Gull *Larus ridibundus* (N = 716, Appendix 4-25)

The species is regarded as migratory within our region. The rather large data material from FB reveals that the area functions as wintering area for breeding populations from southern Sweden, Finland, the Baltic countries and Poland. Wintering areas for local breeders are found further south and south-west mostly along the North Sea and the English Channel but also inland Benelux countries, Great Britain, France, the Iberian Peninsula and around the western Mediterranean Sea. Mean winter location (December to February) of birds ringed in Denmark and Sweden are found around the English Channel (Bønløkke et al. 2006; Fransson et al. 2008).

Common Gull *Larus canus* (N = 844, Appendix 4-26)

The present ring recovery analysis indicates that the population wintering in FB consists of breeding birds from Denmark, southern Sweden, Finland, the Baltic countries and far north-western Russia. The north-western European populations including the local FB breeders are mainly wintering inland as well as offshore in Western Europe: Great Britain, The Netherlands, France and reaching as far south as the Iberian Peninsula. Common Gulls ringed in Denmark during the non-breeding season show mean summer (May-August) recovery positions in southern Finland (Bønløkke et al. 2006). The mean winter positions (December-February) of birds ringed in Denmark are the northern part of the English Channel (Bønløkke et al. 2006). The main migration routes are in a southwest-northeast direction in autumn and spring, respectively. Overall, this indicates that the southern Baltic Sea is an important migratory corridor for Common Gulls on migration from breeding to wintering areas.

Lesser Black-backed Gull *Larus fuscus* (N = 9, Appendix 4-27)

This long-distance migrant is using FB as stop-over site to and from breeding areas along the coast of the Baltic Sea. We found no data from wintering areas. However, the ringing atlases show wintering areas in the northern Atlantic and sub-Saharan Africa (Bakken et al. 2003; Bønløkke et al. 2006; Fransson et al. 2008).

Herring Gull *Larus argentatus* (N = 1111, Appendix 4-28)

FB is important throughout the year for breeding birds originating from The Netherlands, Scandinavia, Finland and western Russia. The wintering area of local breeding birds or birds ringed in FB during the breeding season are found in The Netherlands, northern Germany and Poland, with the most southern recovery in Belgium.

Greater Black-backed Gull *Larus marinus* (N = 50, Appendix 4-29)

Within FB this species is regarded as mostly resident (Cramp and Simmons 1983). FB is visited by breeders from Scandinavia, Finland and even western Russia during the non-breeding season. We found no indications of local breeders moving further south. However, Bønløkke et al. (2006) show evidence of some movements mainly towards the English Channel.

Sandwich Tern *Sterna sandvicensis* (N = 126, Appendix 4-30)

This long-distance migrant winters along the coast of West Africa. According to Cramp (1985) all western European birds share similar winter quarters, mainly on the west coast of Africa from Mauritania south to Cape of Good Hope. Birds ringed or recovered in FB show spring, summer and autumn recoveries throughout inner Danish and southern Baltic waters with few birds recovered further east and west. This indicates that FB is an important area for local breeders as well as breeders from Denmark, Germany and around the southern Baltic Sea during the summer and post-breeding.

Common Tern *Sterna hirundo* (N = 59, Appendix 4-31)

Recoveries of this long-distance migrant is found during spring, summer and autumn throughout the North Sea and the Baltic Sea indicating that Common Terns use FB during passage to and from the wintering areas. Breeders from the southern Baltic See seem to use FB during migration and furthermore, Bønløkke et al. (2006) show that a larger number of breeding birds from western Russia and the Baltic countries are recorded in Danish waters. The wintering areas of local breeding birds are found along the coast of West Africa and as far south as South Africa.

Arctic Tern *Sterna paradisaea* (N = 152, Appendix 4-32)

Recoveries of birds ringed in FB during the summer period seem to dominate the picture. Summer and autumn recoveries are spread out over most of north-western Europe indicating that birds from a large area utilise FB during their annual life cycle. The Arctic Tern is an extreme long-distance migrant migrating to the southern Atlantic Ocean (Cramp 1985). Birds from FB are recovered throughout the year (summer records probably young non-breeders) along the coast of West and southern Africa. These patterns are confirmed by ringing atlases (e.g. Bønløkke et al. 2006).

Little Tern *Sterna albifrons* (N = 99, Appendix 4-33)

The wintering areas of this migratory species are found in West Africa (Cramp 1985; Fransson et al. 2008). We found spring recoveries from southern Europe most likely representing birds on spring migration towards their breeding areas in FB. Breeding birds from Northern Germany, Denmark and The Netherlands are also recovered in FB during summer and autumn indicating that FB is important as staging area for breeding birds originating from this larger area.

1.4.2 Other relevant species

Red-throated Diver *Gavia stellata*

The Red-throated Diver is a circumpolar breeder and the Western Palearctic populations winter in coastal areas of Europe (Cramp and Simmons 1977). The Red-throated Diver winters in the Baltic Sea in high numbers and the few ring-recoveries from Danish waters indicate that these birds come from breeding areas in Sweden and Finland (Bønløkke et al. 2006). This is confirmed by Fransson and Pettersson (2001)

Black-throated Diver *Gavia arctica*

The breeding distribution is circumpolar with the Western Palearctic populations wintering in areas located in coastal areas of Europe (Cramp and Simmons 1977). Danish and German waters are important moulting and wintering areas for this species. However, few birds have been ringed and hence, very little information is available. Fransson and Pettersson (2001) show that Swedish breeders move further south compared to the Red-throated Diver with wintering areas in the Black Sea and the Atlantic Ocean. The only Danish ring recovery is from Siberia, indicating that Black-throated Divers wintering in FB at least partly originate from further north and eastwards relative to Red-throated Diver (Bønløkke et al. 2006).

Little Grebe *Tachybaptus ruficollis*

The Little Grebe breeds in the Western Palearctic from Northern Africa to southern parts of Sweden and throughout the United Kingdom at the northern range limit. It winters mainly in Western Europe (but also Turkey) (Cramp and Simmons 1977). The species is a relatively common breeding bird in Denmark and Germany. The species is partially migratory, while some winter in Denmark (mainly in fresh and brackish waters) others migrate to the southwest and are recovered along the coasts of Germany, the Netherlands, Belgium and Great Britain (Bønløkke et al. 2006). The number of wintering Little Grebe in FB is likely fluctuating in accordance with the harshness of the winter with high numbers in mild winter and low numbers in cold winters. No records from FB above the 1 % of the population criterion (3400) could be found since 2000 (www.dofbasen.dk).

Slavonian Grebe *Podiceps auritus*

This species is a circumpolar breeder (Greenland exempted). The Western Palearctic wintering areas are found along coastal regions of Iceland, Scandinavia (excluding the Eastern Baltic Sea), around the United Kingdom and the Channel area, the Central Mediterranean and the Black Sea (Cramp and Simmons 1977). Records of the species from FB of migrating and staging groups are at a size of 10 in October (www.dofbasen.dk, Hyllekrog, Saksfjed Inddæmning). No records for FB above the 1 % of the population criterion (55) could be found (www.dofbasen.dk).

Black-necked Grebe *Podiceps nigricollis*

The Black-necked Grebe breeds in a patchy distribution in Western and Central Europe as well as in a contiguous area in the Eastern part of the Western Palearctic with wintering areas found along coastal regions of Western Europe and the Mediterranean Sea (Cramp and Simmons 1977). The Black-necked Grebe is an uncommon breeding bird in Denmark. The main wintering areas lie in areas south of the FB (Bønløkke et al. 2006). Outside the breeding season, the species is largely dependent on coastal lagoons and salt lakes (Fjeldså 2004). FB's importance as a

staging area is probably limited. No records for FB above the 1 % of the population criterion (2200) could be found (www.dofbasen.dk).

Great Crested Grebe *Podiceps cristatus*

The Great Crested Grebe breeds from western to the easternmost parts of the Palearctic and wintering areas in Europe are mainly found along the coasts and in inland areas of Western Europe (Cramp and Simmons 1977). The species is a common breeding bird in Denmark and Germany. Most birds are thought to leave Denmark during winter, probably wintering along the coast of the Netherlands, France and Great Britain (the Channel Area), but also the Black Sea (Bønløkke et al. 2006). Since 1960 some wintering areas have been established in the southern Baltic Sea (Bønløkke et al. 2006). Jensen (1993) indicates that FB is an important wintering area during cold winters. No records for FB above the 1 % of the population criterion (3600) could be found since 2000 (www.dofbasen.dk).

Red-necked Grebe *Podiceps grisegena*

The Red-necked Grebe breeds mainly in the eastern part of the Western Palearctic with wintering areas exclusively located along coastal areas of Scandinavia, the Channel area and in the Central Mediterranean (Cramp and Simmons 1977). Thus, European populations are short-distance migrants. The Red-necked Grebe is a relatively common breeding bird in Denmark and Germany. The main wintering area of the Nordic populations is along the south-coast of the Baltic Sea (in mild winters), making FB a potentially important area for these populations. Abroad ring recoveries during winter in Danish waters are from Finland and Germany, and suggest that populations from a wide area use the waters (Bønløkke et al. 2006). FB's importance as a staging area is largely unknown. No records for FB above the 1 % of the population criterion (510) could be found since 2000 (www.dofbasen.dk).

Eurasian Bittern *Botaurus stellaris*

The Eurasian Bittern breeds from the western to the easternmost parts of the Palearctic. The eastern breeding populations in the Western Palearctic are thought to be migratory whereas the populations in Western and Southern Europe mainly are residents or partial short-distance migrants depending on winter temperatures (Cramp and Simmons 1977). The species is an uncommon breeding bird in Denmark with a population estimated at 150-200 pairs. The species is mainly resident, but can undertake southward movements during cold winters (Bønløkke et al. 2006). A major part of the breeding population is concentrated around the Maribo lakes in the FB area. A few recoveries of birds ringed in the Nordic countries (Sweden and Finland) indicate that birds visit FB from these populations during the non-breeding season (Bønløkke et al. 2006). Recoveries of Swedish birds show that some winter further to the south-west in France, Spain and Italy (Fransson and Pettersson 2001).

Bewick's Swan *Cygnus (columbianus) bewickii*

In the Western Palearctic the Bewick's Swan breeds on the Russian tundra all the way to eastern Siberia. The western Siberian populations are migratory and winter in Western Europe (Cramp and Simmons 1977). Denmark is one of the key staging areas of the Bewick's Swan, and the localities are mostly found in western and northern Jutland. Thus, large parts of the population may pass the FB during migration. There are two records of large migrating flocks around 280 (1 % criterion 290) from the FB and a locality just outside the FB (www.dofbasen.dk). Thus large parts of the population may pass the FB briefly during migration.

Whooper Swan *Cygnus cygnus*

The Whooper Swan breeds from the western to the easternmost parts of the Palearctic. The Western Palearctic breeding population winters in northern parts of Western and Central Europe and in Scandinavia (Cramp and Simmons 1977). Populations wintering in Denmark arrive from breeding grounds mainly in Finland and Russia. Birds wintering in the southern part of the country are from mid to south Finland as opposed to the population in north Finland (Bønløkke et al. 2006). Several observations above the 1 % criterion have been recorded in the Fehmarnbelt since 2000 (maximum record (929)) (www.dofbasen.dk). Hence the breeding populations of mid to south Finland and Russia might be influenced by the wintering conditions in FB.

Bean Goose *Anser fabalis*

The Bean Goose breeds from the western to the easternmost parts of the Palearctic. The whole Western Palearctic population is migratory and winters in Europe (Cramp and Simmons 1977). Ringed birds recovered in Denmark are mainly from breeding populations in Sweden and Finland. Especially the Finish birds are recovered in Smålandsfarvandet. Wintering numbers above the 1 % criterion (6000 *rossicus*, 1000 *fabalis*) are reported from January and December for *rossicus* (maximum 10,000), January – March *fabalis* (maximum 2800). Maximum record of unidentified type is 12,000 Nakskov Indrefjord during winter (www.dofbasen.dk).

Greater White-fronted Goose *Anser albifrons*

The Greater White-fronted Goose has a circumpolar breeding range. Breeding birds from Western Greenland (subspecies *flavirostris*) winter mainly on the British Isles. The West Russian breeding population, breeding at latitudes 66 to 75° N, winter in continental Northern Europe, South-eastern Europe, Iraq and Caucasus (Cramp and Simmons 1977). The autumn migration of the Siberian subspecies (*albifrons*) goes mainly south of the Baltic Sea and the FB to winter in the Netherlands, Belgium and northern Germany (Bønløkke et al. 2006, citing Mooij et al. 1999). A single recovery in FB of the *flavirostris* subspecies, ringed in western Greenland in FB (breeding from Greenland and west over), documents that this species sometimes occur. No records for Fehmarnbelt above the 1 % of the population criterion (10,000) could be found (since 2000) (www.dofbasen.dk).

Canada Goose *Branta canadensis*

The Canada Goose is an introduced species from North America now mainly breeding in the United Kingdom, Norway, Sweden, Finland and with smaller breeding populations further south including Denmark. The Scandinavian population is partly migratory some migrating to Northern Germany, Denmark and Sweden (Cramp and Simmons 1977). In cold winters populations from Sweden and Norway move to winter in Denmark (Bakken et al. 2003, Fransson and Pettersson 2001).

Barnacle Goose *Branta leucopsis*

The FB is the main passageway from the Siberian breeding grounds to the staging and wintering areas in the Wadden Sea. The breeding population of Barnacle Goose has increased and its range has expanded dramatically during the last three decades now breeding in north-western Europe (Van Der Jeugd, Eichhorn et al. 2009). In FB, many observations above the 1 % criterion of migrating birds are recorded in April and May and in October and November (www.dofbasen.dk). The largest observation during autumn is 42,600 (Gedser Odde, October), 16,500 in spring (Hyllekrog, May).

Brent Goose *Branta bernicla*

The FB appears to be a major passage point for the Siberian population during autumn and spring migration. The Brent Goose breeds in a circumpolar distribution in the high arctic, in the Western Palearctic on Svalbard and Russian arctic islands at 80°N (Cramp and Simmons 1977). The Russian *bernicla* population winters in North-western Europe (Denmark, North-western Germany, Netherlands, south-east England and west France) the specific location depending on the winter weather conditions (Cramp and Simmons 1977). Denmark harbours the main part (more than 50 %) of the subspecies *hrota* breeding on Svalbard and Greenland. In October, large numbers of more than 20,000 are observed on migration from Gedser in the Fehmarnbelt. Also in May large numbers (above the 1 % criterion – 2000) are observed on migration (up to 3,000 staging and 23,000 on a single day of migration at Hyllekrog) (www.dofbasen.dk).

Gadwall *Anas strepera*

The Gadwall breeds from Western Europe to the easternmost parts of the Palearctic and further east to North America (Cramp and Simmons 1977). The northern and easternmost populations are all migratory wintering in Western Europe, the Mediterranean, the Middle East and as far south as areas along the Nile (Cramp and Simmons 1977). Maribo Lakes in the FB area is an important breeding area for the species in Denmark. No birds have been recovered in the Fehmarnbelt (Bønløkke et al. 2006). Thus, the origins of the large number of staging and wintering birds (in mild winters) during October to December are unknown. Records above the 1 % criterion (600) are from October (maximum 1247, Maribo Lakes) and December (maximum 625, Maribo Lakes) (www.dofbasen.dk).

Long-tailed Duck *Clangula hyemalis*

The Long-tailed Duck breeds in a circumpolar distribution, in the Western Palearctic from 60 to 79° N from Iceland in the west to the Siberian tundra in the east (Cramp and Simmons 1977). The species winters along the coasts of Iceland, Scandinavia (excluding Bay of Botnia), the Baltic Sea, the Wadden Sea and around the British Isles. The Baltic Sea apparently being the most important wintering area in the Western Palearctic (Cramp and Simmons 1977). During the cold winter 1986-87, up to 275,000 off the east coast of Falster west to Hyllekrog were reported (Pagh Jensen 1993). We found no ring-recoveries from the Fehmarnbelt areas. However, Figure 1.3 presents results from seven satellite tracked individuals (FEBI 2013) indicating breeding areas in Yamalia, northern Russia. Furthermore, the Swedish recoveries include one from Siberia and one recovered during winter in Denmark (Fransson and Pettersson 2001). Two Norwegian birds ringed in winter have been recovered, one in Iceland during winter and one in Russia during spring (Bakken et al. 2003).

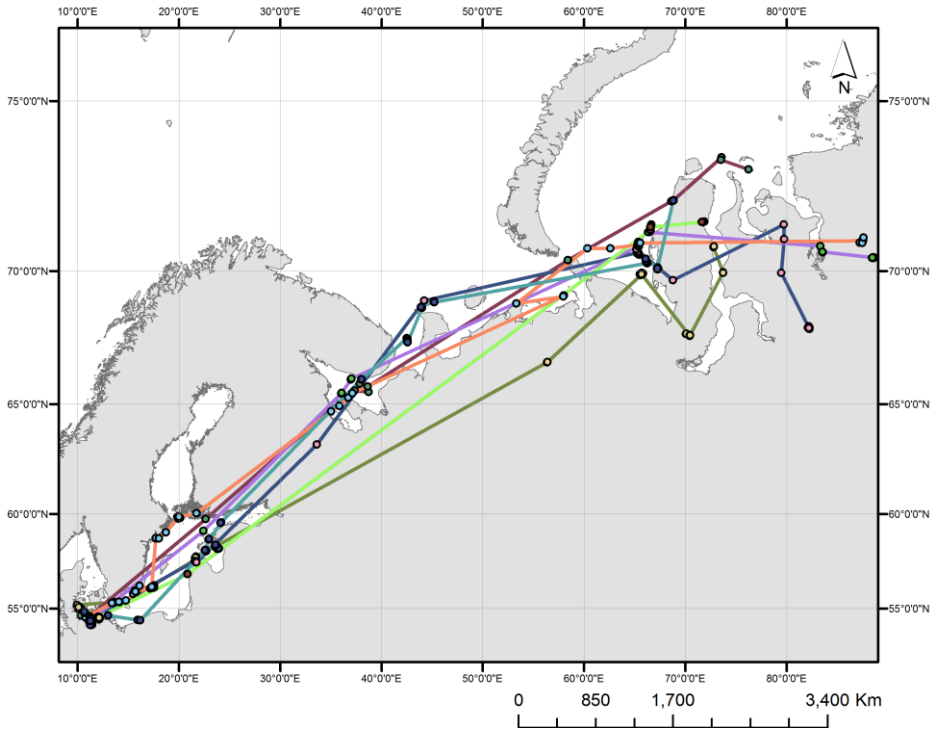

Figure 1.3 *Tracks of seven Long-tailed Ducks satellite-tagged in January 2010 (see FEBI (2013) for details on methods) showing spring migration routes and possible breeding areas.*

Common Scoter *Melanitta nigra*

The Common Scoter's main breeding range is in continental parts of the Western Palearctic from 58° (Norway) to 72°N, but also in the northern parts of the British Isles and Iceland (Cramp and Simmons 1977). The species is migratory and winters along the coasts of Norway, southern Sweden, Denmark, the southern Baltic Sea, around the British Isles and down the coast of Western Europe to 20°N (north-eastern Africa) (Cramp and Simmons 1977). Bønløkke et al. (2006) report only a single ring recovery outside Danish waters: White Sea, eastern Russia. Generally the Wadden Sea and Kattegat are more important for wintering than FB, harbouring larger numbers (Pagh Jensen 1993). We found no ring-recoveries from the FB areas. However, Figure 1.4 presents results from a satellite-tracked individual (FEBI 2013) indicating its breeding area in north-eastern Russia.

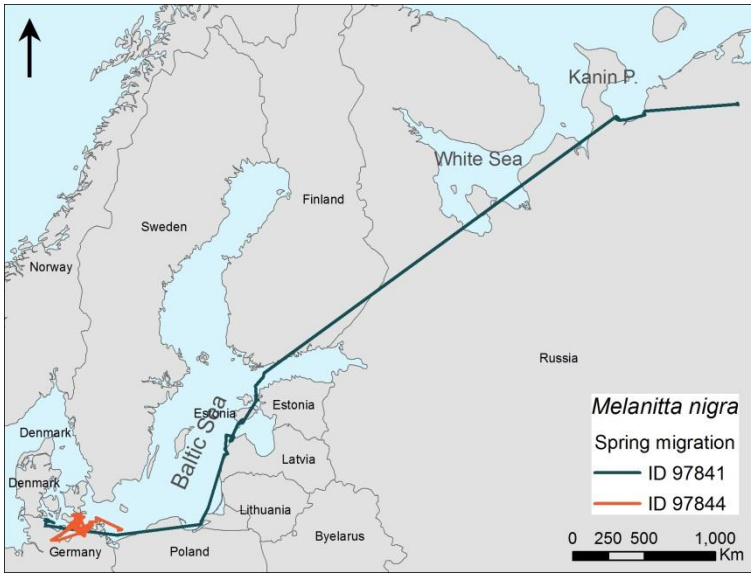

Figure 1.4 Tracks of two Common Scoters satellite-tagged in January 2010 (see FEBI (2013) for details on methods). The female migrated to possible breeding areas in north-eastern Russia, while the male stayed in the southern Baltic during the summer season.

