Ornithological data relevant to the spread of Avian Influenza in Europe (phase 2)

Further identification and first field assessment of Higher Risk Species

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Executive summary

In winter and spring of 2005-2006, a project was carried out for the European Commission to identify species with a higher risk of introducing H5N1 from outside the EU to within EU borders. That desk study analysis was restricted to the predominantly migratory species belonging to the Anseriformes (ducks, geese and swans) and Charadriiformes (shorebirds, skuas, gulls and terns). The occurrence of outbreaks of avian influenza in 14 EU countries in 2006 necessitated a second phase of the project, in which the preliminary analysis of Higher Risk Species was expanded to other bird groups, also through a desk study. In addition higher risk Bridge Species (species which might act as a link between wild birds and poultry) needed to be identified, with regard to the risk of spread of the virus within EU borders once introduced, again through a desk study but also including a first check in the field. The results of this second phase of the project are presented in this report.

As in the first phase, the expanded identification of Higher Risk Species selected for species that
1. frequent freshwater wetland habitats and agricultural areas;
2. occur in groups that are large and/or dense; and
3. show a high degree of mixing with other species.

In addition the following "specific risk factors" were considered:
1. likelihood of exhibiting colonial breeding;
2. likelihood of exhibiting predatory behaviour; and
3. likelihood of exhibiting scavenging behaviour.

As a result 82 **Higher Risk Species (HRS)** in five groups were identified, with some overlap between groups:

Group A: HRS with respect to the introduction and spread of H5N1 in the European Union in the migration and wintering period, based on migratory habit (movement across EU boundaries), habitat, gregariousness and degree of mixing. The 35 HRS thus identified are all waterbirds.

Group B: HRS with respect to the spread of H5N1, once the virus has been introduced to the European Union, during the migration and wintering period, based on migratory habit (resident or movement within the EU), habitat, gregariousness and degree of mixing. A diverse set of 15 waterbirds and terrestrial species are thus identified as HRS.

Group C: HRS with respect to the spread of H5N1 in the European Union in the breeding period, based on habitat and colonial breeding. This set of 18 HRS mainly consists of migratory and non-migratory waterbirds.

Group D: HRS with respect to the spread of H5N1 in the European Union, year-round, by predators and scavengers, which are likely to take diseased waterbirds and waterbird carcasses. The 12 waterbird predator HRS are all raptor species, the 15 waterbird scavenger HRS are a combination of raptors, gulls and crows.

Group E: **Bridge species**, i.e. HRS which may spread H5N1 from wetlands with infected birds to humans and/or poultry, at any time of year. From among the 82 species belonging to groups A-D, 29 were selected as Bridge Species because they were also considered to pose a relatively high contact risk with humans and/or poultry. This group consists primarily, but not exclusively, of waterbirds, pigeons and doves, corvids and sparrows.

An overview of the 82 species involved, including population size and proven carrying of H5N1, if any, is given in Table 2.7.

The small-scale exploratory field assessment of the Bridge Species selection was carried out in February-March and again in April-May 2007, simultaneously in Germany, Italy, Turkey and the UK, on 8-10 farms with poultry in each country. Poultry numbers per farm varied from a few birds kept as a hobby to some 30,000 free range or 300,000 in bird-tight buildings. Monitoring parameters for wild birds on these farms included species presence, numbers and breeding numbers at different distances from the poultry enclosures; contact with poultry; and presence on wetlands on or near the farms concerned.

A total of 126 species were seen during the survey, including 56 of the identified 82 Higher Risk Species. The various species were given a score for each monitoring parameter and the most relevant parameter scores were combined to give a total field study score.

All relevant 27 previously identified higher risk Bridge Species, as well as the other species prominently present during the fieldwork, were ranked according to their total scores. Seventeen out of those 27 proved to have been prominently present on the group of study farms in at least one of the four countries of our study. The absence near the farms of seven other Bridge Species can easily be explained by their geographical distribution and seasonal occurrence. This leaves only three Bridge Species out of 27 unaccounted for in the fieldwork.

On the basis of the field results two additional species were added to the higher risk Bridge Species list. The full list is presented in Table 3.10.

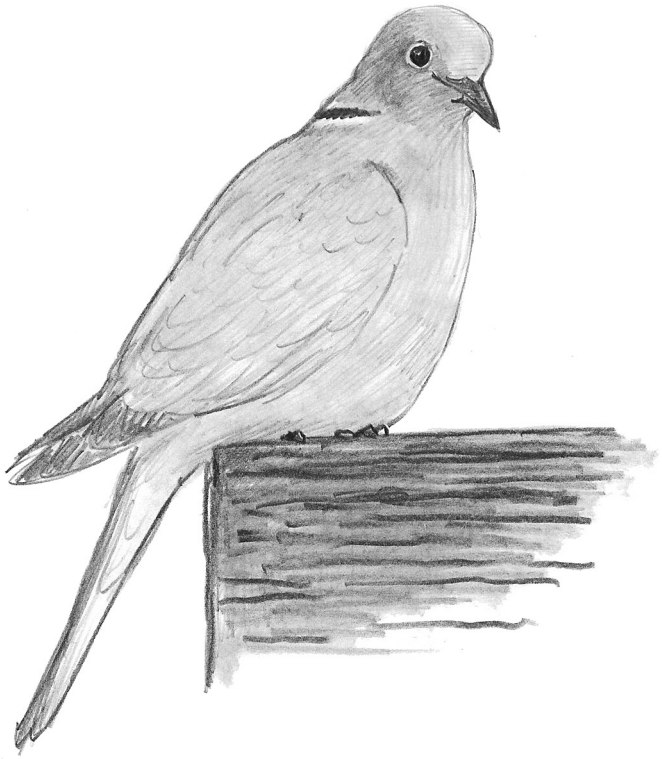
The above results indicate that the desk study method for identifying higher risk Bridge Species that may transfer the Avian Influenza virus to poultry farms was fairly reliable, at least in this limited first field test. The results also indicate that field work is an essential check on the desk study. The two types of study have different drawbacks and complement each other.

The list presented in Table 3.10 should be regarded as preliminary. For a better understanding of potential

spread of HPAI within the EU, more detailed field studies are needed. Such studies may lead to adjustment of the list of species presented in Table 3.10, as well as to insights into the magnitude of the threat which each species poses to poultry farms in different parts of the EU and in different seasons.

We recommend that further research on Bridge Species in relation to Highly Pathogenic Avian Influenza should:

- concentrate on field studies dealing with contact risk between wild birds and poultry
- differentiate between species that may pose a local risk and those that may pose a risk over wider areas
- include more farms, with a better geographic and seasonal coverage and more time spent on individual farms
- include a study of contacts between farms and wetland areas, through waterbirds as well as terrestrial birds
- give special attention to the higher risk Bridge Species identified in Table 4.2, but also to species that just missed selection and are listed only in Table 4.1.



Collared Dove

1 Introduction

The spread of HPAI to Europe

During 2005, the H5N1 strain of Highly Pathogenic Avian Influenza (HPAI) spread north, then west from countries in east and southeast Asia that had been affected by the disease since 1997. Factors causing the spread of HPAI include methods used in the farming and transport of domestic poultry and poultry products, trade (legal and illegal) in wild and domestic birds, and probably transfer between domestic birds and wild migratory birds, especially a number of waterbird species. Knowledge of this disease, although growing fast, is still limited and the relative importance of these factors is still disputed. There now seems little doubt, however, that wild birds are capable of carrying the disease and passing it on to other birds (Olsen et al. 2006).

In 2006 and 2007, outbreaks of HPAI involving both domestic and wild birds occurred in Europe, and were rapidly eradicated in the cases of outbreaks in poultry. The tools and methods for combatting the disease in poultry, defined by the specialized technical agencies FAO and OIE, appear to work if they are implemented appropriately (Domenech et al. 2007). The disease has not yet become prevalent or persistent in wild birds in Europe, and any outbreaks in the wild have died out quickly. Domenech et al (2007) concluded that "Gains will continue to be made locally in controlling and preventing H5N1 HPAI but global eradication of H5N1 HPAI viruses remains a distant and unlikely prospect, particularly if high risk production and marketing practices persist."

As the disease spread, the serious consequences to public health, economic and ecological interests gave HPAI a very high priority among national and international decision makers. In late 2005 the European Commission initiated a number of epidemiological, virological and ornithological studies to find out about the occurrence and behaviour of the disease in wild birds, and about the numbers, distribution and movements of wild bird species which might pose a risk in its spread.

The Phase 1 report

A report prepared for The Commission under Phase 1 of this project, and presented in June 2006, summarised and analysed a large volume of ornithological data collected over a number of decades by Wetlands International (waterbird numbers and key sites) and EURING, the European Union for Bird Ringing (waterbird movements). Data and information on bird numbers and movements in Europe, southwest and central Asia, and Africa were compiled and analysed with the aim of assessing the risk at continental, national and site level of HPAI spreading through the flyways of the birds that use these landscapes for breeding, moulting, staging and "wintering".

The 2006 report also identified a number of so-called Higher Risk Species (HRS), defined as species which pose a relatively high risk of *introducing* Highly Pathogenic Avian Influenza (HPAI) type H5N1 from outside the EU to within EU borders. On the basis of data on AI prevalence in different species, that analysis was restricted to the predominantly migratory species belonging to the Anseriformes (ducks, geese and swans) and Charadriiformes (shorebirds, skuas gulls and terns). During the project period several outbreaks of AI occurred within the EU, and hundreds of wild birds of a variety of species were found dead.

Phase 2

Phase 2 of the project was set up in response to the occurrence of those outbreaks in 14 EU countries in 2006. Results presented in July 2007 comprise this report, together with an expanded and improved version of the Phase 1 analysis of numbers and movements of HRS as a web application on the European Commission website. This report complements the web application by presenting a more complete analysis of the species which pose a higher risk of introducing HPAI into the European Union or of spreading it further once introduced.

The first part of Phase 2 expanded on the preliminary analysis of HRS presented in Phase 1. A much wider list of species was taken into account, besides the Anseriformes and Charadriiformes. This was done through a desk study similar to that in Phase 1. The results of this expanded desk study are presented in Chapter 2 of this report.

Secondly, species which occur at poultry farms and which pose a particular risk of transmitting HPAI from wild birds to domestic birds, and vice-versa (so-called Bridge Species) needed to be identified, with regard to the risk of spread of the virus within EU borders. Such species would be priority candidates for any further study on the risk of wild birds spreading avian influenza within Europe, or for monitoring for infection. This, too, was done through a desk study, the results of which are also presented in Chapter 2.

In addition, a complementary assessment in the field of wild birds on and near poultry farms was designed, and implemented at farms in four parts of Europe. Comparison could then be made the list of Bridge Species selected in the desk study. This small-scale exploratory assessment was carried out in February-March and April-May 2007, simultaneously at 36 poultry farms in Germany, Italy, Turkey and the UK. The results of the fieldwork are presented in Chapter 3 and a comparison with the results of the desk study is made in Chapter 4.

Tufted Duck

2 Identification of Higher Risk Species and Bridge Species

2.1 Introduction

This chapter reports on the results of the expanded Higher Risk Species (HRS) analysis, with respect to the introduction of avian influenza into Europe. It starts by defining the geographical area considered (section 2.2), then gives details of the taxonomic groups considered and the data compiled (section 2.3).

The subsequent analysis of Higher Risk Species (section 2.4) focusses in turn on:
- risk of introduction and spread of H5N1 by migratory species (migration and wintering period) (2.4.2)
- risk of spread of H5N1 by non-migratory species (non-breeding period) (2.4.3)
- risk of spread of H5N1 by colonially breeding birds (breeding period) (2.4.4)
- risk of spread of H5N1 by predators and scavengers (year-round) (2.4.5)
- **bridge species** (2.4.6)
- and possible effects of population size on H5N1 infections in the wild (2.4.7)

Bridge species are defined as bird species which bridge the gap between outbreaks of H5N1 among wild birds and the human environment (human settlements, poultry farms) or vice versa.

The subsequent discussion and conclusions (2.5) are followed by Annexes with:
- the definitions of parameters and explanation of the codes used in this chapter (Annex 2.1)
- evaluations of all species considered in the process of identifying Higher Risk Species in relation to the potential introduction and spread of HPAI viruses in the European Union (Annex 2.2)
- evaluations of colonial breeding as a risk factor (Annex 2.3)
- evaluations of contact risk with humans (Annex 2.4)
- evaluations of contact risk with poultry (Annex 2.5)

2. 2 Geographical area considered

This study focuses on countries which are a member of the European Union. However, from the point of view of bird distribution the geographical area of the European union is a somewhat illogical region. On the one hand there are countries such as Switzerland, which are completely encircled by EU member states. On the other hand, there are outlying islands such as the Azores and the Canary Islands which are very small and at a great distance from the European mainland. From a practical point of view, we have chosen to consider a geographical area which is a spatial entity and includes the following countries (EU countries as of 01.01.2007, and their oceanic islands, marked with an *).

Albania, Andorra, Austria*, Belgium*, Bosnia & Herzegovina, Bulgaria*, Croatia, Czech Republic*, Denmark*, Estonia*, Finland*, France*, Germany*, Gibraltar*, Greece*, Hungary*, Ireland*, Italy*, Latvia*, Liechtenstein, Lithuania, Luxembourg*, FYR of Macedonia, Malta*, Montenegro, Netherlands*, Norway, Poland*, Portugal*, Romania*, Serbia, Slovakia*, Slovenia*, Spain*, Sweden*, Switzerland, United Kingdom*.

European countries and oceanic islands not included in this geographical area are:
Armenia, Azerbaijan, Azores*, Belarus, Canary Islands*, Cyprus*, Faeroe Islands, Georgia, Greenland, Iceland, Madeira*, Moldova, Russia, Svalbard, Turkey, Ukraine.

2.3 Taxonomic groups studied and data collected

Because of a number of practical constraints it was not possible to investigate all bird species occurring in Europe. For practical reasons we excluded a number of groups which, based on their behaviour and ecology, were considered unlikely to become H5N1 infected.