Velvet Scoter *Melanitta fusca*

The Velvet Scoter's main breeding range is in continental parts of Eurasia and in North America. In the Western Palearctic it breeds along the Swedish, Finnish and Baltic coasts (Cramp and Simmons 1977). The species is migratory and winters along the coasts of Norway, southern Sweden, Denmark, in the southern Baltic Sea, the Wadden Sea, less commonly around the United Kingdom and the coasts of the Channel area (Cramp and Simmons 1977). The populations wintering in Northern Europe originate from the Baltic Sea and the White Sea (eastern Russia) (Bønløkke et al. 2006). Generally FB is not important for the wintering population, whereas Kattegat houses a large part of this population (Pagh Jensen 1993).

Common Goldeneye *Bucephala clangula*

The Common Goldeneye has a circumpolar breeding range, in Europe mostly in Norway, Sweden and Finland (Bønløkke et al. 2006). It is a short-distance migrant to our region (FB), though the non-breeding range is more to the east (to the Baltic countries) in mild winter. Formerly estimated wintering population was 170,000 in Denmark and western Baltic (Cramp and Simmons 1977).

Smew *Mergellus albellus*

The Western Palearctic breeding range includes Scandinavia extending east through Finland and Russia (Cramp and Simmons 1977). The species is migratory, but specific routes are poorly known. Part of the Scandinavian and Russian populations winter around the coasts of Denmark, Germany, Great Britain and the Netherlands (Cramp and Simmons 1977). There is only one ring recovery in Denmark from northern Sweden. Several observations above the 1 %-criterion (400) of wintering birds in FB exist in DOFbasen, e.g. 815 from Hyllekrog-Rødsand in 2009 (www.dofbasen.dk).

Common Merganser *Mergus merganser*

The Common Merganser is migratory and partially migratory with a circumpolar breeding range. Western Palearctic populations breed within the Baltic region and are believed to spend the non-breeding season in the western Baltic Sea (FB). During the non-breeding season north-eastern European populations migrate to the Baltic region and beyond to Netherlands and Britain (Cramp and Simmons 1977).

Crane *Grus grus*

The Crane breeds from northern Central Europe north over in most of Scandinavia continuing east to the eastern European and Russian steppes. The European subspecies *grus* winters in southern Europe and northern Africa (Cramp 1985). A large proportion of the Scandinavian breeding population passes through northern Germany and the western parts of the Baltic Sea on migration. The Zingst Peninsula and surrounding areas located east of FB is a very important staging area for this population on spring and autumn migration. From Rügen the birds continue north by crossing the Baltic Sea. The specific route depends on wind conditions. However, migration observations indicate that most migrants fly east of the FB (e.g. www.dofbasen.dk).

Little Gull *Larus minutus*

The Little Gull breeds from north-eastern Europe in a patchy distribution through the Palearctic to the east. The species is considered all migratory, wintering essentially offshore in the North Sea and Irish Sea southwards to the Mediterranean, and to a lesser extent in the Black Sea. Main autumn migration goes through the Baltic, North Sea and English Channel. Sheltered bays of the Baltic and the North Sea probably serve as moulting areas for adults of Baltic and Russian populations in autumn.

Common Guillemot *Uria aalge*

The Common Guillemot has a circumpolar distribution. It breeds in north-western Europe, and its movement is essentially dispersive for 1st-year birds, whereas adults are residential. Baltic populations spend the non-breeding season in the Baltic Sea, with post-fledgling dispersal to FB, into the Gulfs of Bothnia and Finland and along the east coast of Jutland, Denmark (Cramp 1985).

Razorbill *Alca torda*

The species breeds on temperate and boreal coasts of the north Atlantic. The Western Palearctic populations have a breeding range in coastal areas of north-western Europe, mainly Iceland, Great Britain and northern Norway. The relict Baltic populations (Finnish, Swedish and Danish) stay in the Baltic throughout the year, shifting south and southwest (to FB) during winter. The non-breeding range is warm temperate and Mediterranean zones of western Europe (Cramp 1985).

Black Guillemot *Cepphus grylle*

The Black Guillemot is resident and dispersive, and the least migratory of the group (Alcidae). The species has a circumpolar distribution from beyond 88°N through arctic, subarctic and boreal to north temperate zones. Main distribution along northern north Atlantic coasts, though relict populations in the Baltic Sea exist, of which some may utilise FB during the non-breeding season. Winter range is determined by availability of unfrozen waters (Cramp 1985).

Little Auk *Alle alle*

The species is the most arctic of the group (Alcidae), breeding mainly in Greenland and high arctic islands. During the non-breeding season Little Auks migrate from Barents Sea westwards into Norwegian Sea, and south to Grand Banks of Newfoundland following cold currents. Though in small numbers, it regularly winters in north-western Europe (Skagerak and Scotland) (Cramp 1985).

Atlantic Puffin *Fratercula arctica*

The distribution of the Atlantic Puffin is the northern north Atlantic, in Western Palaearctic mainly Iceland, Great Britain, Norway and Faeroe Islands. Breeds from the margin of high-arctic through low-arctic and boreal to temperate zones. High-arctic *naumanni* winters in East Greenland. Nominate low-arctic *arctica* winters in the Atlantic, Norwegian waters and Skagerak. Some southern populations (*grabae*) stay in the North Sea, whereas some migrate south to 30N and the Bay of Biscay, even penetrating the western Mediterranean (Cramp 1985).

Long-distance migratory Waders

FB is passed by a large number of migratory wader species during spring and autumn migration. Although, ring-recoveries are very limited for these species, FB is used as staging area for large number of birds during the migration period. The species migrate through the region towards the primary stop-over site: Wadden Sea, where they either winter or stop-over before moving to their wintering areas along the Atlantic coast of Europe and/or Africa. The most abundant species are Bar-tailed Godwit (*Limosa lapponica*), Dunlin (*Calidiris alpina*) and Knot (*Calidris canutus*). The likely breeding areas are Siberia and Scandinavia: Knot between 1 and 5°C isoclines; Dunlin less restricted, in sub-arctic regions as well; and Bar-tailed Godwit within from boreal to, locally, high arctic, but mainly continental mainland low Arctic (Cramp and Simmons 1983).

Table 1.1 Summarising the detailed information on the breeding and the non-breeding ranges of the populations occurring in Fehmarnbelt (FB). The geographic areas for each species are listed in order of importance for the FB populations. If more than one sub-species are present within the area, this information is given as well. Furthermore, season of occurrence (all year, winter, summer, migration period), migratory strategy (migratory, partially migratory) of the populations occurring in Fehmarnbelt as well as a reference to section and appendices for each species are also provided.

Common name	Scientific name	Breeding ranges of populations occurring in Fehmarnbelt	Non-breeding range of populations occurring in Fehmarnbelt	Season of occurrence	Migratory strategy	Section	Appendix
Red-throated Diver	*Gavia stellata*	Arctic Western Palaearctic, Sweden, Finland	Western Europe, Baltic Sea, FB, Black Sea, Caspian Sea	Winter	Migratory	4.2	
Black-throated Diver	*Gavia arctica*	Arctic Western Palaearctic, Siberia	Western Europe, Baltic Sea, FB, Black Sea, Caspian Sea	Winter	Migratory	4.2	
Little Grebe	*Tachybaptus ruficollis*	North-western Europe, Denmark, FB	Wadden Sea, English Channel, FB	All year	Migratory	4.2	
Great Crested Grebe	*Podiceps cristatus*	Northern and north-eastern Europe, FB	English Channel, southern Baltic Sea	All year	Partially migratory	4.2	
Red-necked Grebe	*Podiceps grisegena*	North-eastern Europe, Finland, FB	FB, Baltic Sea, North Sea, English Channel	All year	Migratory	4.2	
Slavonian Grebe	*Podiceps auritus*	Circumpolar	North Sea, English Channel, western Baltic Sea, Mediterranean, Black Sea	Winter	Migratory	4.2	
Black-necked Grebe	*Podiceps nigricollis*	Western, central, eastern Europe	Western Europe, Mediterranean	Migration	Migratory	4.2	
Great Cormorant	*Phalacrocorax carbo*	FB, Scandinavia, Finland, the Netherlands	FB, Southern Baltic Sea, the Netherlands, central Europe	All year	Migratory	4.1	x

Common name	Scientific name	Breeding ranges of populations occurring in Fehmarnbelt	Non-breeding range of populations occurring in Fehmarnbelt	Season of occurrence	Migratory strategy	Section	Appendix
Grey Heron	*Ardea cinerea*	FB, Denmark, southern Sweden, northern Germany	FB, Southern Baltic region, FB, central Germany	All year	Partially migratory	4.1	x
Mute Swan	*Cygnus olor*	FB, Germany, Poland, Baltic countries, Sweden	FB, Denmark, northern Germany, the Netherlands	All year	Partially migratory	4.1	x
Bewick's Swan	*Cygnus* (*columbianus*) *bewickii*	Russian tundra to eastern Sibiria	Western and northern Jutland, Denmark	Winter and migration	Migratory	4.2	
Whooper Swan	*Cygnus cygnus*	Central Finland, Western Russia	Southern Denmark, FB	Winter	Migratory	4.2	
Bean Goose	*Anser fabalis*	Sweden, Finland	Western Baltic Sea, Smålandsfarvandet, FB	Winter	Migratory	4.2	
Greater White-fronted Goose	*Anser albifrons*	Western Russia (*flavirostris*); Siberia (*albifrons*)	British Isles (*flavirostris*); the Netherlands, Belgium, northern Germany, southern Denmark, FB (*albifrons*)	Winter	Migratory	4.2	
Canada Goose	*Branta canadensis*	Scandinavia	South-western Baltic region, southern Denmark and Sweden, northern Germany	All year	Migratory	4.2	
Barnacle Goose	*Branta leucopsis*	Siberia	Wadden Sea	Migration	Migratory	4.2	
Brent Goose	*Branta bernicla*	Siberia and Russian arctic islands (*bernicla*); Svalbard, Greenland (*hrota*)	Western and north-western Europe, Denmark (*bernicla*). Denmark, FB (*hrota*)	Winter	Migratory	4.2	

Common name	Scientific name	Breeding ranges of populations occurring in Fehmarnbelt	Non-breeding range of populations occurring in Fehmarnbelt	Season of occurrence	Migratory strategy	Section	Appendix
Greylag Goose	*Anser anser*	Scandinavia, Germany, FB	FB, Spain, France, Tunisia	All year	Partially migratory	4.1	x
Common Shelduck	*Tadorna tadorna*	Denmark, FB, northern Germany, the Netherlands	FB, Wadden Sea, Great Britain, France	All year	Partially migratory	4.1	x
Eurasian Wigeon	*Anas penelope*	Northern and north-eastern Europe east to Siberia	Western, south-western Europe	Winter and migration	Migratory	4.1	x
Gadwall	*Anas strepera*	FB (Maribo Lakes), Denmark, northern Europe	FB, Denmark, western Europe, Mediterranean, Middle East, Nile Delta	All year	Migratory	4.2	
Eurasian Teal	*Anas crecca*	Sweden, Finland, Baltic countries, FB, north-western Russia	Western Europe, from Great Britain to Spain.	Summer and migration	Migratory	4.1	x
Mallard	*Anas platyrhynchos*	FB, Sweden, Finland, the Baltic countries, Russia, Poland	FB, northern Germany, the Netherlands, Great Britain, France	All year	Partially migratory	4.1	x
Northern Pintail	*Anas acuta*	Finland, north-western and western Russia to Ural Mountains	Benelux countries, Great Britain, Spain, the Sahel-zone	Migration	Migratory	4.1	x

Common name	Scientific name	Breeding ranges of populations occurring in Fehmarnbelt	Non-breeding range of populations occurring in Fehmarnbelt	Season of occurrence	Migratory strategy	Section	Appendix
Garganey	*Anas querquedula*	Denmark, FB, Sweden, Baltic region	West Africa	Summer	Migratory	4.1	x
Northern Shoveler	*Anas clypeata*	Nordic countries, Russia, Benelux countries	Great Britain, France, Spain	Migration	Migratory	4.1	x
Common Pochard	*Aythya ferina*	Baltic countries, eastern Europe, eastern and central Russia	Great Britain, France, Iberian Peninsula	Winter and migration	Migratory	4.1	x
Tufted Duck	*Aythya fuligula*	Sweden, Finland, Russia east of the Ural Mountains	FB, western and north-western Europe south to Iberian Peninsula	All year	Partially migratory	4.1	x
Greater Scaup	*Aythya marila*	Russia extending east of the Ural Mountains	FB, southern Baltic Sea	Winter	Migratory	4.1	x
Common Eider	*Somateria mollissima*	South-western Finland, around Ålandøerne, Baltic Sea, Wadden Sea	FB, southern Baltic Sea	All year	Migratory	4.1	x
Long-tailed Duck	*Clangula hyemalis*	Iceland to Siberian tundra, 60 to 79° N	Baltic Sea, Iceland	Winter	Migratory	4.2	

Common name	Scientific name	Breeding ranges of populations occurring in Fehmarnbelt	Non-breeding range of populations occurring in Fehmarnbelt	Season of occurrence	Migratory strategy	Section	Appendix
Common Scoter	*Melanitta nigra*	North-eastern Russia, 58°N (Norway) to 72°N	Wadden Sea, North Sea, Kattegat, southern Baltic Sea, FB	Winter	Migratory	4.2	
Velvet Scoter	*Melanitta fusca*	Swedish, Finnish, Baltic coasts	Wadden Sea, North Sea, Kattegat, southern Baltic Sea, FB	Winter	Migratory	4.2	
Common Goldeneye	*Bucephala clangula*	Norway, Sweden, Finland	Coasts of Norway, southern Sweden, Baltic Sea, FB	Winter	Migratory	4.2	
Smew	*Mergellus albellus*	Northern Sweden, Finland east to Kamchatka	Southern North Sea, southern Baltic Sea, FB	Winter	Migratory	4.2	
Red-breasted Merganser	*Mergus serrator*	FB, Baltic Sea, Gulf of Finland, Norway	Southern Baltic Sea	All year	Partially migratory	4.1	x
Common Merganser	*Mergus merganser*	Fennoscandia, south-eastern Denmark, north-western Europe	FB, western Baltic	Winter	Migratory	4.2	
Moorhen	*Gallinula chloropus*	FB, Southern Scandinavia	Benelux countries, France, Germany, northern Italy, Spain	All year	Partially migratory	4.1	x

Common name	Scientific name	Breeding ranges of populations occurring in Fehmarnbelt	Non-breeding range of populations occurring in Fehmarnbelt	Season of occurrence	Migratory strategy	Section	Appendix
Common Coot	*Fulica atra*	FB, Denmark, Sweden, Finland, Baltic countries, Poland	FB, Benelux countries, France, Germany	All year	Partially migratory	4.1	x
Crane	*Grus grus*	Scandinavia	Southern Europe, northern and north-eastern Africa	Migration	Migratory	4.2	
Eurasian Oystercatcher	*Haematopus ostralegus*	Southern Baltic Sea, FB	North-western European coasts	Summer and migration	Migratory	4.1	x
Pied Avocet	*Recurvirostra avosetta*	Southern Baltic Sea, FB	Germany, Netherlands, France, Spain	Summer and migration	Migratory	4.1	x
Ringed Plover	*Charadrius hiaticula*	Scandinavia, Finland, FB	FB, Great Britain, France, Spain, Morocco	All year	Migratory	4.1	x
Northern Lapwing	*Vanellus vanellus*	FB, Sweden and Finland	FB, Great Britain, France, the Iberian Peninsula	All year	Migratory	4.1	x
Dunlin	*Calidris alpina*	Baltic Sea, Norway, Finland, Russia	Great Britain and France	Migration	Migratory	4.1	x
Common Sandpiper	*Actitis hypoleucos*	Sweden and Finland	West Africa	Migration	Migratory	4.1	x

Common name	Scientific name	Breeding ranges of populations occurring in Fehmarnbelt	Non-breeding range of populations occurring in Fehmarnbelt	Season of occurrence	Migratory strategy	Section	Appendix
Black-headed Gull	*Larus ridibundus*	Denmark, FB, Sweden, Finland, the Baltic countries and Poland	FB, North Sea, English Channel	All year	Partially migratory	4.1	x
Common Gull	*Larus canus*	Denmark, FB, Southern Sweden, Finland, the Baltic countries	English Channel, FB	All year	Partially migratory	4.1	x
Lesser Black-backed Gull	*Larus fuscus*	Baltic Sea	Northern Atlantic, sub-Saharan Africa	Summer and migration	Migratory	4.1	x
Herring Gull	*Larus argentatus*	The Netherlands, Scandinavia, Finland, western Russia, FB	FB, The Netherlands, northern Germany, Poland	All year	Partially migratory	4.1	x
Greater Black-backed Gull	*Larus marinus*	Scandinavia, Finland, western Russia	FB and English Channel	Winter	Partially migratory	4.1	x
Little Gull	*Larus minutus*	Northern Russia and Finland	Off shore in North Sea and English Channel	Migration	Migratory	4.2	
Sandwich Tern	*Sterna sandvicensis*	FB, inner Danish and southern Baltic waters	West Africa	Summer and Migration	Migratory	4.1	x

Common name	Scientific name	Breeding ranges of populations occurring in Fehmarnbelt	Non-breeding range of populations occurring in Fehmarnbelt	Season of occurrence	Migratory strategy	Section	Appendix
Common Tern	*Sterna hirundo*	Southern Baltic Sea, Baltic countries, western Russia	Southwest and west Africa	Summer and Migration	Migratory	4.1	x
Arctic Tern	*Sterna paradisaea*	North-western Europe	Southern Atlantic	Summer and Migration	Migratory	4.1	x
Little Tern	*Sterna albifrons*	FB, Denmark, northern Germany, the Netherlands	West Africa	Summer and Migration	Migratory	4.1	x
Common Murre	*Uria aalge*	Baltic Sea	FB, Gulfs of Bothnia and Finland.	Winter	Partially migratory	4.2	
Razorbill	*Alca torda*	Baltic Sea	FB, Southern and south-western Baltic Sea	Winter	Partially migratory	4.2	
Black Guillemot	*Cepphus grille*	Kattegat, Baltic Sea	Baltic Sea	Winter	Partially migratory	4.2	
Little Auk	*Alle alle*	High arctic, Greenland, Svalbard	Skagerak, Scotland	Winter	Partially migratory	4.2	
Atlantic Puffin	*Fratercula arctica*	North Atlantic Ocean	North Sea, Skagerak	Winter	Partially migratory	4.2	

1.5 Conclusions

This ring recovery analysis show that FB is a stop-over site as well as moulting and wintering area for many different populations of a large number of waterbird species breeding mainly in the Nordic countries, the Baltic countries and Russia. Additionally, birds originating from central Europe for example Germany, Poland and the Netherlands are also utilising FB during the non-breeding season.

Birds breeding in the FB are either residents (e.g. Mute Swan) or move towards south-east for wintering grounds in western Europe (e.g. Northern Shoveler, Eurasian Oystercatcher), with few long-distance migrants moving to southern Europe (e.g. Greylag Goose, Common Coot), northern Africa (e.g. Ringed Plover, Moorhen, Northern Lapwing) or even sub-Saharan Africa (e.g. Garganey, Lesser Black-backed Gull, Common Tern).

A group of species perform long-distance movements from far northern, north-eastern and eastern breeding areas using FB as stop-over site or wintering area. These are mostly geese and ducks but also a large group of waders. A large proportion of these populations continue towards west and southwest to spend the winter in Great Britain, The Netherlands, France and the Iberian Peninsula. Breeding birds from closer areas like the Scandinavian Peninsula wintering in FB are represented by for example Great Cormorant, Grey Heron, Mute Swan and Greylag Goose.

The group of gulls and terns (*Larus* and *Sterna*) shows diverse patterns in accordance with their species-specific migration strategies. Some are mostly residents or only moving shorter distances (Herring Gull) while others are long-distance migrants (Lesser Black-backed Gull, the species of terns (*Sterna*)). During winter FB hosts Scandinavian and Russian populations of the gulls (*Larus*) for example Herring Gull and Greater Black-backed Gull.

Coots from the Baltic region winter in FB while local breeders move further south to winter in western European countries. Local breeding Moorhens migrate south or stay in small numbers. FB is an important stop-over site for local breeding waders as well as other species of waders on migration from Arctic and sub-Arctic breeding areas.

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APPENDIX

Species-specific maps representing ringed bird recoveries

Explanation of displayed maps

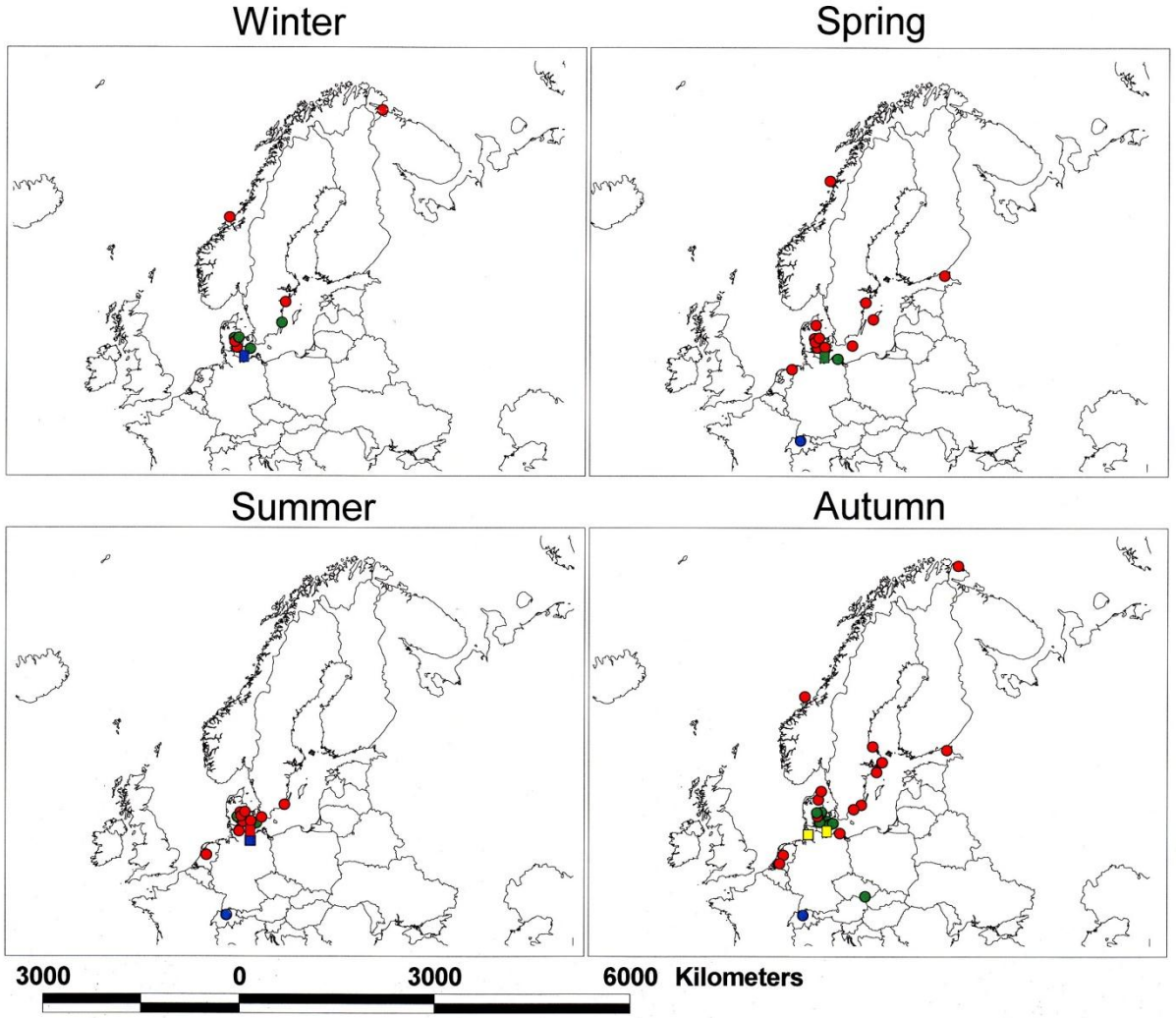
The species maps contain four separate frames each showing records made within Fehmarnbelt in a given season.

The type of record outside the area is indicated by a circle (ringing) or square (recovery), while the season of the record outside the area is indicated by the symbol colour (blue = winter, green = spring, red = summer and yellow = autumn).

The total number of records that the species maps are based on is given as the N-value. In the Result section, we are describing the ring-recovery patterns of each species in detail.

As supplement to the ringing data, we have included data from FEBI telemetry studies on Common Scoter *Melanitta nigra*, Common Eider *Somateria mollissima*, Long-tailed Duck *Clangula hyemalis* and Tufted Duck *Aythya fuligula*.

Great Cormorant (Phalacrocorax carbo)

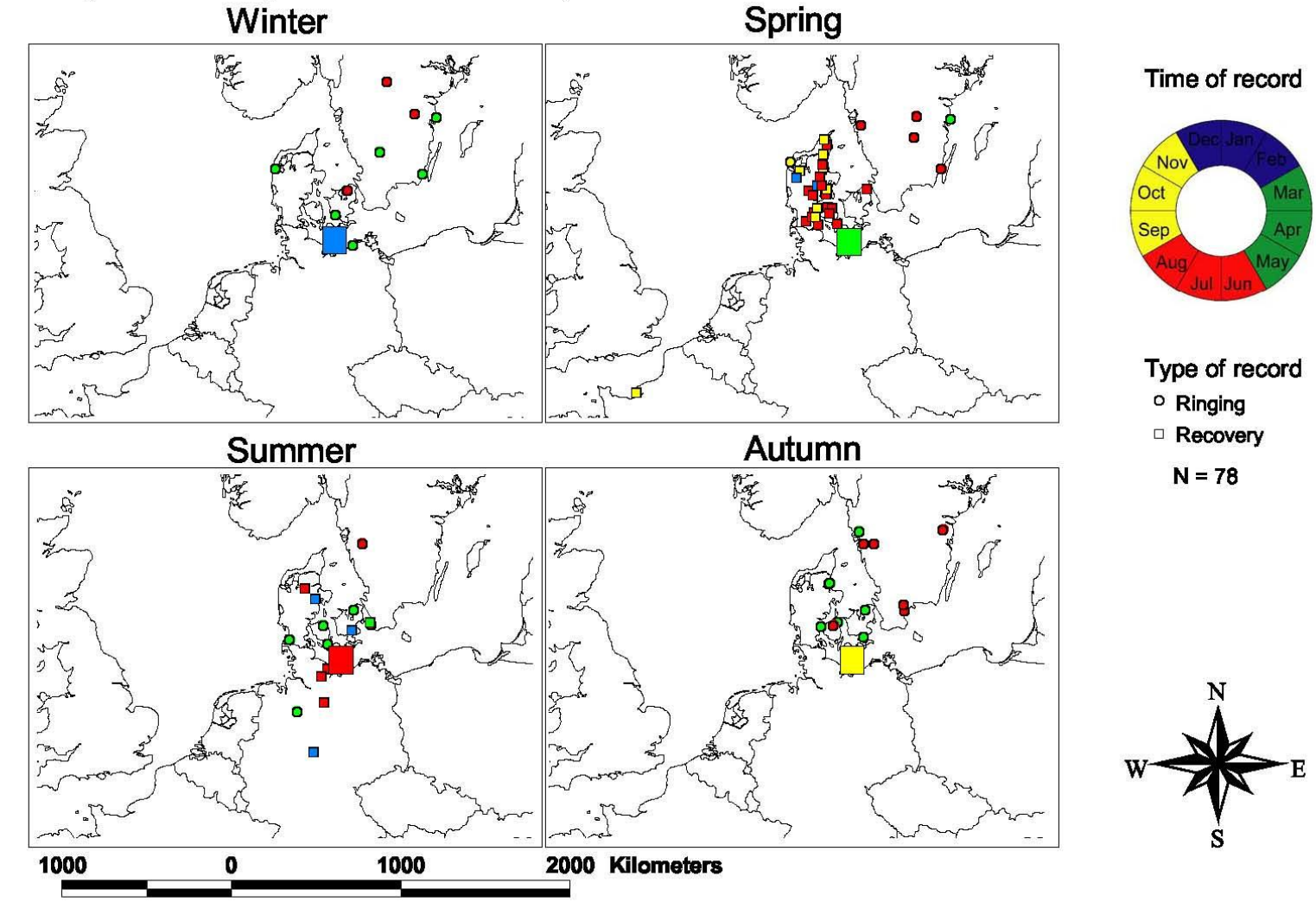


Type of record

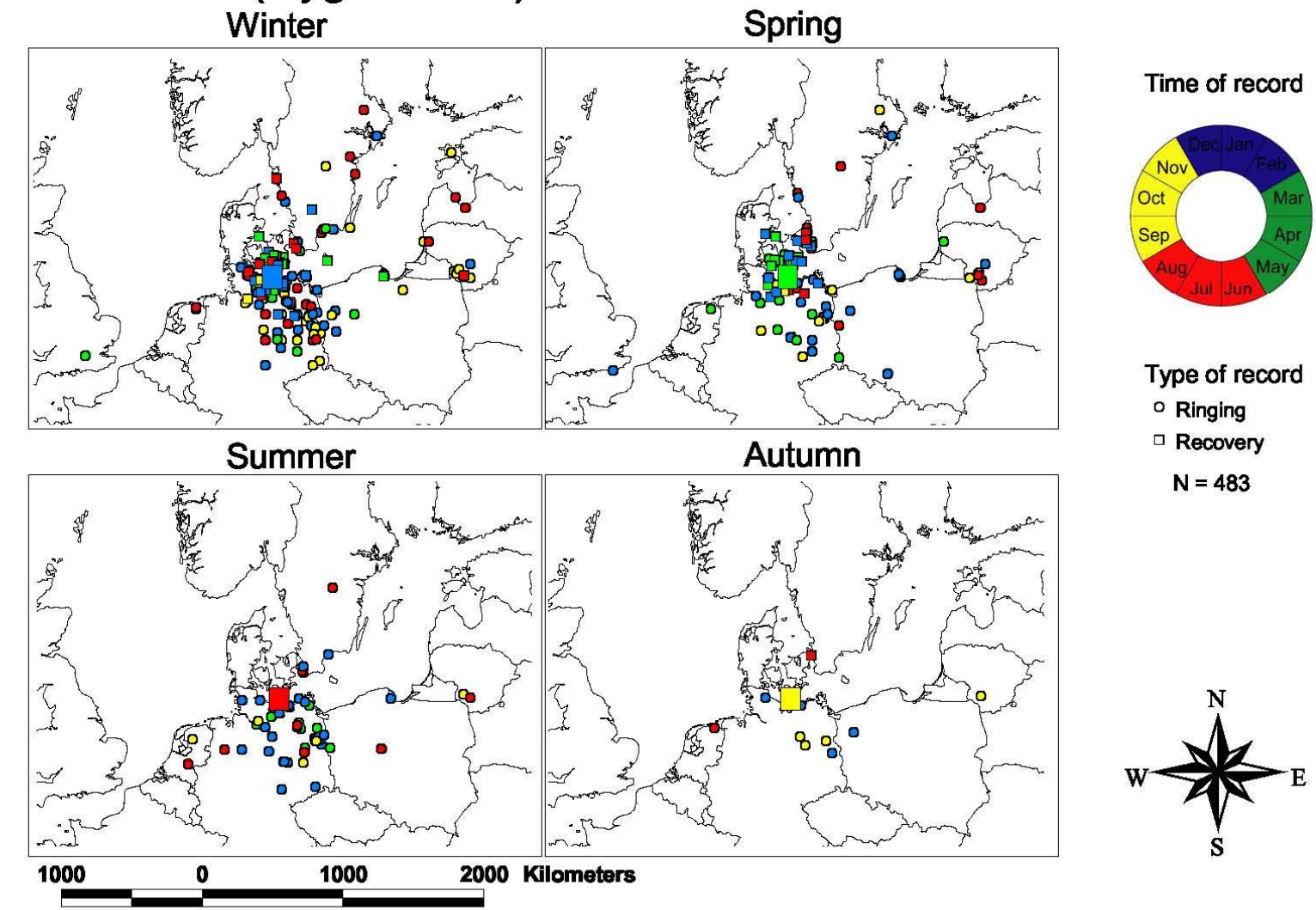
- ○ Ringing
- □ Recovery

N = 146

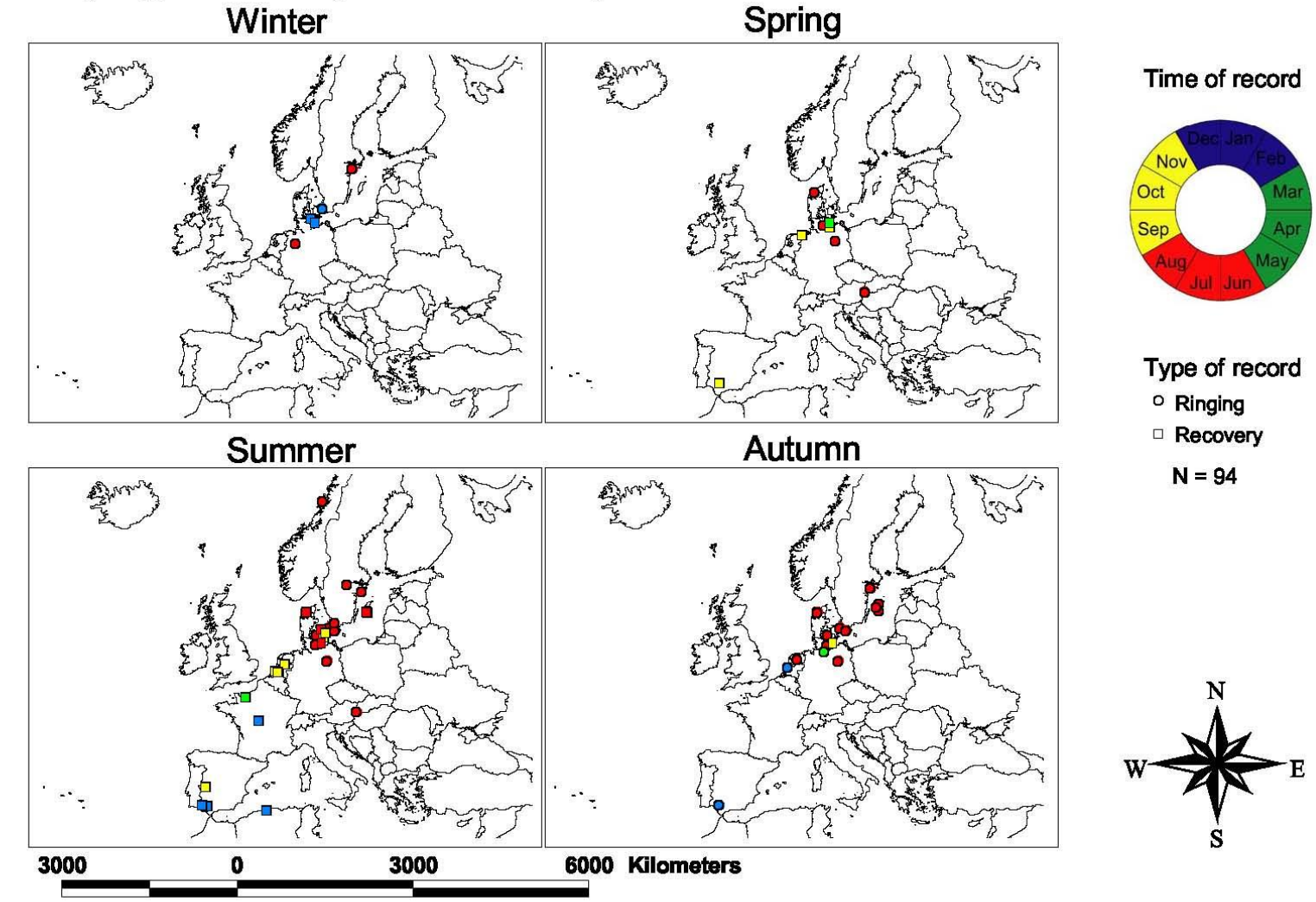
Grey Heron (Ardea cinerea)



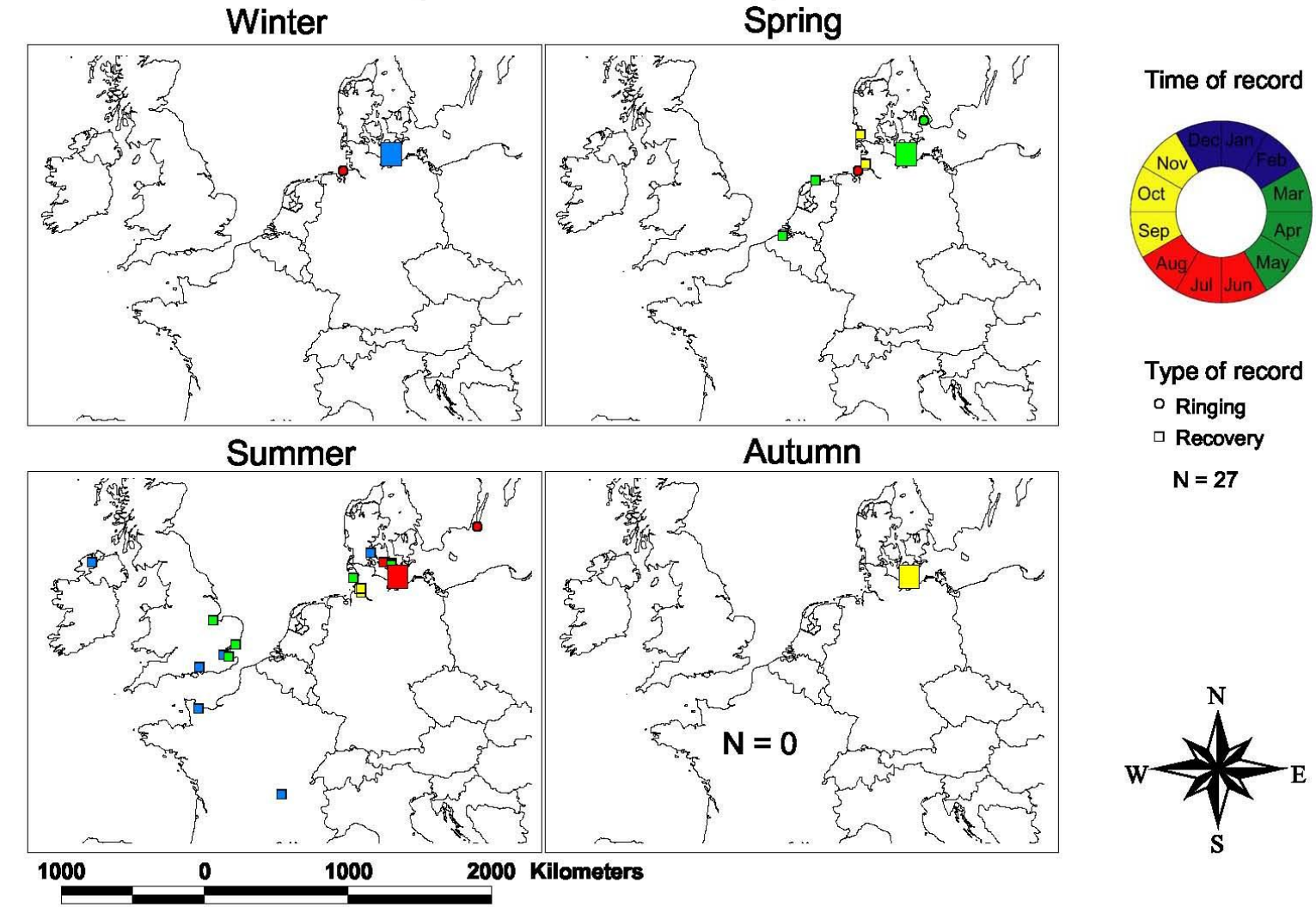
Mute Swan (Cygnus olor)