Thus we retained for analysis all European representatives of the following orders:
- Gaviiformes (divers),
- Podicipediformes (grebes),
- Pelecaniformes (cormorants and pelicans),
- Ciconiiformes (bitterns, herons, egrets, storks, ibises and spoonbills),
- Phoenicopteriformes (flamingos),
- Accipitriformes (hawks, vultures and eagles),
- Falconiformes (falcons and allies),
- Galliformes (grouse and partridges),
- Gruiformes (rails, cranes and bustards),
- Columbiformes (pigeons),
- Passeriformes,only the following families:
    - Alaudidae (larks)
    - Hirundinidae (swallows)
    - Motacillidae (pipits, wagtails)
    - Turdidae (only the thrushes)
    - Laniidae (shrikes)
    - Corvidae (crows and allies)
    - Sturnidae (starlings)
    - Passeridae (sparrows, rock sparrows, snow finches)
    - Fringillidae (finches)
    - Emberizidae (buntings)

All species were listed in a spreadsheet (together with data collected during Phase 1 of the project for the Anseriformes and Charadriiformes) and the following information was added:

Migration behaviour
- Migratory status (long distance migrant, short distance

migrant or resident)
- Does species migrate into EU (substantial part of population passes EU borders)
- Cold-weather movements (propensity to undertake cold-weather movements)

Preferred habitat
- Preferred habitat in breeding season
- Preferred habitat during migration and wintering)

Gregariousness (group size and density)
- Gregariousness in breeding season
- Gregariousness during migration and wintering

Degree of mixing with other bird species
- Degree of mixing during migration and wintering

Specific risk factors
- Colonial breeding
- Roosting concentrations
- Moulting concentrations
- Predation behaviour
- Scavenging behaviour

Occurrence and contact risk with humans and poultry
- Occurrence on farmland
- Occurrence at wetlands
- Contact risk with humans
- Contact risk with poultry

H5N1 confirmed
- Infections with H5N1 in Europe
- Infection with H5N1 worldwide

Information on migration, habitat, gregariousness, degree of mixing, specific risk factors and occurrence was based on expert knowledge, supplemented by various literature sources, especially Cramp & Simmons, vol I-IX (1977-1994). Coded information provided by three experts was considered, matched with literature data and finally converted to a mean score.

Information on data gathering and on criteria used for coding are given in Annex 2.1, and the spreadsheet with all species considered and their relevant characteristics is presented in Annex 2.2.

2.4 Analysis of Higher Risk Species

2.4.1 Introduction

Identification of Higher Risk Species was carried out, based on the assumption that the chances of infection and further spread of H5N1 are relatively high in:
1. species that frequent freshwater wetland habitats and agricultural areas;
2. species that occur in groups that are large and/or dense;
3. species that show a high degree of mixing with other species.

Arguments for these assumptions have been put forward in the report of Phase 1 of this project (Delany et al. 2006).

In addition, the following “specific risk factors” were considered:
4. likelihood of exhibiting colonial breeding
5. likelihood of exhibiting predator behaviour
6. likelihood of exhibiting scavenging behaviour

Not all data columns provided in the spreadsheet have been used in the subsequent analyses. Some of the characteristics recorded proved to be of little value in determining risk of carrying and transferring Highly Pathogenic Avian Influenza. Other data provided in the sheet show functional overlap with each other, and only the most relevant characteristics were retained. For example, data on colonial breeding, social roosting and moult concentrations are covered by the scores for gregariousness, and occurrence on farmland and at wetlands are included in habitat scores.

2.4.2 Risk of introduction and spread of H5N1 by migratory species (migration and wintering period)

During phase I of this project a selection was made and bird species were identified which pose a relatively high risk (as compared to other birds) of spreading Highly Pathogenic Avian Influenza (H5N1) along their migration routes from outbreak sites outside the European Union to within EU borders. Only the essentials of that identification process were repeated here. For full information reference is made to the report of phase I.

With H5N1 spreading westwards through central Asia the emphasis was on species breeding in northern Asia which migrate to, or pass through, Europe in order to winter at lower latitudes. All species of the Anatidae and Charadriidae of which a substantial part of the population passes EU borders were included in the analysis. It was argued that species which prefer agricultural fields and freshwater habitats, which are gregarious and have a high degree of mixing with other species, should be regarded as posing a higher risk of introducing H5N1 from outside the EU to within EU borders. In evaluating such species, the following steps were taken.

Species were <u>not</u> selected if (codes used in the spreadsheet given in brackets):
- They occurred mainly in marine (M) or littoral environ ments (L) or other habitats (O) (i.e. species whose habitat codes begin with O, L or M since such species are expected to only occasionally use freshwater and/or agricultural habitats
- They showed hardly any, or only low gregariousness (i.e. codes denoting small group size (O and S) in combination with low and medium density (L and M). In Annex 2.2 these are the codes OO, OL, OM, OH, SO, SL, SM, LO and MO*
- They showed little mixing with other species (showing either hardly any mixing (O) or a low degree of mixing (L).

The resultant selection of 26 Higher Risk Species on the basis of habitat use, gregariousness and degree of mixing consisted of 2 swan, 8 goose, 10 duck, 4 shorebird and 2 gull species.

In the framework of the present phase 2 project the same type of analysis was undertaken for a much larger group of migratory bird species of which a substantial part of the population passes EU borders, including all the species belonging to the orders and families mentioned above. The results of the previous analysis and the present one are combined in Table 2.1. HRS already identified are indicated (phase 1). Additional to the list of phase I are 1 grebe, 2 cormorant, 2 egret, 1 stork, 1 ibis, 1 spoonbill and 1 coot species (total 9 additional species).

All species posing a relatively high risk of introducing H5N1 into the European Union by spreading the virus along their migratory pathway are in fact wetland species. They can roughly be divided into three categories: (1) species breeding at northern latitudes which migrate to, or pass through, the European Union for wintering (example Greater White-fronted Goose); (2) species breeding in the EU which spend the winter in Africa (example Black-tailed Godwit); and (3) species breeding both inside and outside the EU which migrate over shorter distances (example Great Cormorant). To a large extent, categories 1 and 2 pass through different geographical regions and are present in the EU in different seasons. Likewise the risks of introduction of the H5N1 virus by these groups differ. Species of group 1 might be expected to introduce the virus from outbreak areas in the north and the east and during autumn migration. Species of group 2 might be expected to introduce the virus from more southerly outbreak areas during spring migration.

Table 2.1. *Higher Risk Species, i.e. species posing a higher risk of introducing H5N1 from outside the EU to within EU borders, as identified on the basis of habitat use, gregariousness and degree of mixing with other species. Only migratory species of which a substantial part of the population passes EU borders were considered. Selection criteria used refer to the migration and winter periods only. Species already identified as such during phase I are indicated. Habitat codes: A=agricultural, F=freshwater, M=marine, L=littoral, N=freshwater marsh; Gregariousness codes: group size (L=large, M=medium) and group density (H=high, M=medium, L=low) following each other. Mixing codes: H=high, M=medium. (See also Annexes 2.1 and 2.2.*

English name	Scientific name	Habitat	Greg.	Mixing	
Great Crested Grebe	*Podiceps cristatus*	FM	ML	M	
Pygmy Cormorant	*Phalacrocorax pygmeus*	FM	MM	M	
Great Cormorant	*Phalacrocorax carbo*	FM	MM	H	
Cattle Egret	*Bubulcus ibis*	FAN	MM	M	
Little Egret	*Egretta garzetta*	FNL	MM	M	
White Stork	*Ciconia ciconia*	FA	LL	M	
Glossy Ibis	*Plegadis falcinellus*	FL	MM	M	
Eurasian Spoonbill	*Platalea leucorodia*	FL	MM	M	
Mute Swan	*Cygnus olor*	FA	ML	M	phase 1
Bewick's Swan	*Cygnus columbianus*	FA	ML	M	phase 1
Bean Goose	*Anser fabalis*	FA	LM	H	phase 1
Pink-footed Goose	*Anser brachyrhynchus*	FA	LH	M	phase 1
Greater White-fronted Goose	*Anser albifrons albifrons*	FA	LH	H	phase 1
Lesser White-fronted Goose	*Anser erythropus*	FA	LH	M	phase 1
Greylag Goose	*Anser anser*	FA	LH	H	phase 1
Barnacle Goose	*Branta leucopsis*	FAL	LH	H	phase 1
Brent Goose	*Branta bernicla*	FAL	LH	M	phase 1
Red-breasted Goose	*Branta ruficollis*	AL	MH	H	phase 1
Eurasian Wigeon	*Anas penelope*	FAL	LH	H	phase 1
Common Teal	*Anas crecca*	FAL	MH	H	phase 1
Mallard	*Anas platyrhynchos*	FAL	MH	H	phase 1
Northern Pintail	*Anas acuta*	FAL	MH	H	phase 1
Garganey	*Anas querquedula*	F	MM	H	phase 1
Northern Shoveler	*Anas clypeata*	FL	MH	H	Phase 1
Marbled Teal	*Marmaronetta angustirostris*	F	MM	H	phase 1
Red-crested Pochard	*Netta rufina*	F	MM	?	phase 1
Common Pochard	*Aythya ferina*	F	MH	H	phase 1
Tufted Duck	*Aythya fuligula*	F	MH	H	phase 1
Common Coot	*Fulica atra*	FN	LH	H	
Northern Lapwing	*Vanellus vanellus*	FA	MH	M	phase 1
European Golden Plover	*Pluvialis apricaria*	AN	LH	M	phase 1
Black-tailed Godwit	*Limosa limosa*	FAL	MM	H	phase 1
Ruff	*Philomachus pugnax*	FA	MM	M	phase 1
Black-headed Gull	*Larus ridibundus*	FAL	LM	H	phase 1
Common Gull	*Larus canus*	FAL	MM	H	phase 1