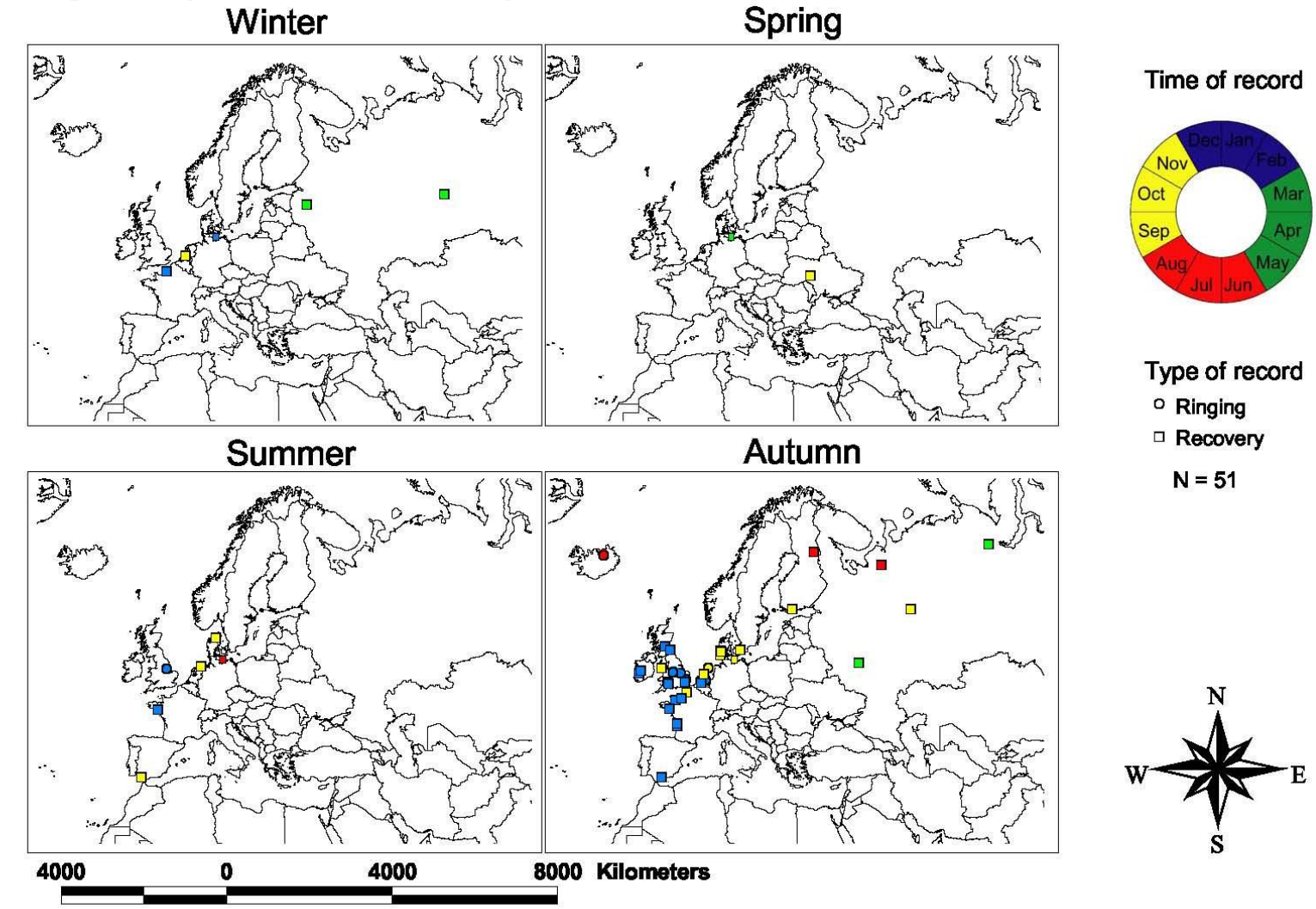
Greylag Goose (Anser anser)



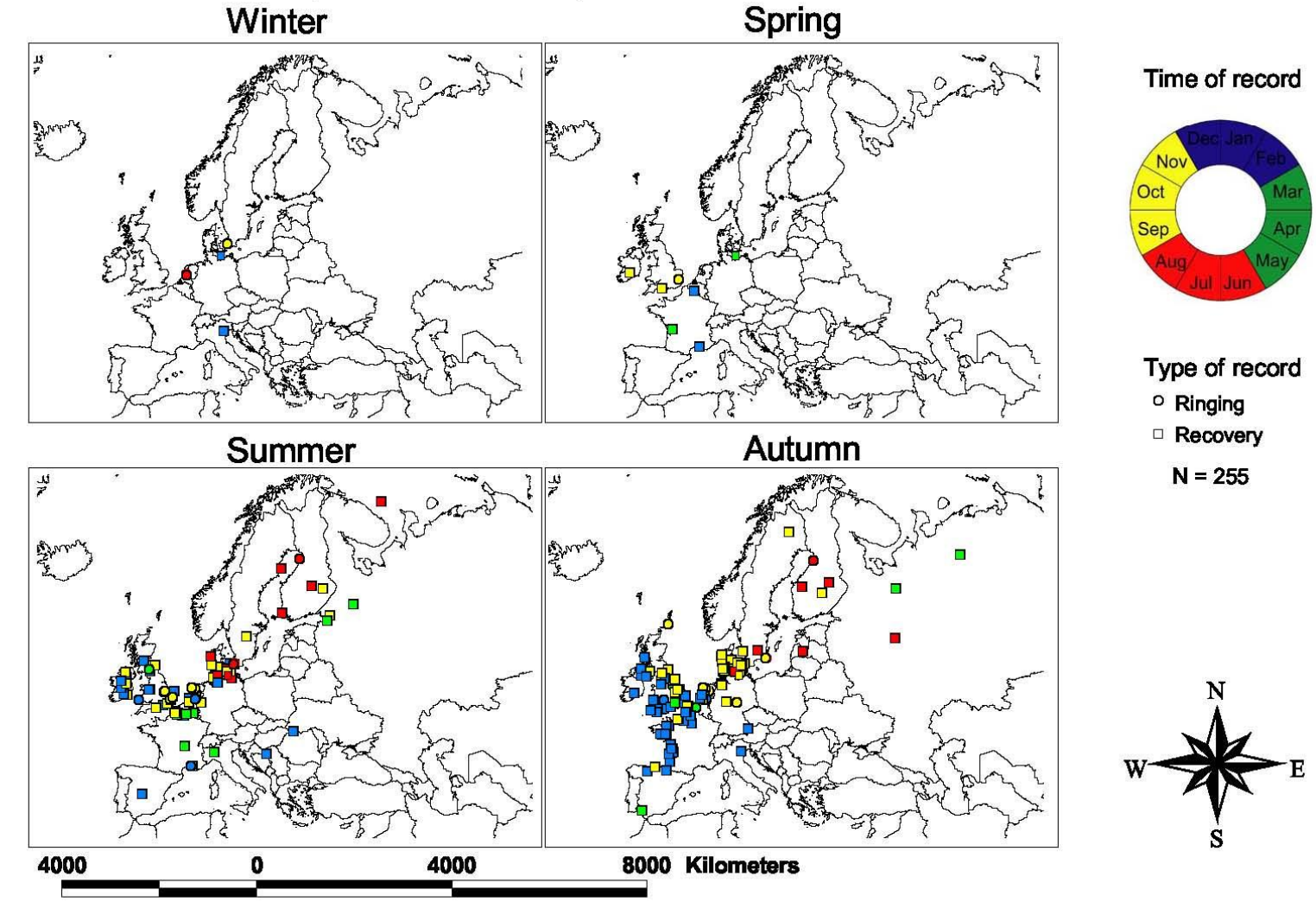
Common Shelduck (Tadorna tadorna)



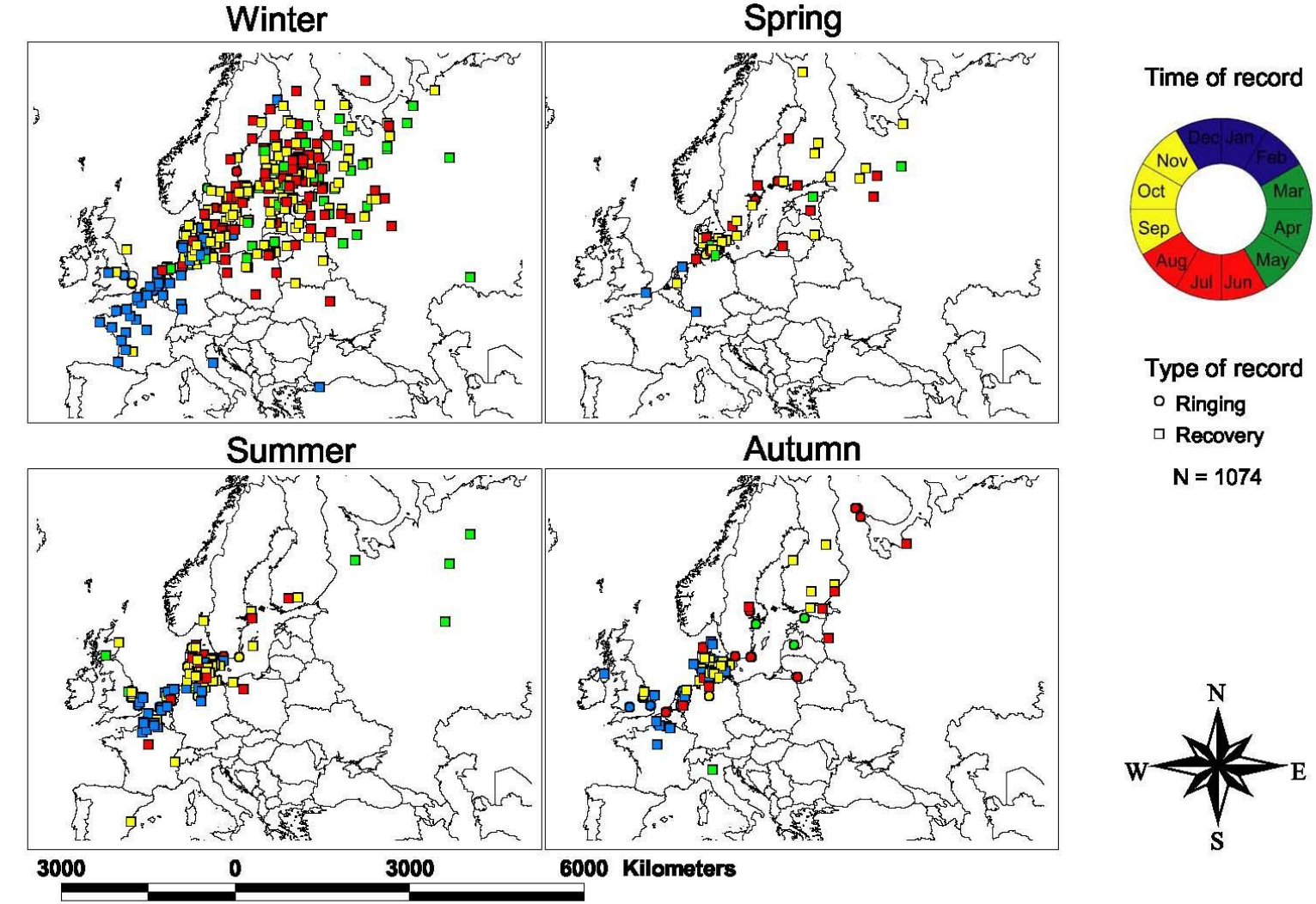
Wigeon (Anas penelope)



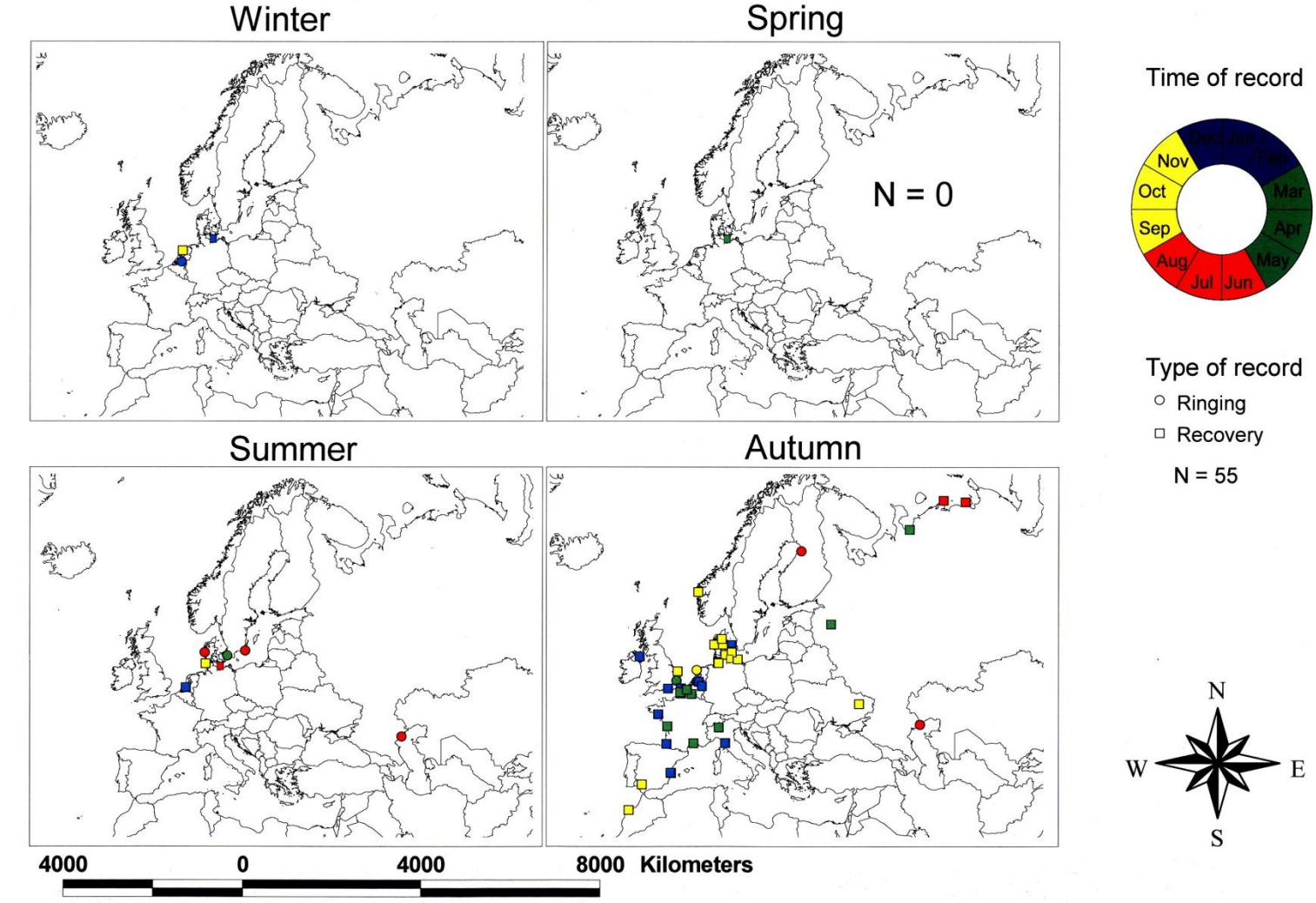
Eurasian Teal (Anas crecca)



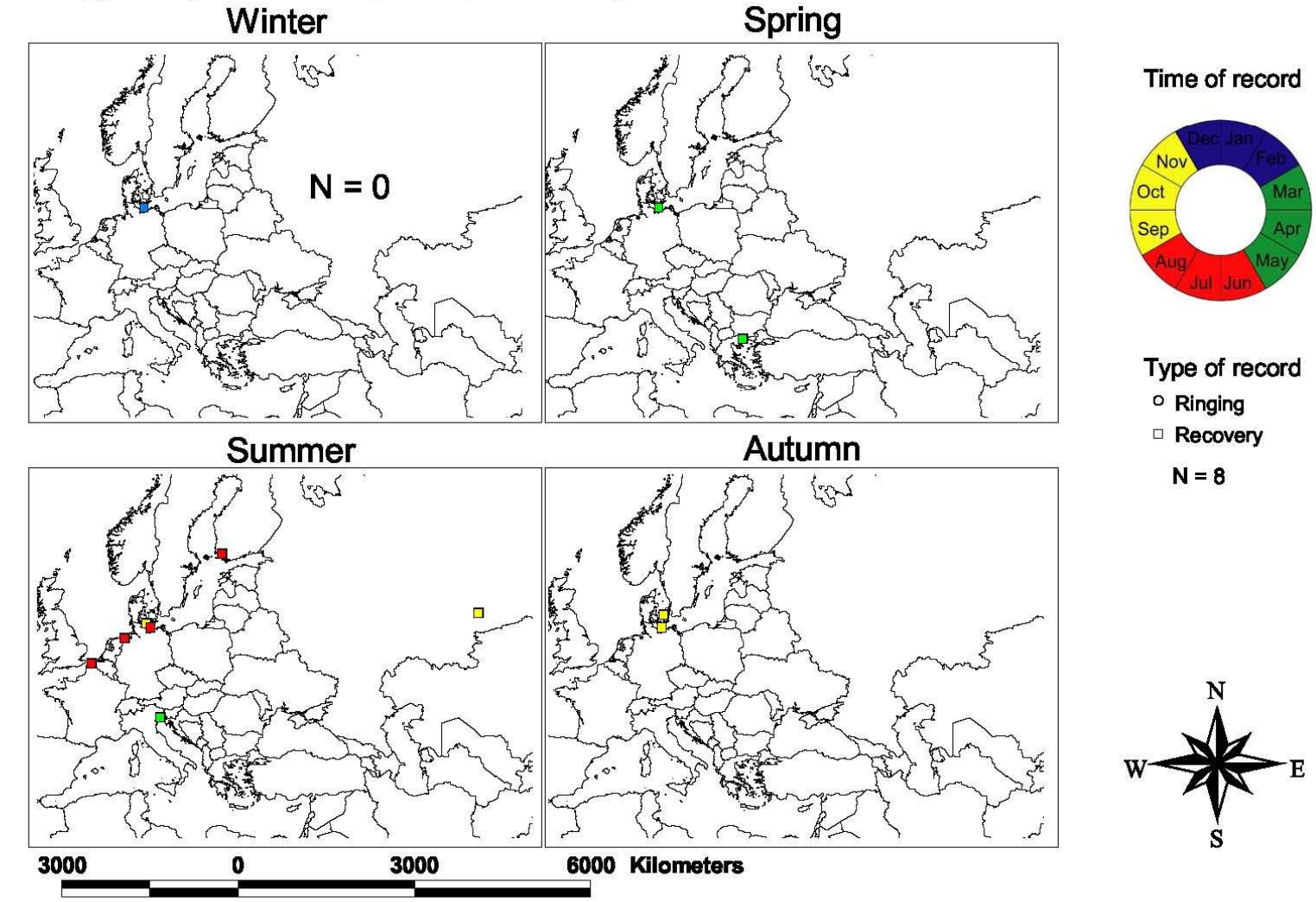
Mallard (Anas platyrhynchos)



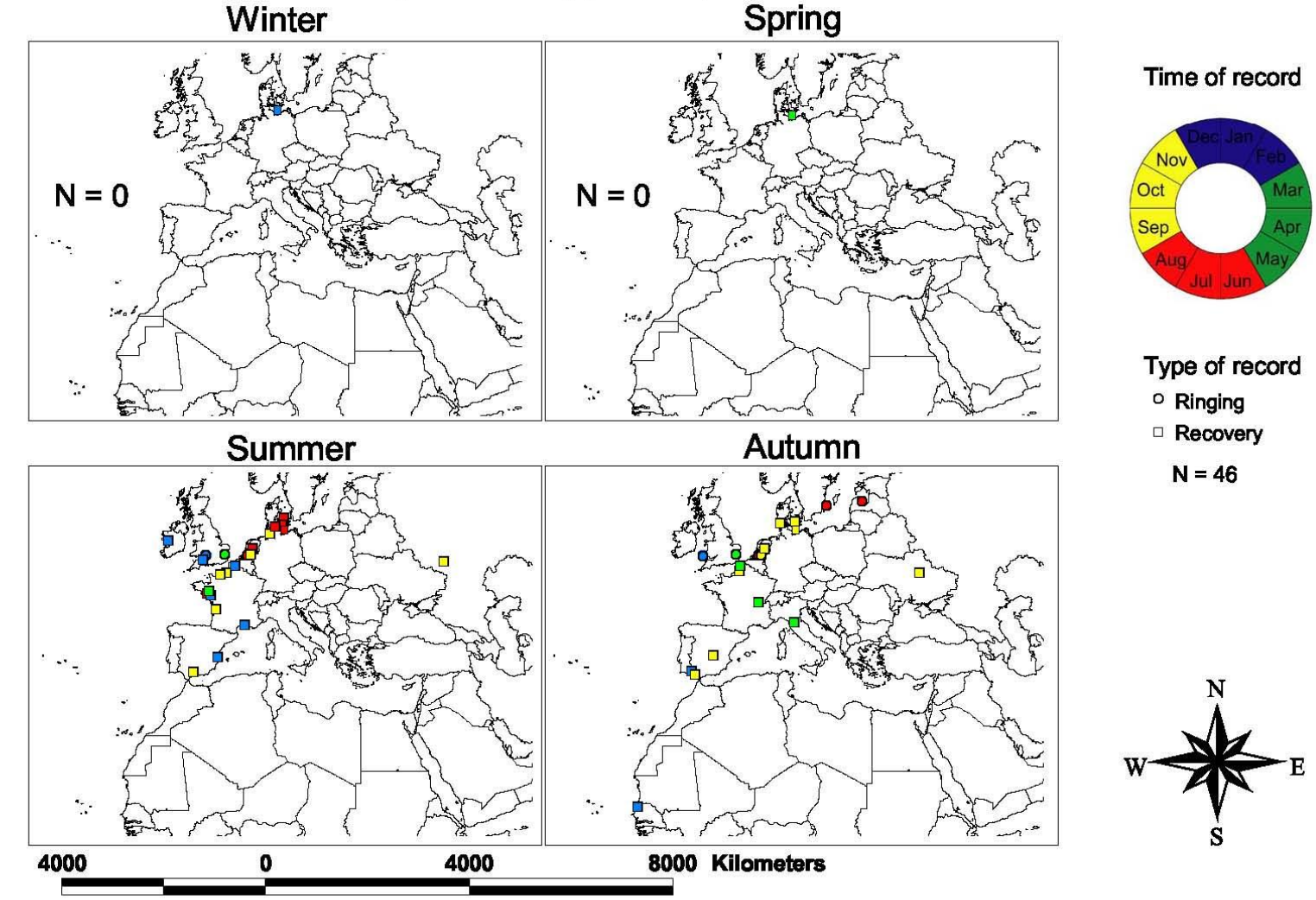
Northern Pintail (Anas acuta)



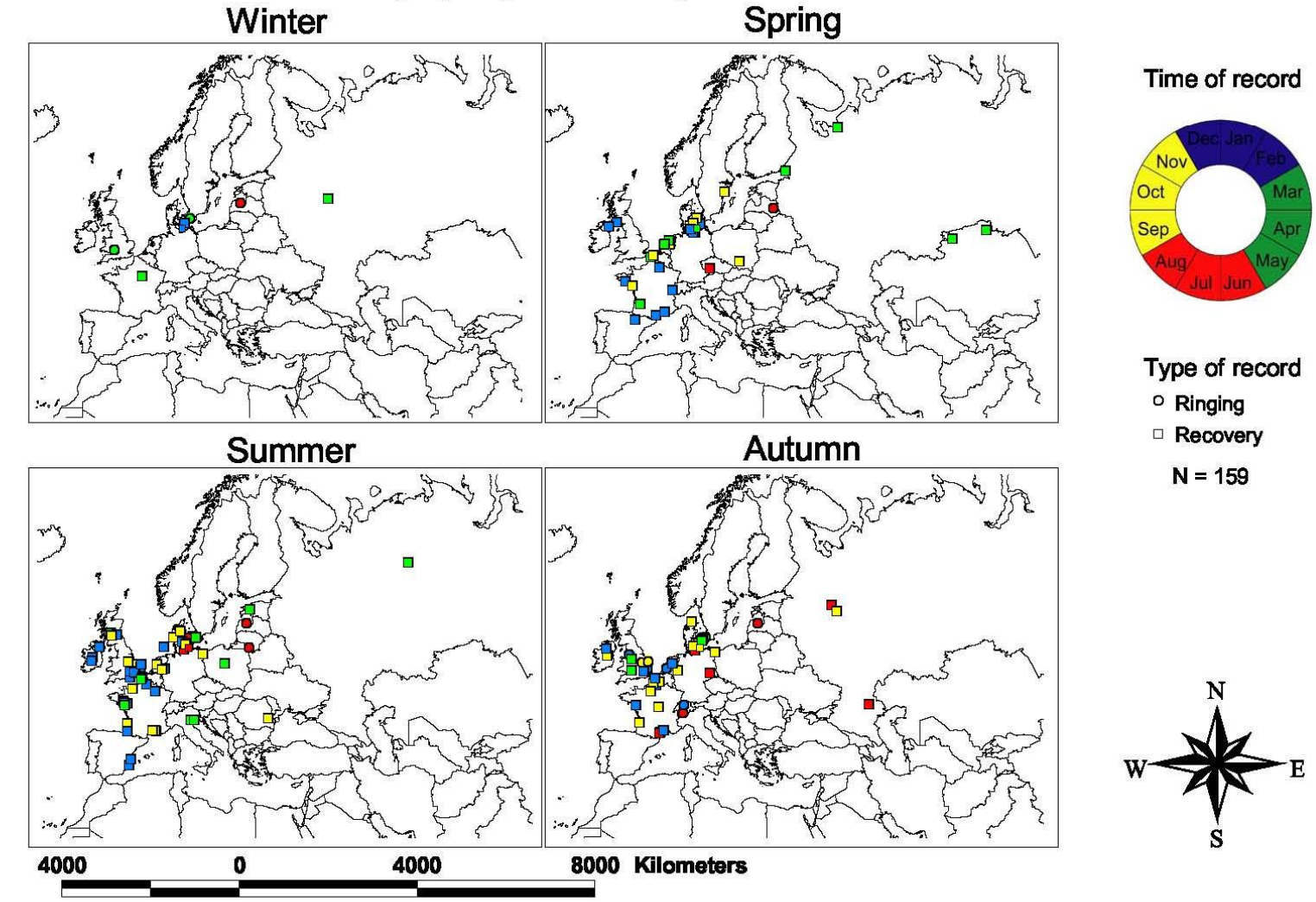
Garganey (Anas querquedula)



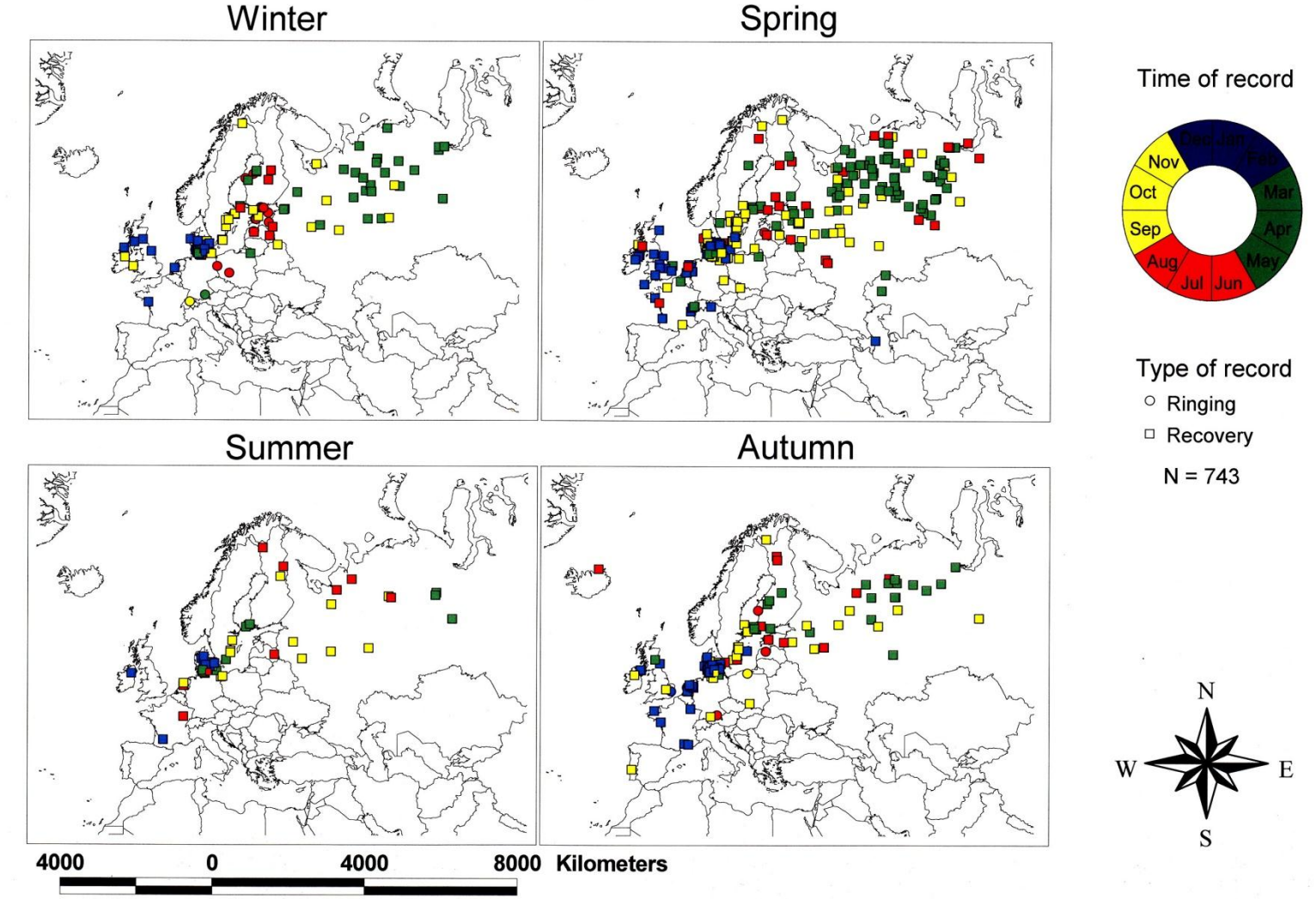
Northern Shoveler (Anas clypeata)



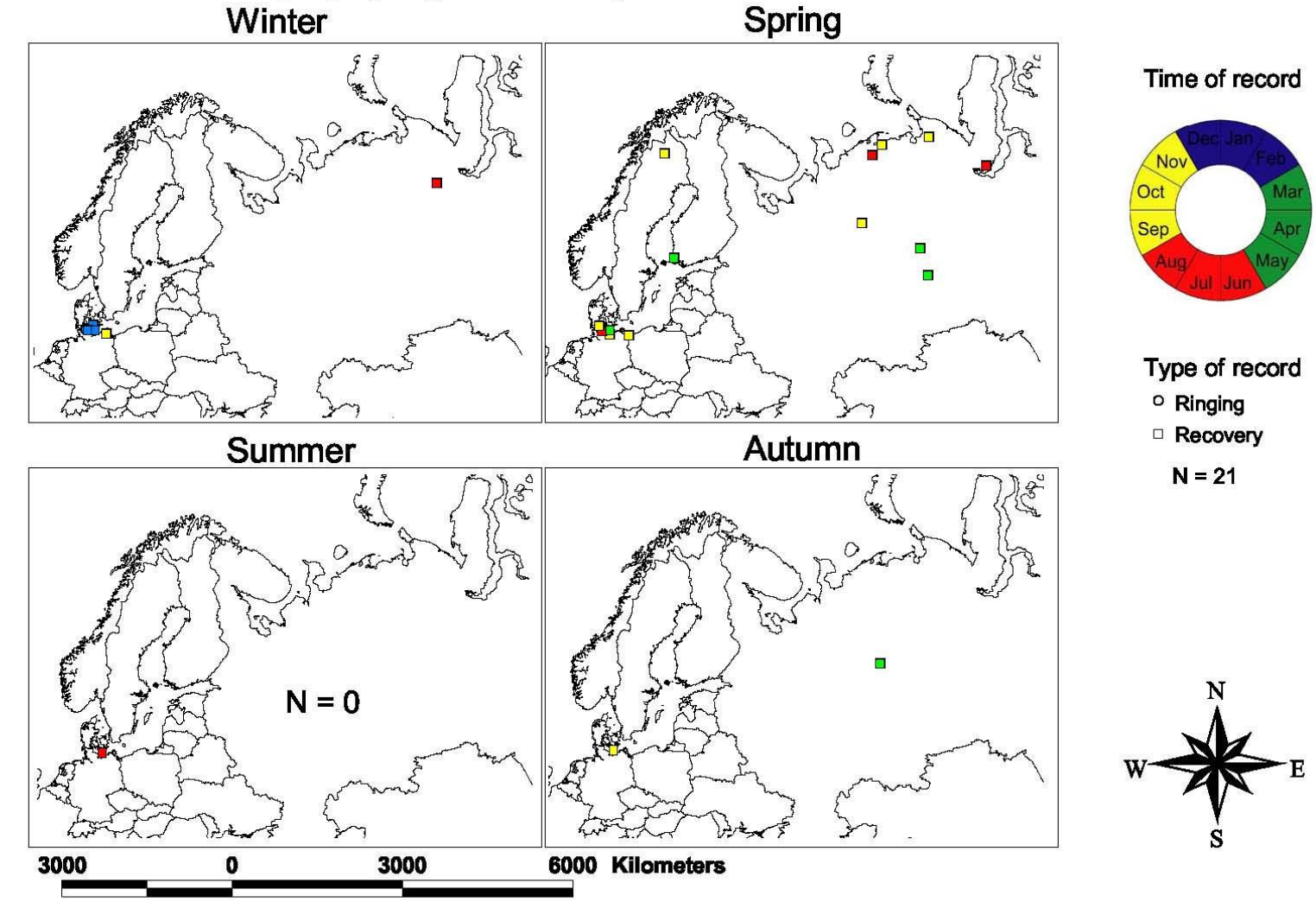
Common Pochard (Aythya ferina)



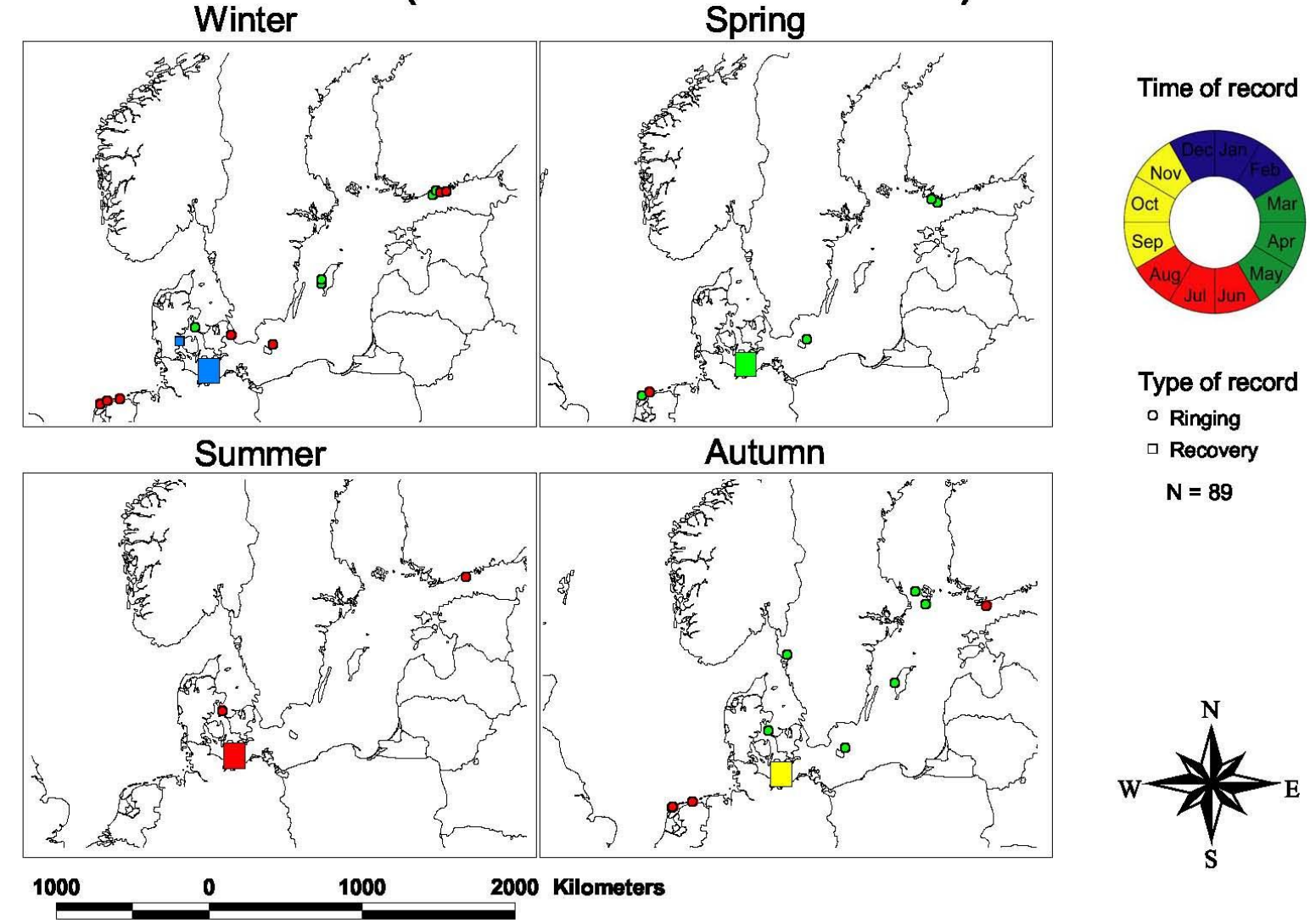
Tufted Duck (Aythya fuligula)



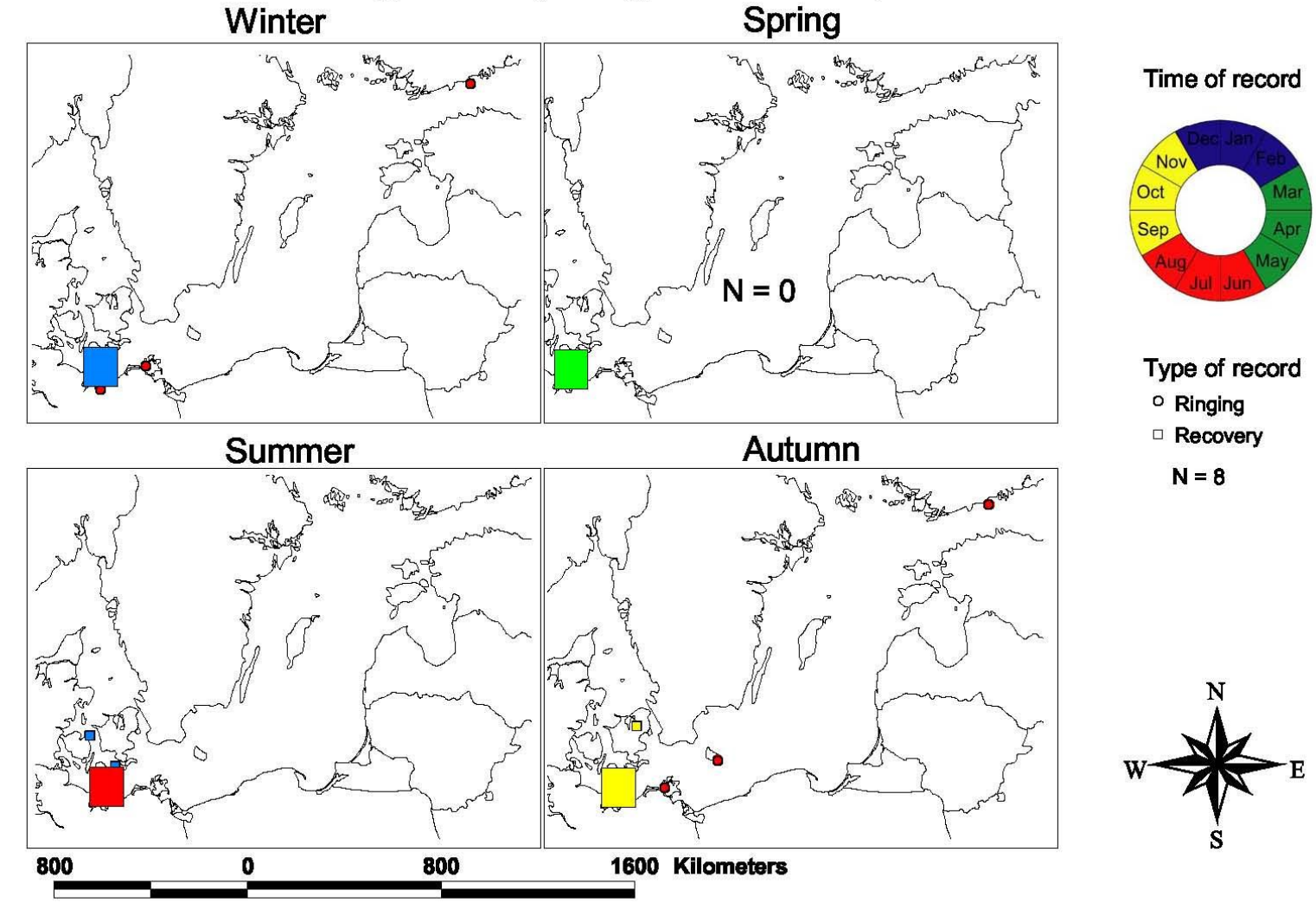
Greater Scaup (Aythya marila)