Table 2.2. *Higher Risk Species, i.e. species posing a higher risk of spreading H5N1 further once it has been introduced into the EU, as identified on the basis of habitat use, gregariousness and degree of mixing with other species. Only species classified as "non-migratory" were considered, i.e. resident species and shorter-distance migrants which mainly complete their life cycle within Europe. Selection criteria used refer to the non-breeding season, which is similar to the "migration and winter periods" for longer distance migrants. For explanation of codes see caption of table 2.1. See also Annexes 2.1 and 2.2.*

English name	Scientific name	Habitat	Greg.	Mixing
Greater Canada Goose	*Branta canadensis*	FA	MM	H
Crested Coot	*Fulica cristata*	FN	MM	M
Stock Dove	*Columba oenas*	A	SH	M
Common Wood Pigeon	*Columba palumbus*	A	LH	M
Eurasian Collared Dove	*Streptopelia decaocto*	AO	MH	M
Fieldfare	*Turdus pilaris*	AO	MM	M
Redwing	*Turdus iliacus*	AO	MM	M
Eurasian Jackdaw	*Corvus monedula*	AO	MM	H
Rook	*Corvus frugilegus*	A	LM	H
Common Starling	*Sturnus vulgaris*	AO	LH	H
Spotless Starling	*Sturnus unicolor*	AO	MH	H
House Sparrow	*Passer domesticus*	AO	MM	H
Spanish Sparrow	*Passer hispaniolensis*	AO	MM	H
Chaffinch	*Fringilla coelebs*	AO	MM	H
Brambling	*Fringilla montifringilla*	A	MH	H

2.4.3 Risk of spread of H5N1 by non-migratory species (non-breeding period)

In case H5N1 is introduced to the EU by migratory bird species visiting the EU during migration and wintering, further spread can potentially take place by other species coming into contact with these migrants. These can be resident species or shorter-distance migrants which complete their life cycle mainly within Europe. For practical reasons, in this study both categories will be taken together and termed "non-migratory species". A similar analysis as described above for the migrants was carried out: i.e. a selection of species on the basis of habitat use, gregariousness and degree of mixing. The results are presented in Table 2.2. They show that in this way a completely new set of bird species is identified as Higher Risk Species for the spreading of HPAI. Except for Greater Canada Goose and Crested Coot, which are both freshwater species (code F), all other species predominantly occur in agricultural areas (code A), usually in combination with other terrestrial habitats (code O). The selection consists of 1 goose, 1 coot, 3 pigeon, 2 thrush, 2 crow, 2 starling, 2 sparrow and 2 finch species making a total of 15 species.

2.4.4 Risk of spread of H5N1 by colonial breeding birds (breeding period)

The Higher Risk Species identified so far have been selected because they pose a relatively high risk with respect to the introduction and spread of H5N1 during migration and winter. Autumn migration is directly followed by the wintering period, which is covered by the above analysis. However, spring migration is followed by the breeding period which, so far, has been left out of consideration. In case H5N1 is introduced into the EU by spring migrants, further spread of the virus can be expected to be dependent of the behaviour of local breeding birds. The latter may or may not actually take part in the process of breeding, as part of a population of "breeding birds" always consists of non-breeding individuals. When faced with the task of giving scores for habitat use, gregariousness and degree of mixing for breeding birds, we encountered a number of problems and it was felt impossible to score degree of mixing because of a lack of knowledge. The overriding factor determining degree of gregariousness appeared to be colonial breeding. We therefore decided to also select species as Higher Risk Species on the basis of habitat use and degree of coloniality.

A considerable majority of bird species are non-gregarious during breeding, living in pairs or small family groups. In certain taxonomic groups, however, colonial breeding commonly occurs. We have assumed that the following characteristics of a breeding colony are likely to contribute to the risk of spreading H5N1:

- colony size (the number of birds breeding within a particular colony)
- nest density
- accumulation of faeces near nests or at communal roosting places associated with the breeding colony

The above mentioned aspects of colonial breeding have been considered for each species, and the risk of spreading H5N1 through colonial breeding has been assessed as high (H), medium (M), low (L) or zero (O). For further details see Annexes 2.1 and 2.2.

Table 2.3. presents all species which, during the breeding season, mainly occur in freshwater (F) and agricultural (A) habitats and which have been given high or medium scores with respect to the risk of virus spread related to colonial breeding. The selection includes 2 cormorant, 2 pelican, 7 heron and egret, 1 stork, 1 ibis, 1 spoonbill, 1 gull, 2 swallow and 1 crow species. All species appear to be at least partially migratory and strongly associated with freshwater, the Rook being the only exception.

Table 2.3. *Higher Risk Species, i.e. species posing a higher risk of spreading H5N1 further during the breeding season once it has been introduced into the EU, as identified on the basis of various colonial breeding parameters. The selection includes only those species which (mainly) occur in freshwater (F) and agricultural (A) habitats and whose risk associated with their colonial breeding habits is assessed to be medium (M) and high (H). See also Annexes 2.1 and 2.2.*

English name	Scientific name	Habitat	Risk
Pygmy Cormorant	*Phalacrocorax pygmeus*	F	H
Great Cormorant	*Phalacrocorax carbo*	FM	H
White pelican	*Pelecanus onocrotalus*	FM	H
Dalmatian Pelican	*Pelecanus crispus*	FM	H
Black-crowned Night Heron	*Nycticorax nycticorax*	FN	H
Squacco Heron	*Ardeola ralloides*	FN	H
Cattle Egret	*Bubulcus ibis*	FNA	H
Little Egret	*Egretta garzetta*	FNL	H
Great White Egret	*Ardea alba*	FN	M
Grey Heron	*Ardea cinerea*	FNAL	M
Purple Heron	*Ardea purpurea*	FN	M
White Stork	*Ciconia ciconia*	FA	M
Glossy Ibis	*Plegadis falcinellus*	F	M
Eurasian Spoonbill	*Platalea leucorodia*	FNL	H
Black-headed Gull	*Larus ridibundus*	FLNA	H
Sand Martin	*Riparia riparia*	F	M
Barn Swallow	*Hirundo rustica*	FA	M
Rook	*Corvus frugilegus*	A	M

It should be noted that the selection on habitat is rather rigid in this case. It excludes several gull and tern species which predominantly occur in the littoral zone, but which may also frequent freshwater and agricultural areas. Therefore, in Annex 2.3 an overview is given for all European breeding bird species which have been given scores H, M and L for colonial breeding.

2.4.5 Risk of spread of H5N1 by predators and scavengers (year-round)

Outbreaks of H5N1 among wild birds are characterised by a relatively large number of birds found dead. Epidemiological data suggest that infected birds usually die within a few days following symptoms of disease becoming apparent. In case of an outbreak, predators and scavengers can be expected to run a relatively high risk of being infected with H5N1 as they may selectively take diseased birds or bird carcasses.

For each species the risk of being infected with H5N1 was related to the estimated chance of taking waterbirds (HRS and associated species) and assessed as high (H), medium (M), low (L) and zero (O). Details are given in Annexes 2.1 and 2.2.

Tables 2.4 and 2.5 present all species which have been given a high or medium score with respect to the risk of virus spread related to preying or scavenging upon H5N1 infected waterbirds in freshwater habitat. The list of predators selected includes 12 raptor species. The list of scavengers is composed of 6 raptor, 4 gull and 5 crow species.

Table 2.4. *Higher Risk Species, i.e. species posing a higher risk of spreading H5N1 further once it has been introduced into the EU, as identified on the basis of the frequency of their taking freshwater birds as prey throughout the year. The selection includes species with risk scores medium (M) and high (H) only.*

English name	Scientific name	Risk
Black Kite	*Milvus migrans*	M
White-tailed Eagle	*Haliaeetus albicilla*	H
Eurasian Marsh Harrier	*Circus aeruginosus*	M
Northern Goshawk	*Accipiter gentilis*	M
Eurasian Sparrowhawk	*Accipiter nisus*	M
Greater Spotted Eagle	*Aquila clanga*	M
Imperial Eagle	*Aquila heliaca*	H
Golden Eagle	*Aquila chrysaetos*	M
Lanner	*Falco biarmicus*	H
Saker	*Falco cherrug*	H
Gyr Falcon	*Falco rusticolus*	H
Peregrine Falcon	*Falco peregrinus*	H

Table 2.5. *Higher Risk Species, i.e. species posing a higher risk of spreading H5N1 further once it has been introduced into the EU, as identified on the basis of the frequency of their taking dead freshwater birds for food throughout the year. The selection includes species with risk scores medium (M) and high (H) only.*

English name	Scientific name	Risk
Black Kite	*Milvus migrans*	H
Red Kite	*Milvus milvus*	M
White-tailed Eagle	*Haliaeetus albicilla*	M
Golden Eagle	*Aquila chrysaetos*	M
Common Buzzard	*Buteo buteo*	M
Rough-legged Buzzard	*Buteo lagopus*	M
Lesser Black-backed Gull	*Larus fuscus*	M
Yellow-legged Gull	*Larus michahellis*	M
Herring Gull	*Larus argentatus*	M
Great Black-backed Gull	*Larus marinus*	M
Black-billed Magpie	*Pica pica*	M
Eurasian Jackdaw	*Corvus monedula*	M
Carrion Crow	*Corvus corone*	M
Hooded Crow	*Corvus cornix*	M
Common Raven	*Corvus corax*	H

It should be noted that the predators listed can be expected to be especially at risk of being infected by H5N1 because of their feeding behaviour. It is not likely that they play a prominent role in further spreading the disease because most of them are largely non-gregarious. Most species listed in Table 2.4 are solitary or live in pairs for most of the year, although flocking may occur during migration and roosting (e.g. Black Kite). A completely different situation holds for most of the scavengers listed in Table 2.5. All gulls selected are highly gregarious as they breed in colonies and usually make use of large roosts throughout the year. Rook and Jackdaw are colonial breeders as well and all corvids selected may gather in large mixed species roosts outside the breeding season.

2.4.6 Bridge species

Bridge species are defined as bird species which bridge the gap between outbreaks of H5N1 among wild birds and the human environment (human settlements, poultry farms) or vice versa. Bridge species need to fulfil two conditions: (1) that they have a relatively high chance of getting infected with and spreading H5N1, and (2) that they have a relatively high chance of coming into contact with humans and/or poultry. In the previous section we have selected wild bird species which, for a number of reasons, should be regarded as posing a relatively high risk with respect to the introduction and spread of H5N1 in the European Union. These HRS thus fulfil the first condition. In order to study which bird species fulfil the second condition, all species subject to study in this project have been considered with respect to their contact *risk with humans* and their contact *risk with poultry*. Both factors were assessed as high (H), medium (M), low (L) or zero (O). Details of the criteria underlying the assessment are given in Annex 2.1.

Table 2.6 presents all HRS identified earlier which also have an assessed high (H) or medium (M) risk of coming into contact with humans and/or poultry. The results show that 10 HRS are also selected as Bridge Species because they pose a relatively high risk of spreading H5N1 to poultry, one species appears to pose a relatively high risk of spreading H5N1 to humans, and 18 species appear to pose a relatively high risk of spreading H5N1 to both humans and poultry (see codes given in bold). More detailed information is given in Annexes 2.4 and 2.5 in which complete lists are presented of bird species with a positive score (H, M or L) for contact risk with humans and poultry

2.4.7 Population size and H5N1 infections in the wild

The threat posed by a particular bird species with respect to the risk of introducing and spreading H5N1 into the EU (and similarly into each individual country) can be expected to be related to the number of individuals of that species present and, in case of a migratory species, the length of its stay. Table 2.7 gives a combined overview of all HRS identified above. For each species the estimated size of the breeding and non-breeding populations for the EU (27 countries, as of May 2007) have been added, as well as whether a species has been found carrying H5N1 in the wild (all found dead). The table shows marked differences with numbers varying between 0 (Pink-footed Goose and others) and 62,000,000 (Chaffinch) for breeding populations (note numbers are in pairs) and between 30 (Crested Coot) and 3,000,000 (Mallard) for wintering populations (note numbers refer to individuals). Numbers given here are different from those presented in Table 2.5 of the report of phase 1 of this project. The numbers given in the phase 1 report referred to the bio-geographic populations of the various species including Europe. These figures may differ from those given here, as they may include large parts of Russia. The present figures are a better representation of the situation in the EU. Moreover, for a number of species they give insight into the presence in the EU in different seasons (breeding and wintering populations).

There are several HRS which have been found infected with H5N1 in the wild, most of which are from Europe during the outbreaks in the winter 2005-2006. If waterbird HRS and non-waterbird HRS are considered separately, it appears that a higher proportion of the first (18 out of 48 = 38%) as compared to the latter (7 out of 34 = 21%) have been confirmed as carrying H5N1. In both groups H5N1 provenance is far greater than in the species not selected as being of higher risk (15 out of 229 = 7%).