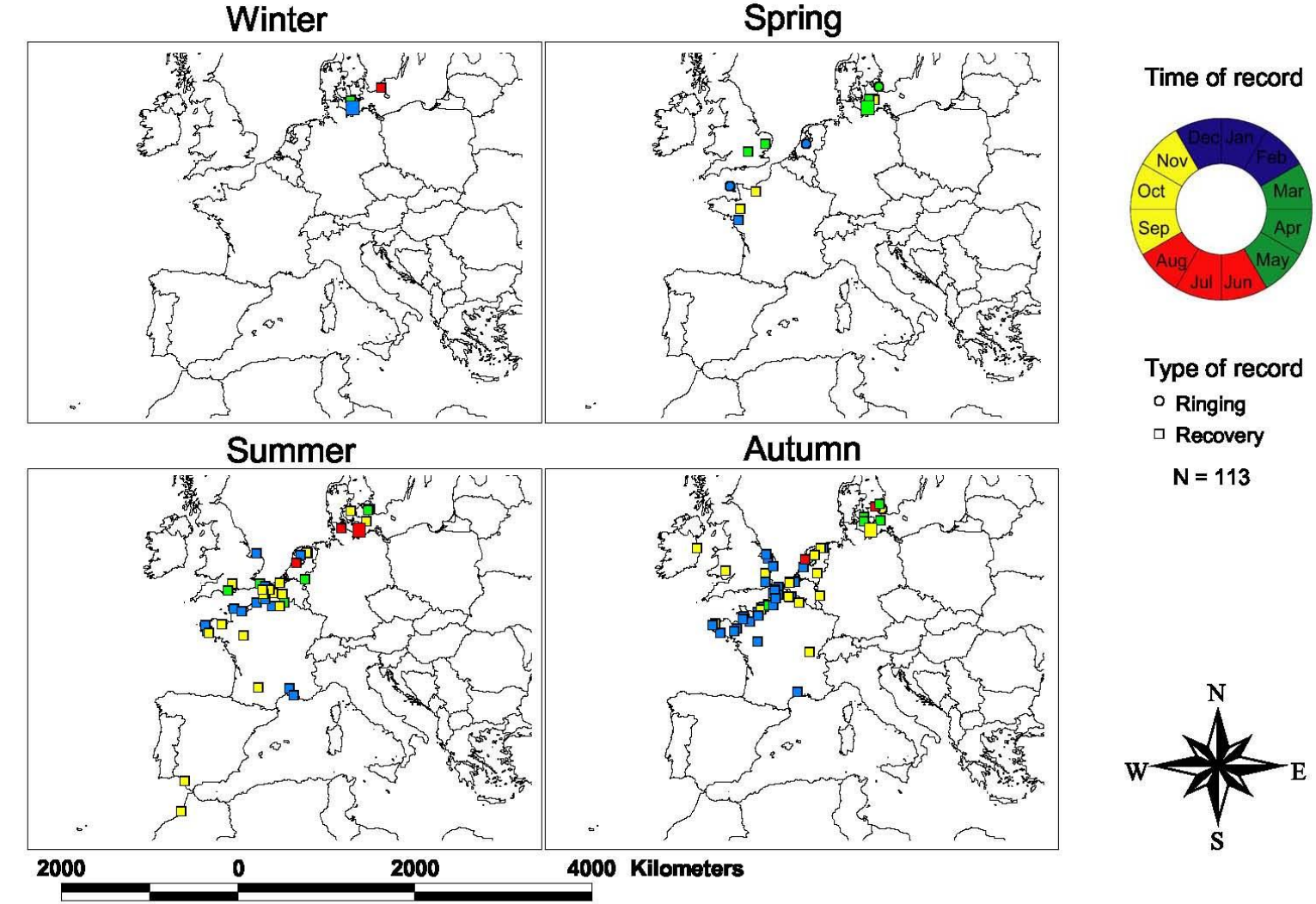
Common Eider (Somateria mollissima)



Red-breasted Merganser (Mergus serrator)



Moorhen (Gallinula chloropus)



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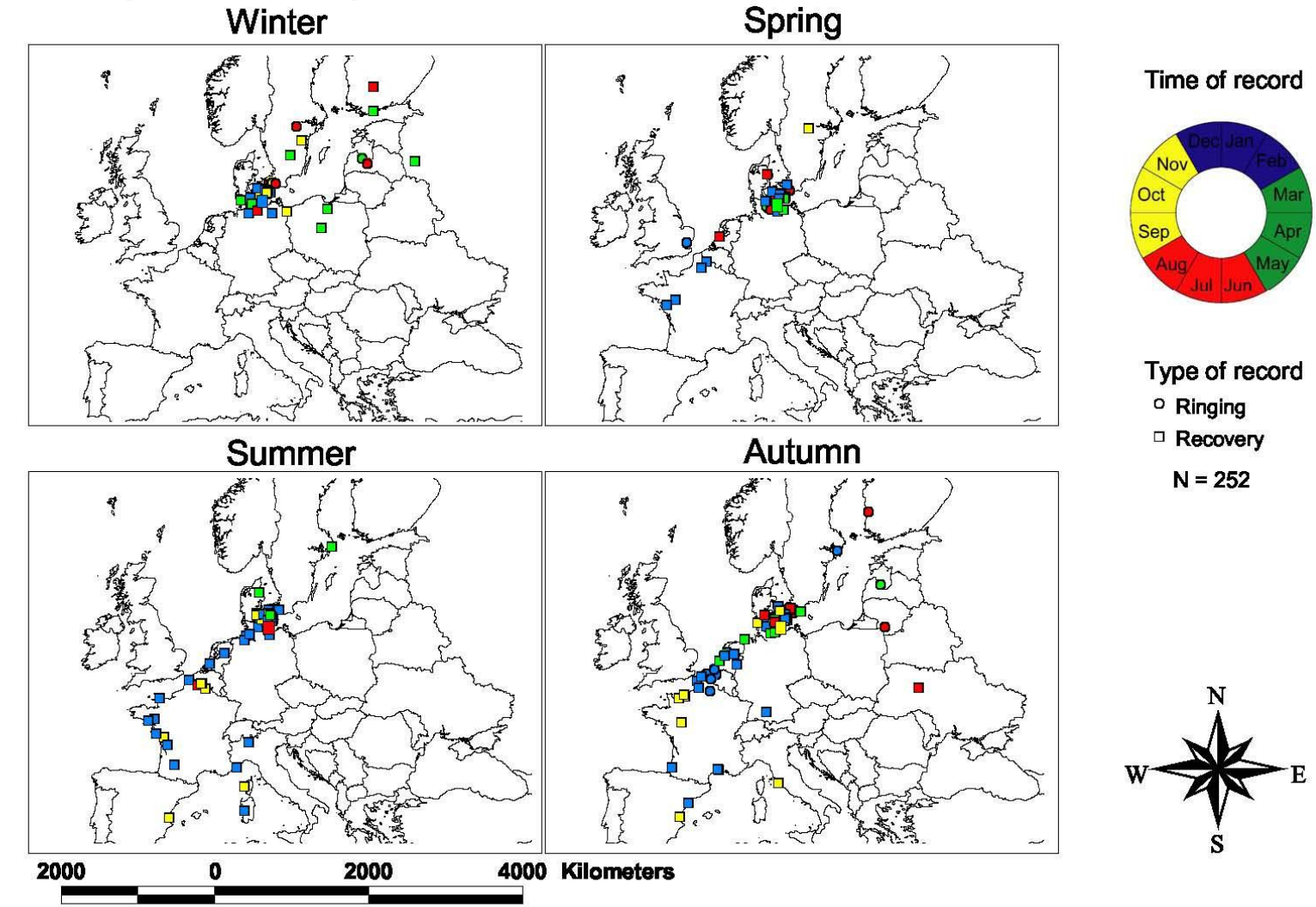
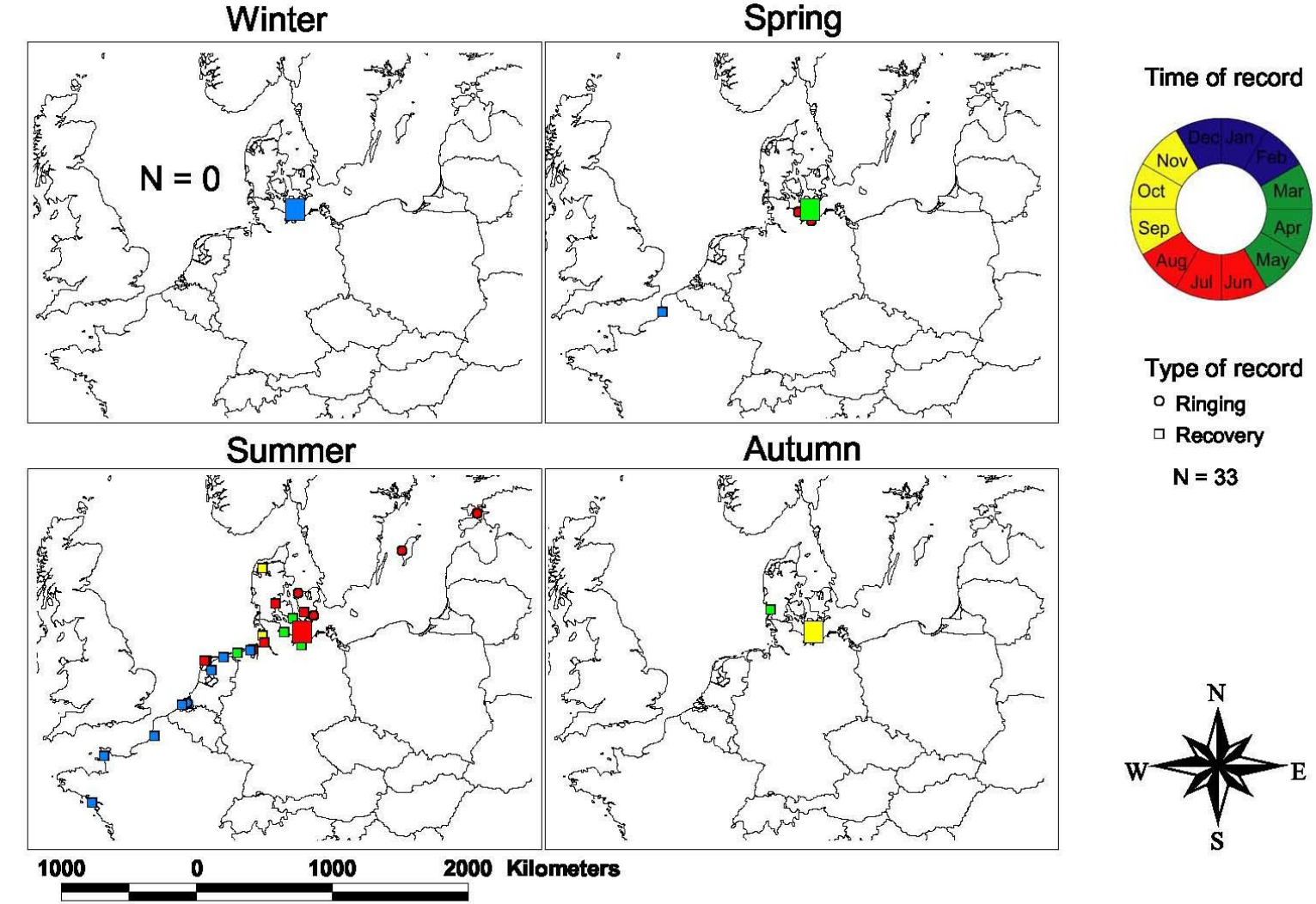


Eurasian Oystercatcher (Haematopus ostralegus)



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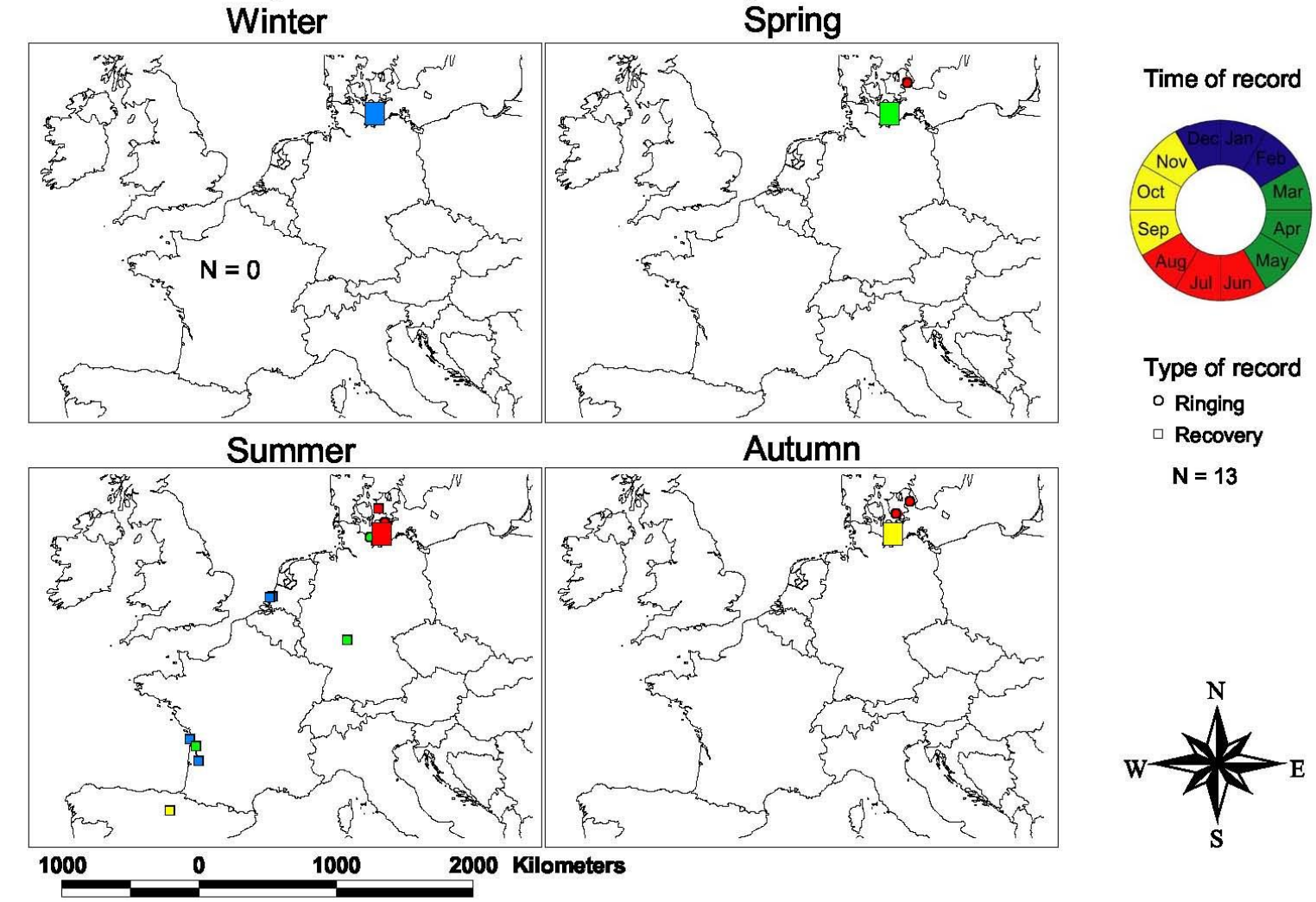

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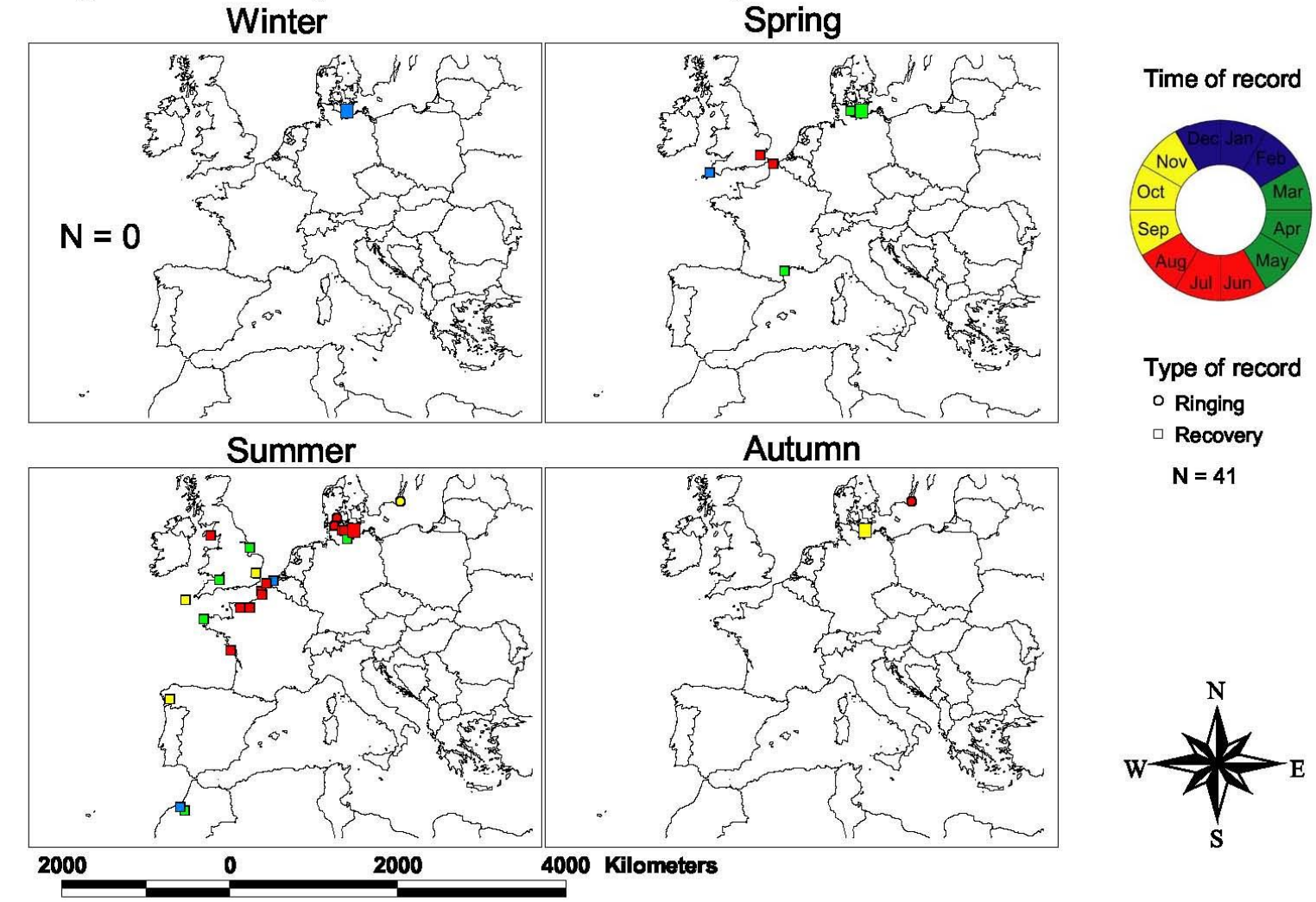

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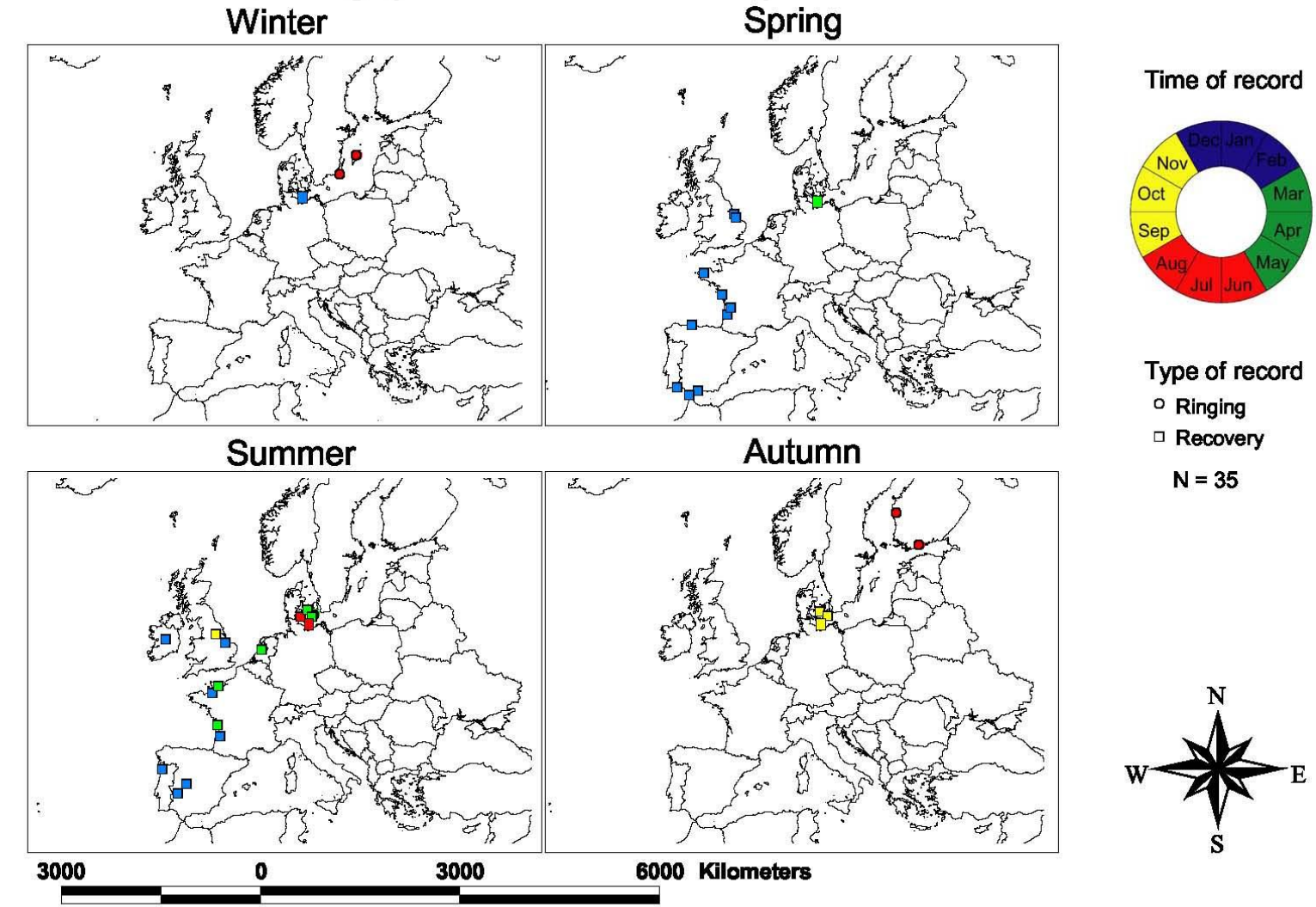