Table 2.6. *Bridge Species, i.e. HRS that also pose a higher risk of spreading H5N1 from wild birds to humans and/or poultry, as identified on the basis of an assessment of the frequency of their contacts with humans and/or poultry (frequency H high or M medium). Coding for HRS refers to the HRS-categories identified in the earlier sections of this chapter and is as follows: M = migratory birds, n-M = non-migratory birds, C = colonial breeding birds, S = scavengers. See also Annexes 2.4 and 2.5.*

English name	Scientific name	Contact humans	Contact poultry	HRS
Cattle Egret	*Bubulcus ibis*	**M**	**H**	M,C
Grey Heron	*Ardea cinerea*	L	**M**	C
White Stork	*Ciconia ciconia*	**H**	**M**	M,C
Mute Swan	*Cygnus olor*	**M**	**M**	M
Greater White-fronted Goose	*Anser albifrons albifrons*	L	**M**	M
Greylag Goose	*Anser anser*	L	**M**	M
Greater Canada Goose	*Branta canadensis*	**M**	L	n-M
Eurasian Wigeon	*Anas penelope*	0	**M**	M
Common Teal	*Anas crecca*	0	**M**	M
Mallard	*Anas platyrhynchos*	**M**	**H**	M
Common Coot	*Fulica atra*	L	**M**	M
Northern Lapwing	*Vanellus vanellus*	0	**M**	M
Black-headed Gull	*Larus ridibundus*	**M**	**H**	M,C
Stock Dove	*Columba oenas*	L	**H**	n-M
Common Wood Pigeon	*Columba palumbus*	**M**	**H**	n-M
Eurasian Collared Dove	*Streptopelia decaocto*	**H**	**H**	n-M
Barn Swallow	*Hirundo rustica*	**H**	**M**	C
Fieldfare	*Turdus pilaris*	L	**M**	n-M
Redwing	*Turdus iliacus*	L	**M**	n-M
Black-billed Magpie	*Pica pica*	**M**	**H**	S
Eurasian Jackdaw	*Corvus monedula*	**H**	**H**	n-M,S
Rook	*Corvus frugilegus*	**M**	**M**	n-M,C
Carrion Crow	*Corvus corone*	**M**	**M**	S
Hooded Crow	*Corvus cornix*	**M**	**M**	S
Common Starling	*Sturnus vulgaris*	**H**	**H**	n-M
Spotless Starling	*Sturnus unicolor*	**H**	**H**	n-M
House Sparrow	*Passer domesticus*	**H**	**H**	n-M
Spanish Sparrow	*Passer hispaniolensis*	**H**	**H**	n-M
Chaffinch	*Fringilla coelebs*	**M**	**M**	n-M

2.5 Discussion and conclusions

The aim of the present analysis of *wild bird species which pose a relatively high risk of spreading Highly Pathogenic Avian influenza in the European Union* builds on the earlier analysis presented in the phase I report. This earlier analysis focused on a limited number of wild bird species (representatives of the Anseriformes and Charadriiformes) supposed to have the potential to spread H5N1 along their migration routes, thus being able to introduce the virus into the European Union. This analysis was felt to be incomplete because many wild bird taxa relevant for the spread of H5N1 were not included. We therefore decided to refine our analysis by including a further 11 bird orders, and to identify Higher Risk Species with respect to the *further* spread as well as the *introduction* into Europe, taking into account seasonal aspects and a number of additional risk factors. The refined analysis has led us to identify the following categories of wild Higher Risk Species. In presenting these categories, however, we emphasise that the results of our analysis say nothing about the likelihood of wild birds as opposed to domestic birds transferring H5N1 to (other) domestic birds or humans.

Group A: HRS with respect to the *introduction and spread* of H5N1 into the European Union in the *migration and wintering period*. The species are selected on the basis of being migratory (passing EU borders), using freshwater and/or agricultural habitat, being highly gregarious and having a high degree of mixing. The HRS thus identified are all waterbirds (Table 2.1);

Group B: HRS with respect to the *spread* of H5N1, once the virus has been introduced to the European Union. The focus is on the *winter period* (more precisely, the migration and wintering period of the above mentioned category). Species are selected on the basis of being "non-migratory" (residents or mainly migrating within EU), using freshwater and/or agricultural habitat, being highly gregarious and mixing to a high degree with other bird species. A diverse set of waterbirds and terrestrial species are thus identified as HRS (Table 2.2)

Group C: HRS with respect to the *spread* of H5N1 in the European Union in the *breeding period*. Species are selected on the basis of habitat and aspects of colonial breeding, resulting in a set of HRS which mainly consists of migratory and non-migratory waterbirds (Table 2.3).

Table 2.7. *Combined list of the 82 HRS identified in the present study. Different groups of HRS are indicated by crosses. Bridge species have been indicated with H (risk of infection of humans) and P (idem for poultry). Breeding population size (minimum and maximum) is given in pairs. Winter population (minimum unless stated) is given in individuals (Birdlife data base of European birds). In case no data are available (species absent or no reliable data available) a dash has been inserted. The table also indicates whether a species has been found dead in the wild carrying H5N1 in Europe and worldwide. In case a species has only been found carrying H5N1 outside Europe, the cross has been put in brackets. Three species which were included as confirmed H5N1 carriers in Table 2.6 of the report of the first phase of this project (Delany et al. 2006) have now been excluded, because new information shows the cases concerned refer to experimental birds (Common Teal) or to observations now regarded as unreliable (Garganey and Northern Shoveler).*

English name	Scientific name	Migr	Non-migr	Col	Pred	Scav	Bridge	Breeding pop. (pairs)	Winter pop. (individuals)	H5N1
Great Crested Grebe	*Podiceps cristatus*	X						160,000-240,000	140,000	X
Pygmy Cormorant	*Phalacrocorax pygmeus*	X		X				13,200-16,000	40,000	
Great Cormorant	*Phalacrocorax carbo*	X		X				170,000-180,000	270,000	(X)
White pelican	*Pelecanus onocrotalus*			X				3,550-4,100	-	
Dalmatian Pelican	*Pelecanus crispus*			X				950-1,230	-	
Black-crowned Night Heron	*Nycticorax nycticorax*			X				31,000-41,000	-	
Squacco Heron	*Ardeola ralloides*			X				8,000-10,200	-	
Cattle Egret	*Bubulcus ibis*	X		X			H P	50,000-140,000	60,000	
Little Egret	*Egretta garzetta*	X		X				44,000-61,000	-	X
Great White Egret	*Ardea alba*			X				3,400-5,100	-	
Grey Heron	*Ardea cinerea*			X			P	135,000-165,000	74,000	X
Purple Heron	*Ardea purpurea*			X				8,800-10,400	-	
White Stork	*Ciconia ciconia*	X		X			H P	110,000-120,000	-	X
Glossy Ibis	*Plegadis falcinellus*	X		X				3,110-3,590	-	
Eurasian Spoonbill	*Platalea leucorodia*	X		X				4,600-7,300	-	
Mute Swan	*Cygnus olor*	X					H P	69,000-93,000	230,000	X
Bewick's Swan	*Cygnus columbianus*	X						1	23,000	
Bean Goose	*Anser fabalis*	X						2,300-3,200	380,000	
Pink-footed Goose	*Anser brachyrhynchus*	X						0	290,000	
Greater White-fronted Goose	*Anser albifrons albifrons*	X					P	0	1,030,000	(X)
Lesser White-fronted Goose	*Anser erythropus*	X						0-5	174	
Greylag Goose	*Anser anser*	X					P	66,000-88,000	355,000	X
Greater Canada Goose	*Branta canadensis*		X				H	-	-	X
Barnacle Goose	*Branta leucopsis*	X						5,900-7,600	370,000	X
Brent Goose	*Branta bernicla*	X						0	240,000	
Red-breasted Goose	*Branta ruficollis*	X						0	24,000	X
Eurasian Wigeon	*Anas penelope*	X					P	70,000-120,000	1,600,000	
Common Teal	*Anas crecca*	X					P	220,000-360,000	570,000	
Mallard	*Anas platyrhynchos*	X					H P	1,800,000-3,000,000	3,000,000	X
Northern Pintail	*Anas acuta*	X						16,000-27,000	97,000	X
Garganey	*Anas querquedula*	X						17,000-28,000	-	
Northern Shoveler	*Anas clypeata*	X						30,000-38,000	140,000	
Marbled Teal	*Marmaronetta angustirostris*	X						30-210	220 max.	
Red-crested Pochard	*Netta rufina*	X						4,700-12,600	14,000	
Common Pochard	*Aythya ferina*	X						84,000-130,000	500,000	(X)
Tufted Duck	*Aythya fuligula*	X						180,000-290,000	980,000	X
Black Kite	*Milvus migrans*				X	X		30,000-44,000	-	
Red Kite	*Milvus milvus*					X		18,000-23,000	-	
White-tailed Eagle	*Haliaeetus albicilla*				X	X		1,500-1,700	3,600	
Eurasian Marsh Harrier	*Circus aeruginosus*				X			31,000-42,000	-	
Northern Goshawk	*Accipiter gentilis*				X			52,000-79,000	-	X
Eurasian Sparrowhawk	*Accipiter nisus*				X			150,000-220,000	-	
Greater Spotted Eagle	*Aquila clanga*				X			30-57	-	
Imperial Eagle	*Aquila heliaca*				X			112-145	-	
Golden Eagle	*Aquila chrysaetos*				X	X		4,300-4,800	-	
Common Buzzard	*Buteo buteo*					X		440,000-630,000	-	X
Rough-legged Buzzard	*Buteo lagopus*					X		2,500-9,000	55,000	X
Lanner	*Falco biarmicus*				X			140-200	-	
Saker	*Falco cherrug*				X			170-240	-	