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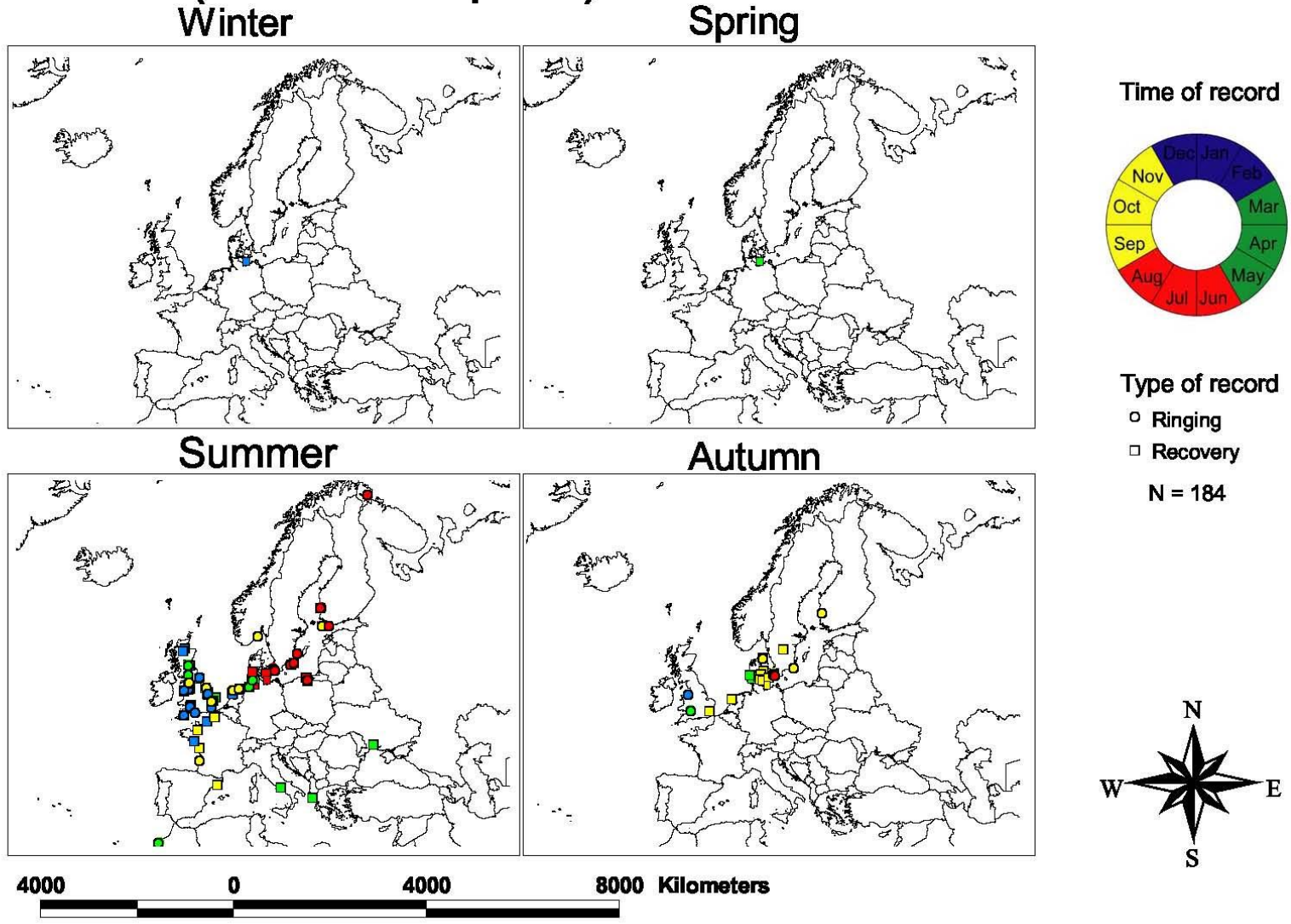

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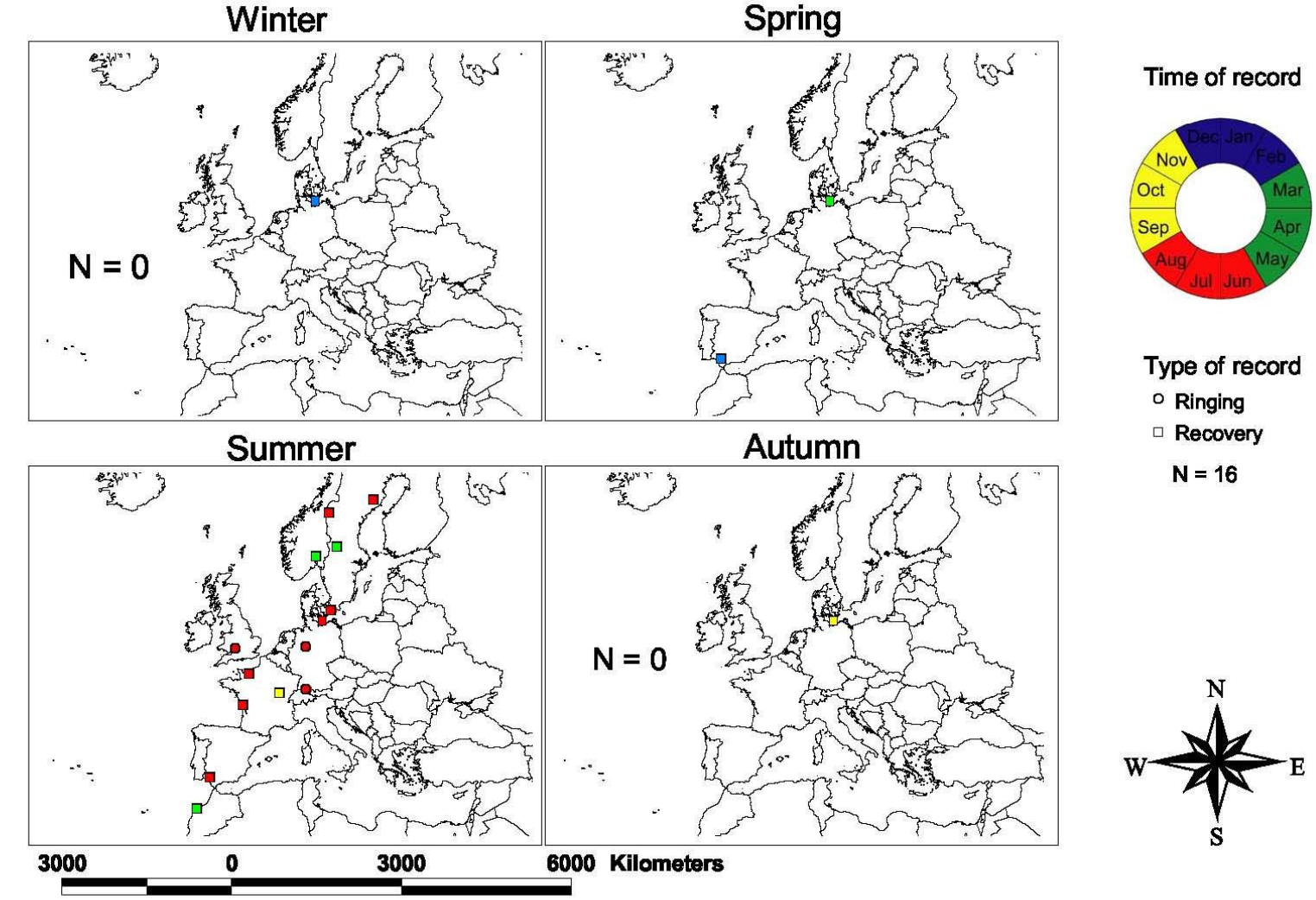
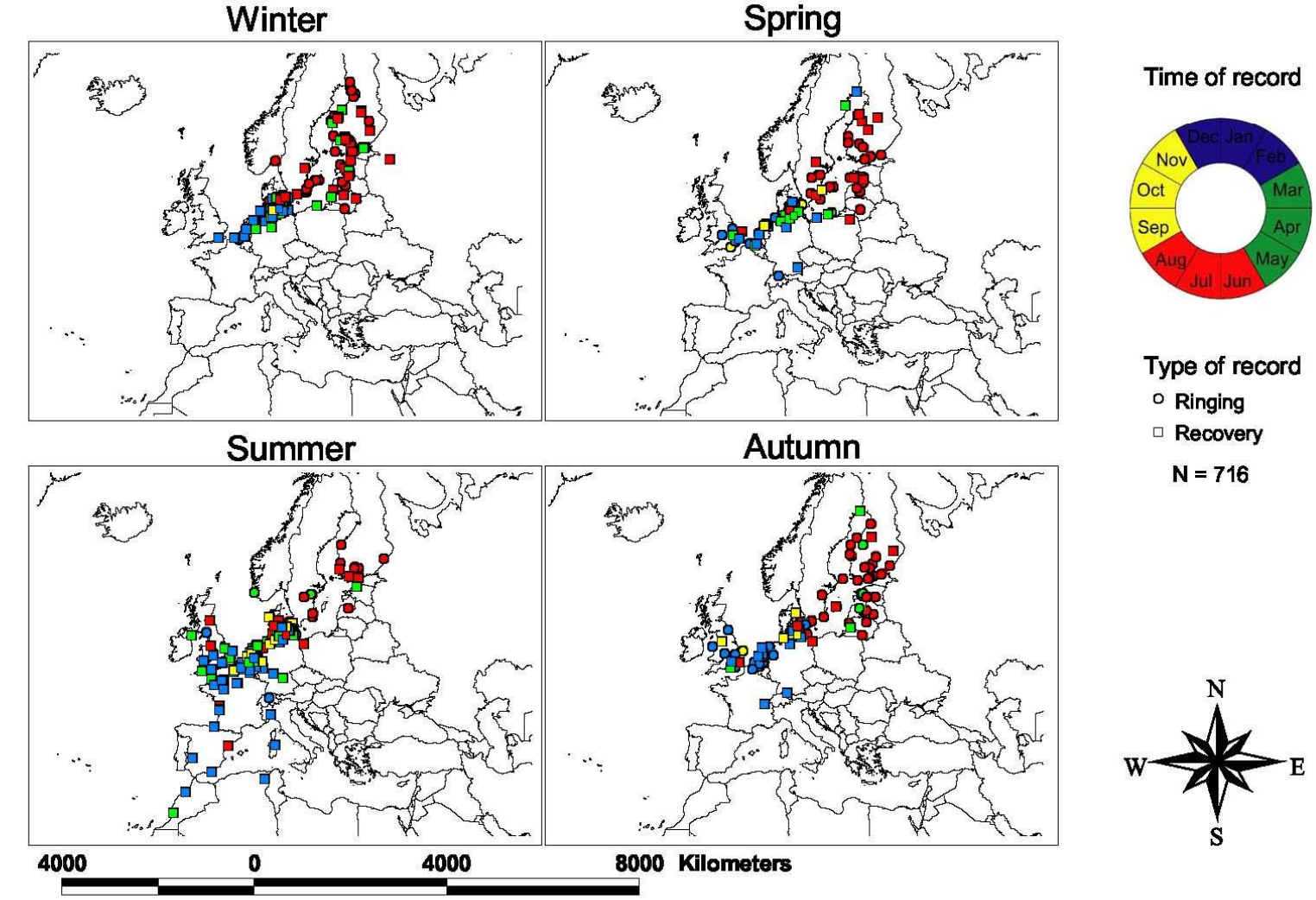


Black-headed Gull (Larus ridibundus)



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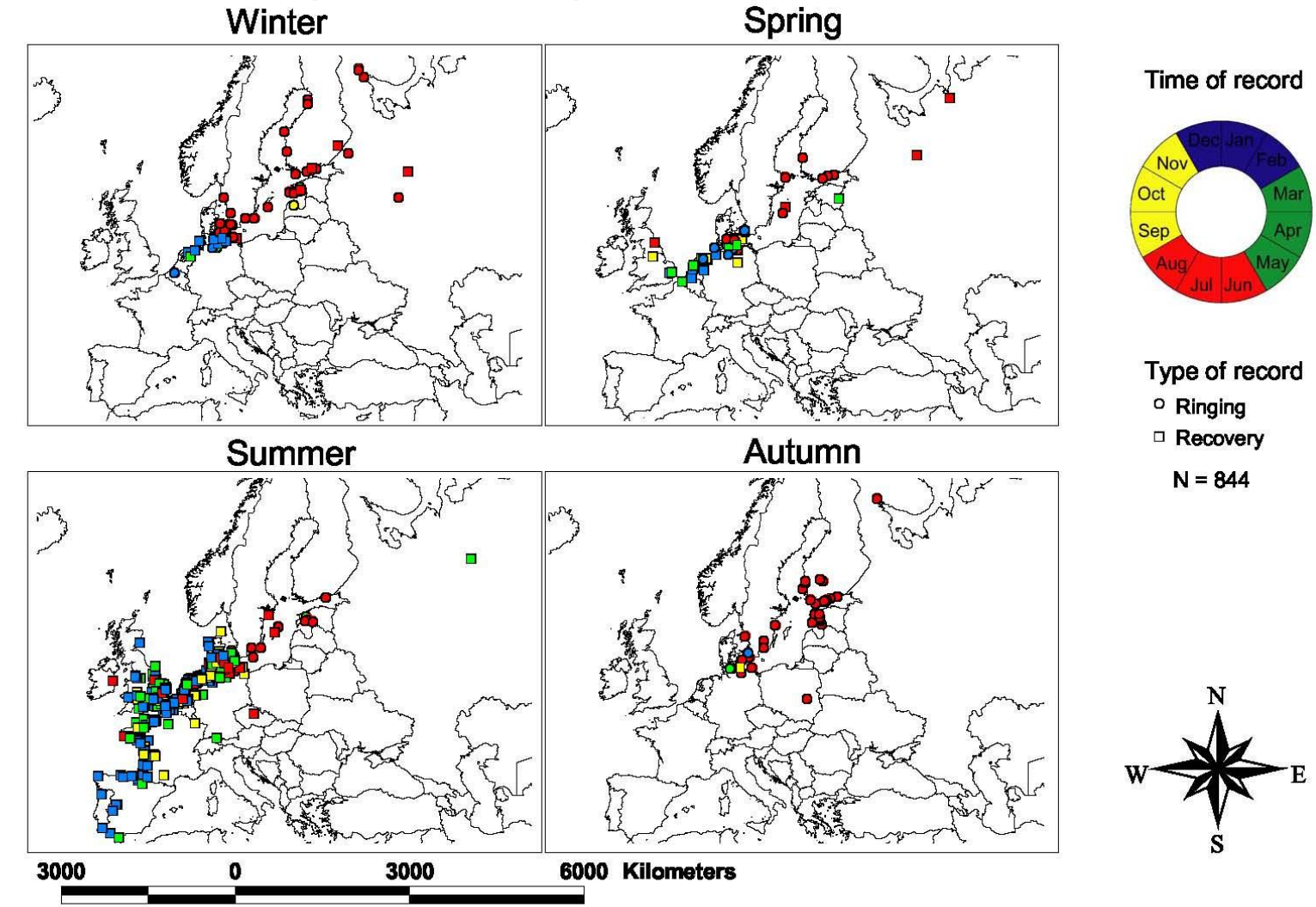

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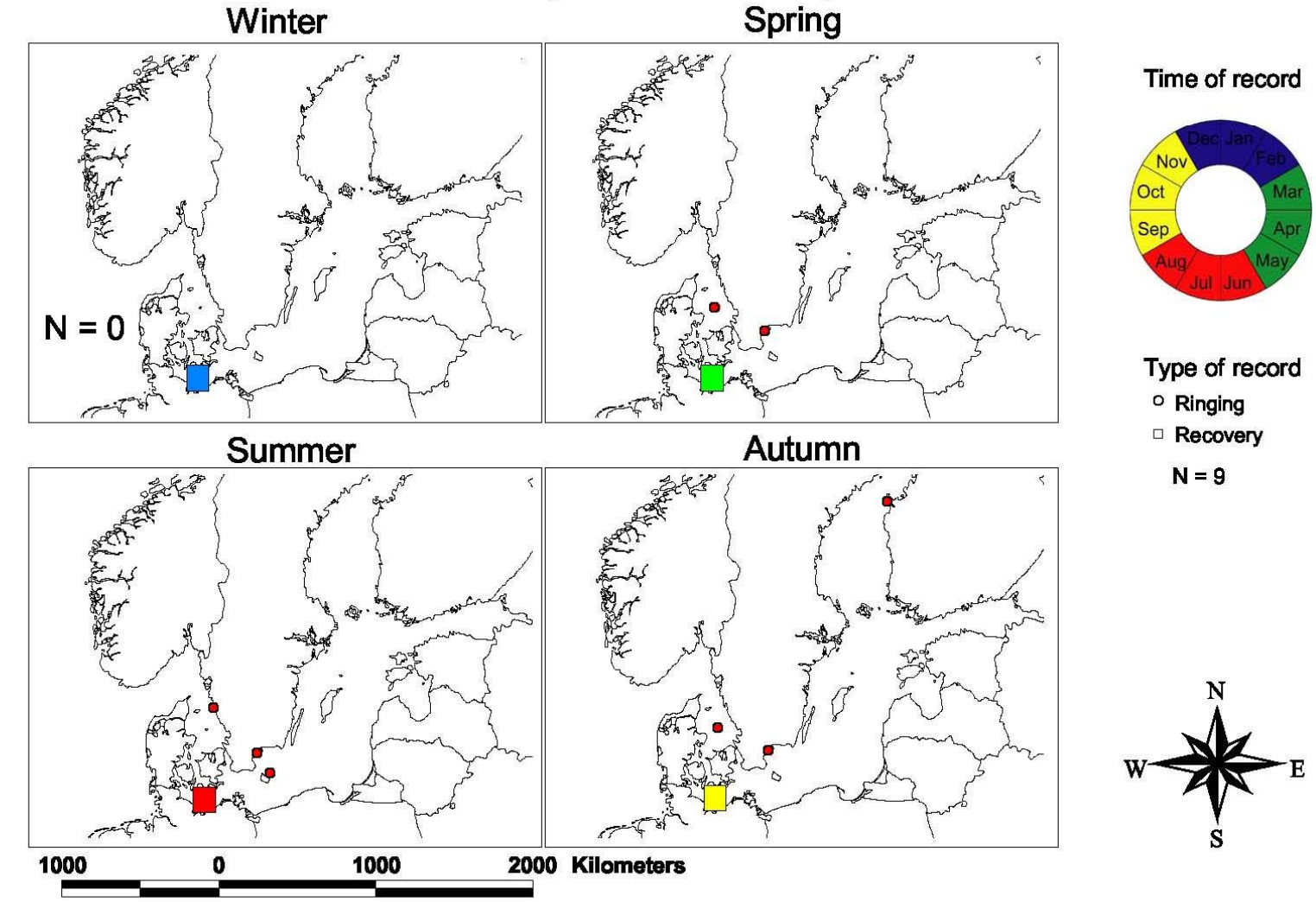