Table 2.7. *Continued*

English name	Scientific name	Migr	Non-migr	Col	Pred	Scav	Bridge	Breeding pop. (pairs)	Winter pop. (individuals)	H5N1
Gyr Falcon	*Falco rusticolus*				X			110-170	-	
Peregrine Falcon	*Falco peregrinus*				X			7,500-8,900	-	X
Common Coot	*Fulica atra*	X					P	670,000-1,220,000	1,600,000	X
Crested Coot	*Fulica cristata*		X					80	30 max.	
Northern Lapwing	*Vanellus vanellus*	X					P	870,000-1,360,000	820,000	
European Golden Plover	*Pluvialis apricaria*	X						130,000-240,000	2,800,000	
Black-tailed Godwit	*Limosa limosa*	X						60,000-69,000	60.000	
Ruff	*Philomachus pugnax*	X						51,000-71,000	-	
Black-headed Gull	*Larus ridibundus*	X		X			H P	1,000,000-1,320,000	-	(X)
Common Gull	*Larus canus*	X						270,000-420,000	-	X
Lesser Black-backed Gull	*Larus fuscus*					X		240,000-260,000	-	
Yellow-legged Gull	*Larus michahellis*					X		230,000-420,000	-	
Herring Gull	*Larus argentatus*					X		500,000-590,000	-	
Great Black-backed Gull	*Larus marinus*					X		41,000-51,000	-	
Stock Dove	*Columba oenas*		X				P	470,000-650,000	-	
Common Wood Pigeon	*Columba palumbus*		X				H P	7,500,000-13,000,000	-	
Eurasian Collared Dove	*Streptopelia decaocto*		X				H P	2,500,000-5,900,000	-	
Sand Martin	*Riparia riparia*			X				970,000-2,360,000	-	
Barn Swallow	*Hirundo rustica*			X			H P	9,500,000-21,000,000	-	
Fieldfare	*Turdus pilaris*		X				P	2,500,000-4,900,000	-	
Redwing	*Turdus iliacus*		X				P	2,400,000-4,300,000	-	
Black-billed Magpie	*Pica pica*					X	H P	3,900,000-9,400,000	-	
Eurasian Jackdaw	*Corvus monedula*		X			X	H P	2,500,000-4,600,000	-	X
Rook	*Corvus frugilegus*		X	X			H P	2,500,000-3,800,000	-	
Carrion Crow	*Corvus corone*					X	H P	4,100,000-8,700,000	-	
Hooded Crow	*Corvus cornix*					X	H P			X
Common Raven	*Corvus corax*					X		160,000-270,000	-	
Common Starling	*Sturnus vulgaris*		X				H P	14,000,000-34,000,000	-	(X)
Spotless Starling	*Sturnus unicolor*		X				H P	2,100,000-3,100,000	-	
House Sparrow	*Passer domesticus*		X				H P	37,000,000-80,000,000	-	
Spanish Sparrow	*Passer hispaniolensis*		X				H P	1,200,000-3,700,000	-	
Chaffinch	*Fringilla coelebs*		X				H P	62,000,000-122,000,000	-	
Brambling	*Fringilla montifringilla*		X					1,500,000-4,500,000	-	

Group D: HRS with respect to the *spread* of H5N1 in the European Union, *year-round*, by predators and scavengers, which are likely to take diseased birds and bird carcasses. Species are selected on the basis of their likelihood of taking waterbirds for food. Two sets of HRS are thus identified: waterbird predators, which are all raptor species (Table 2.4), and waterbird scavengers, which consist of raptors, gulls and crows (Table 2.5).

Group E: Bridge species, i.e. HRS which may also spread H5N1 to humans and/or poultry (*year-round*). Species are selected on the basis of being HRS (groups above) as well as having a relatively high contact risk with humans and/or poultry.

The ways in which the various groups of HRS identified might contribute to the spread of H5N1 is illustrated in Figure 2.1. It should be stressed that Figure 2.1 gives a simplified and incomplete picture of possible H5N1 transmission routes. Here we fully concentrate on the possible mechanisms of spread through wild birds, ignoring the prominent role of trade of poultry and poultry products in the spread of avian influenza worldwide. We hypothesize that outbreaks caused by wild birds are most likely to start in wetlands where the virus is introduced by migratory species (group A above). Further spread is likely to take place by a variety of waterbirds, migratory and non-migratory, to neighbouring wetlands and agricultural habitat (groups B and C above). Both waterbirds and terrestrial bird species might play a role

in the spread of H5N1 to human habitation, poultry holdings in particular (group E above). In all cases the behaviour of a species is regarded as important with respect to its role in the spread of avian influenza. Factors supposed to facilitate spread are related to gregariousness and degree of mixing with other species. Moulting concentrations, social roosts and breeding colonies are thought to be of special importance in this respect.

Predators and scavengers (group D) are difficult to place in the figure, because they have been selected on the basis of highly specific behaviour. Raptor species (all predators and part of the scavengers selected) may run a higher risk of becoming infected than other species. However, they are not expected to play a prominent role in spreading H5N1 because most raptors are non-gregarious for most of their life. The same does not hold for the gulls and crows among the scavengers, most of which are gregarious when roosting and/or during their colonial breeding.

It should be stressed that the way in which our analysis has been carried out includes certain methodological weaknesses. These should be kept in mind when interpreting and using the results. Firstly, classifying aspects of behaviour and ecology has largely been done on the basis of expert judgement, simply because no appropriate data are available in the literature. As a rule, scoring the ecology and behaviour of a species (usually on a four-unit scale varying from 0 to high) was based on estimates made by at least 3 experts. In most cases good agreement was found between the scores provided by different experts, but there were also examples where marked disagreement occurred. This is due to a certain amount of interpretation in evaluation of each species, related to different personal experiences of the evaluators with a species and sometimes to geographical differences in species behaviour. The classifications made should therefore not be seen as absolute.