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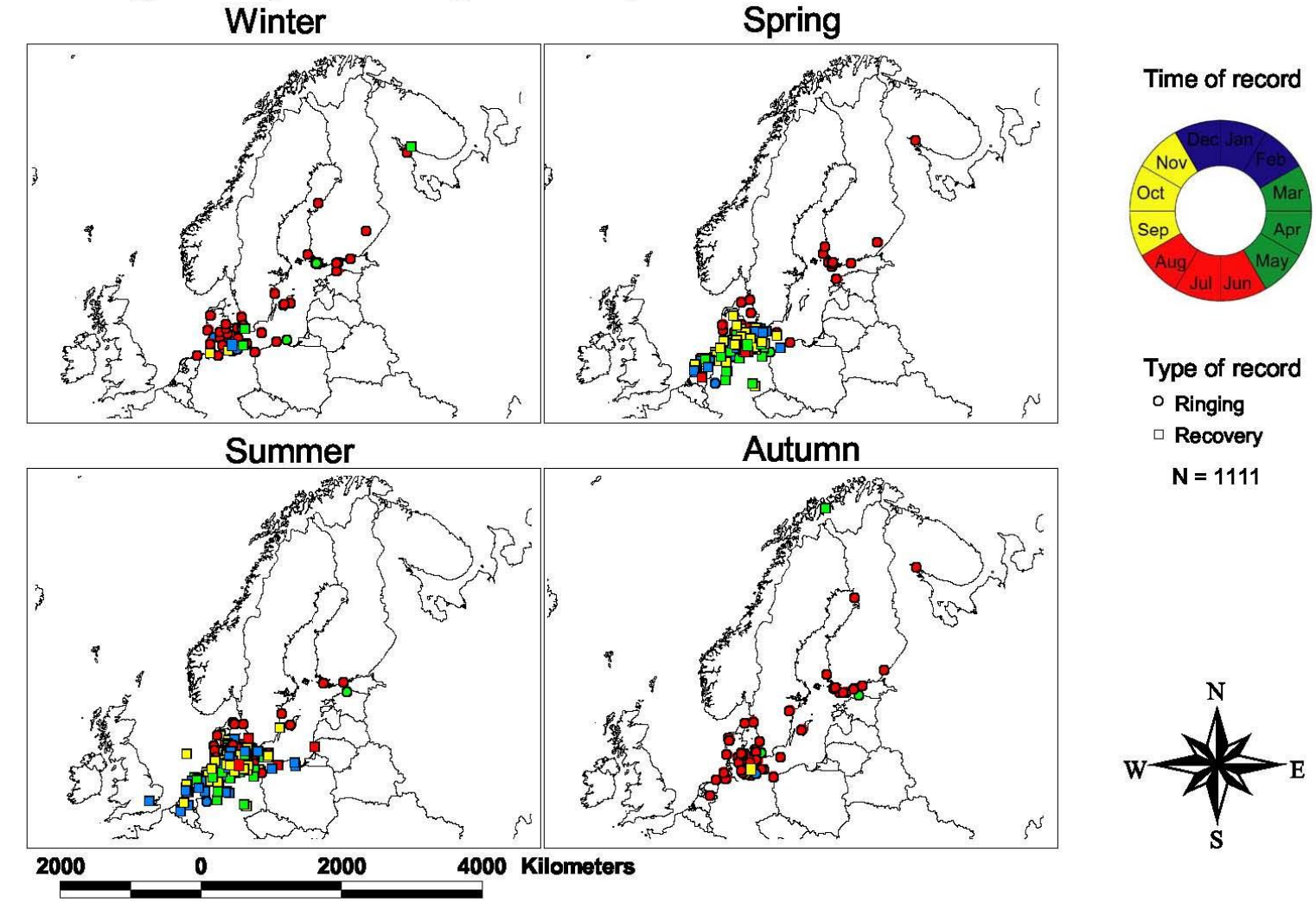

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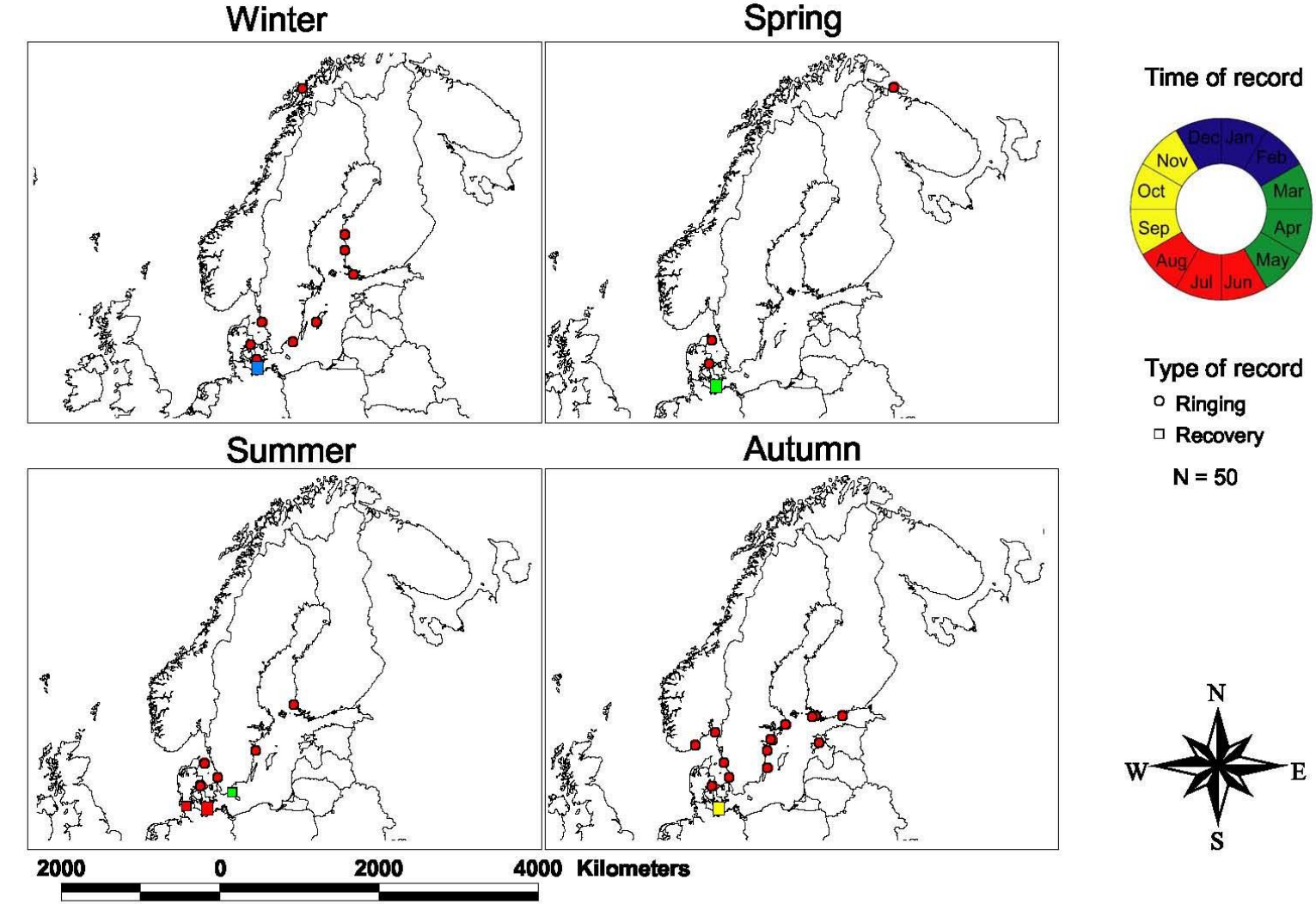

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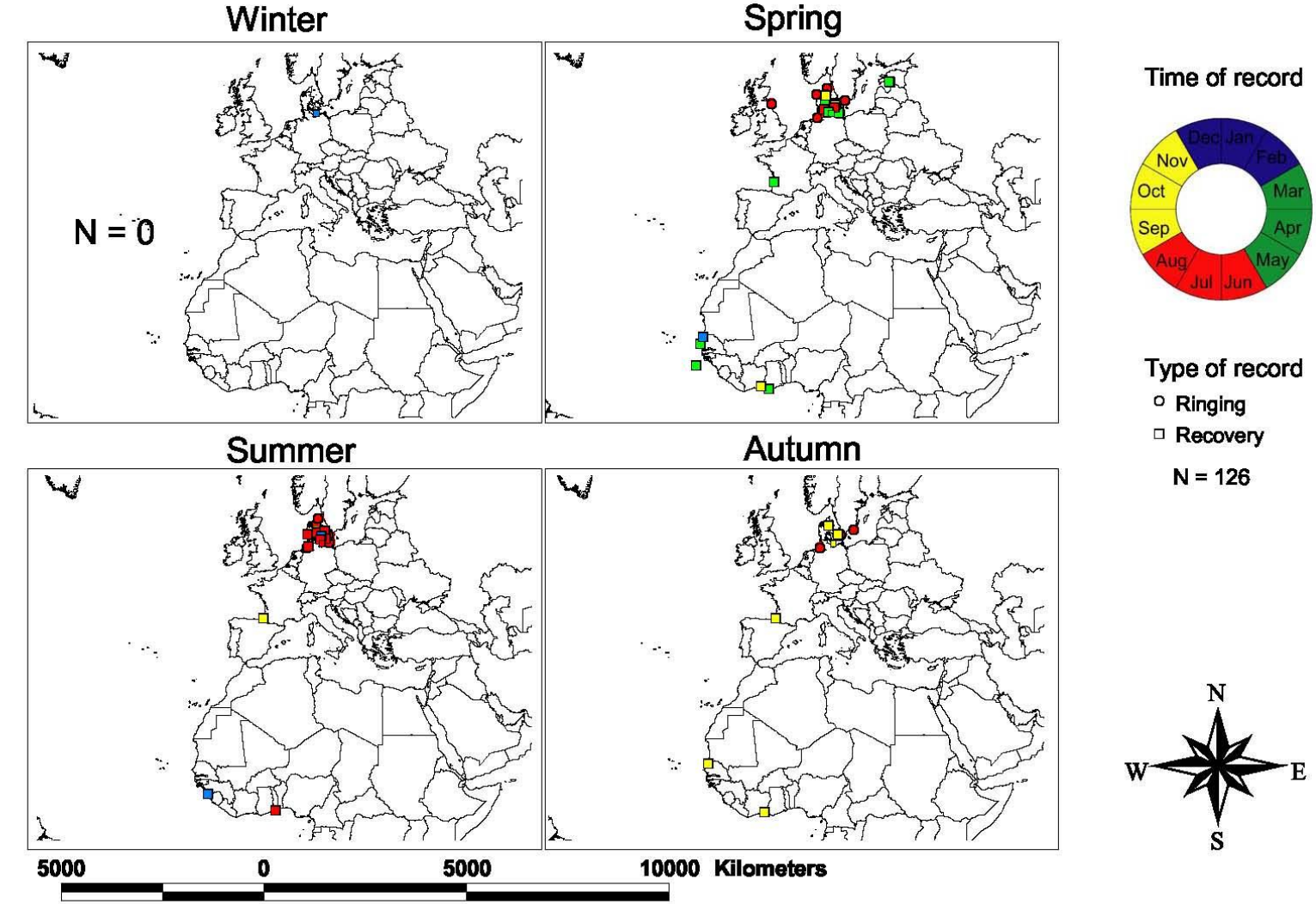

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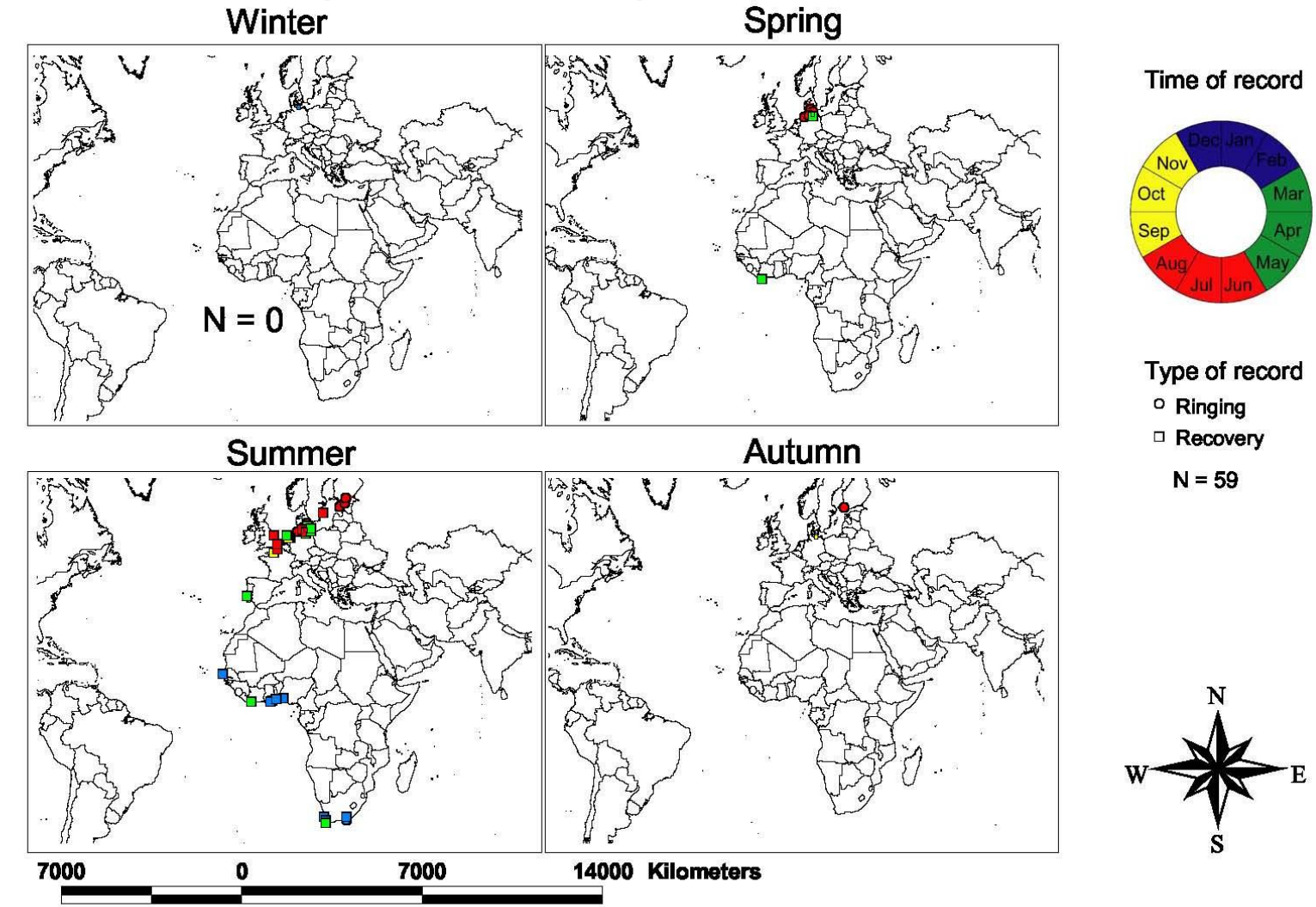

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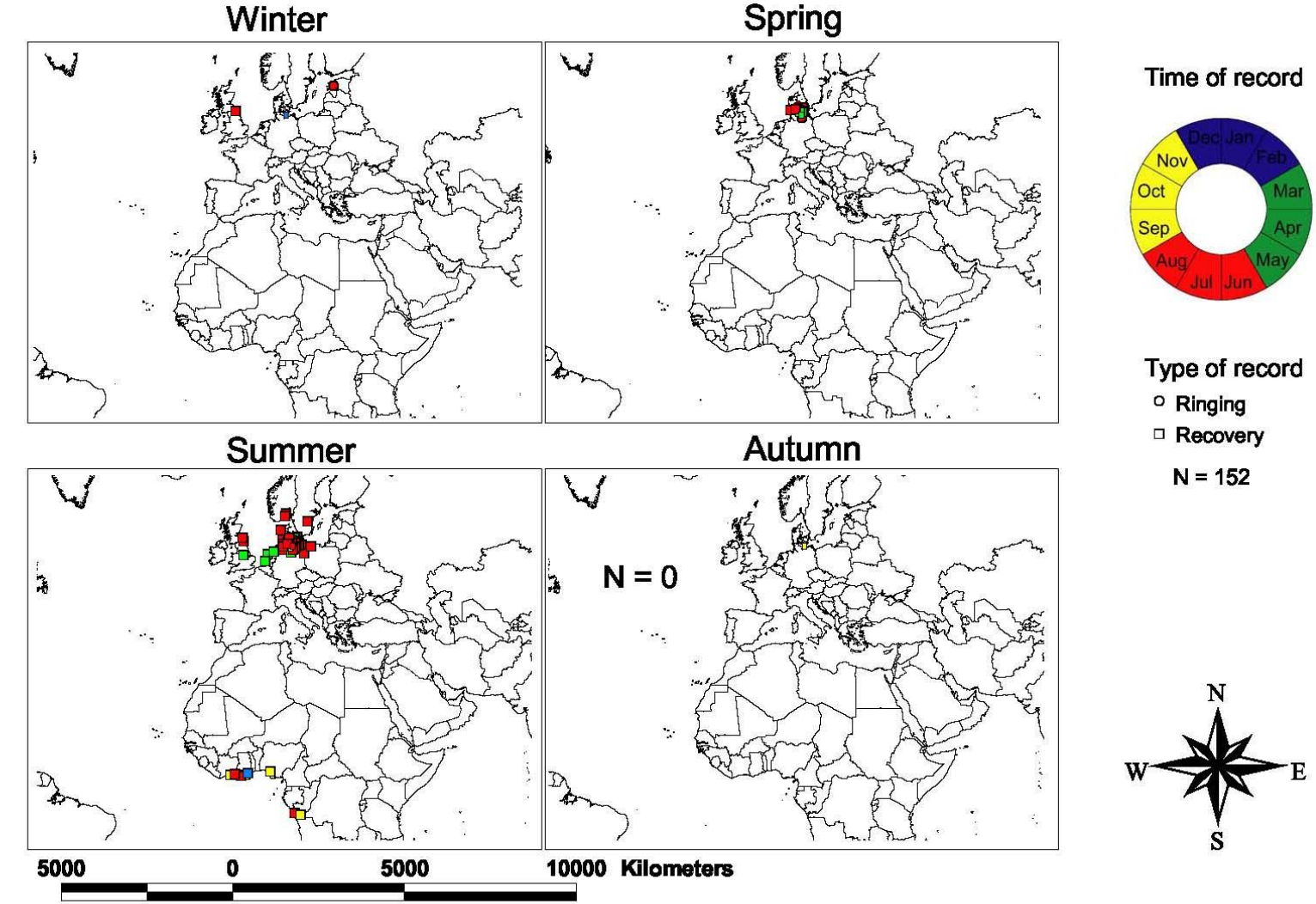
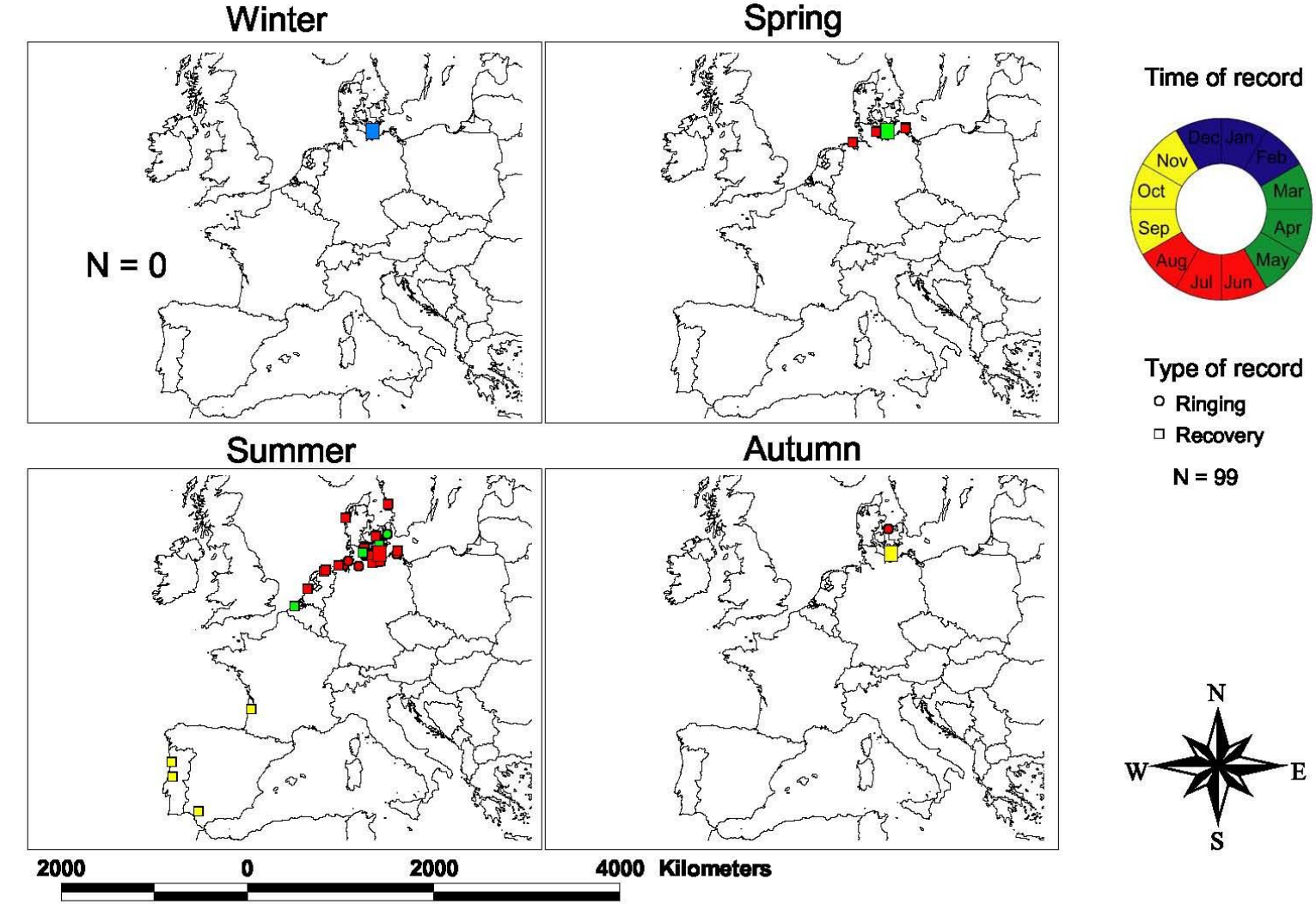


Little Tern (Sterna albifrons)



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