Secondly, the way in which we made our selections was rather rigid. As an example, HRS for the introduction and spread of H5N1 in the migration and wintering period were selected on the basis of habitat use, level of gregariousness and degree of mixing successively. According to our method, a species with habitat code FL (freshwater and littoral) was selected whereas a species with code LF was not. One might argue that the differences in habitat use by these species might be rather

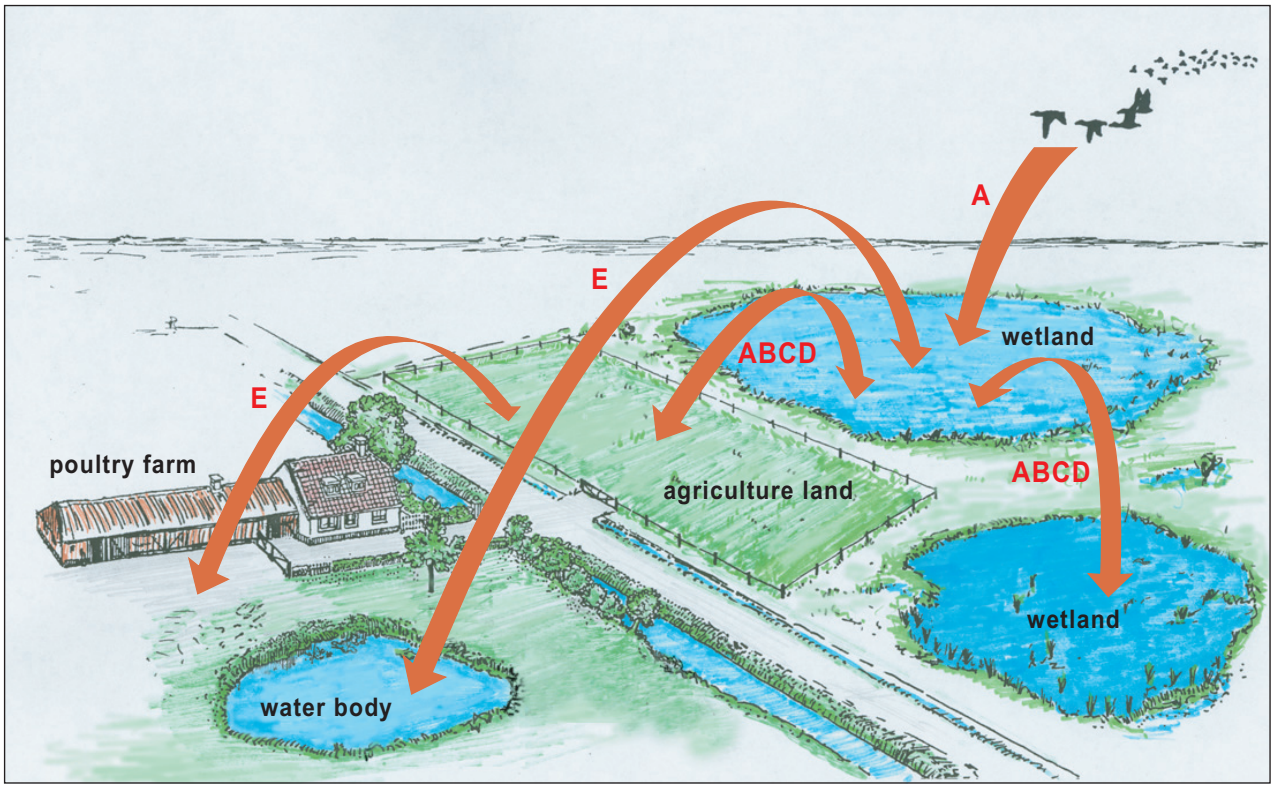


Figure 2.1. *Generalised diagram of the ways in which wild birds, as opposed to domestic birds, might spread H5N1. It should be stressed that the diagram is largely hypothetical, as there is hardly any scientific proof for most of the transmission routes suggested here. The underlying idea is that migratory waterbirds introduce H5N1 to wetland sites. Waterbirds (migrants and residents) may then spread the virus to other wetlands and to agricultural land habitat. Bridge species may further spread the virus to the human environment, poultry farms in particular. The risk of spread by a particular species is thought to be facilitated by a number of factors such as habitat choice, gregariousness (colonial breeding, roosting and moulting concentrations, etc.), degree of mixing with other species and specific behaviour such as predation and scavenging. Letters next to arrows refer to the groups of Higher Risk Species mentioned above.*

small. In the same way species scoring M (medium) for both gregariousness and mixing were selected, whereas a species scoring respectively H (high) and L (low) for these two factors, or L and H, was not. In such cases, too, one might argue that the differences between both species in terms of risk in relation to virus spread are questionable.

The above examples refer to marginal species which were just selected, or just not selected. In most cases, however, our analysis is expected to have resulted in an appropriate distinction between species with marked differences in behaviour and ecology relevant for the spread of H5N1. The proportion of HRS for which H5N1 has been confirmed in the wild (Table 2.7: waterbirds 38%, terrestrial species 21%) is far higher than for species not so identified (7%). This marked difference in H5N1 prevalence leads us to conclude that overall the species we identified as Higher Risk Species are indeed more likely to be infected with H5N1 than the non-selected species.

It should be stressed that the HRS were identified on the basis of species specific behavioural and ecological characteristics. This means, that an *individua*l belonging to a HRS can be expected to pose a higher risk of spreading H5N1 as compared to an *individual* belonging to a species not identified as such. In all cases, the risk that a species introduces or spreads H5N1 to a particular area is likely to be correlated with the number of individuals of that species present. The risk of a wild bird species spreading H5N1 should therefore always be considered in relation to a particular geographical area (country, site), taking the local (seasonal) abundance of that species into account.

Finally, it should be realised that the mechanisms of spread of H5N1 by wild birds are poorly understood, and that the proportion of wild birds carrying H5N1 seems to be extremely low. Up until now, within Europe and the United States, more than 300,000 wild birds have been sampled with respect to the presence of Avian Influenza viruses. There have been no, or very few, published and confirmed positives for H5N1 in individuals that appeared to be healthy, as opposed to in dead birds (pers. comm. FAO).

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Grey Heron

3 Bridge Species present at poultry farms in four countries

3.1 Introduction

In Chapter 2, higher risk species (HRS), with respect to the spread of avian influenza were identified on the basis of migratory, ecological and behavioural characteristics, as assessed from published literature or through expert judgement. Different categories of HRS were identified, among which were species that regularly occur near humans and/or poultry. In the same chapter we also identified a number of so called Bridge Species, being those that are seen as potential bridgers of the gap between sources of outbreaks of avian influenza among waterbirds in wetlands, and among poultry.

During the desk study on HRS and Bridge Species, direct information on the occurrence of wild birds near poultry proved to be scarce. It was therefore considered important to carry out a first, small-scale field check on the results of the desk study on Bridge Species. The results of such an exploratory study would give a first indication of the validity of the list of Bridge Species selected. It could also identify future directions for this research to take, and identify likely problems.

The field study consisted of collecting field data on the occurrence of wild bird species on or near different types of poultry farms, in different countries across Europe. Apart from realising a reasonable geographical spread over Europe, the choice of sites was also determined by the availability of observers able to do the fieldwork within the time frame of the project. It was because of this latter constraint that observations originally planned for the Ukraine were eventually done in Turkey. Although Turkey is just to the south-east of the geographical area defined for this study, it has experienced avian influenza problems in the recent past and contains poultry rearing enterprises of various scales. The field studies were therefore carried out in a standardised way in E England, N Germany, N Italy and Central Turkey.

3.2 Observation methods

In each country 8 to 10 farms were selected for study. The selections each to include in each country:
- intensive chicken farms, with large numbers of birds kept indoors
- smaller scale “backyard” or free-range farms, with smaller numbers of birds spending some time out doors
- if appropriate, duck, goose and/or turkey farms of any type.

Observations had to be carried out during the first half of 2007. In order to be able to observe different categories of birds, fieldwork was carried out both in late February – early March (for sedentary birds and wintering birds), and in late April – early May (for sedentary birds and most of the migratory breeding birds).

For each farm general information was collected with respect to:
- name and address of farm
- land area of farm and geographical coordinates
- type of farm, number of poultry kept and farming method
- presence of and distance to wetlands near farm.

Wild birds were observed as follows. At each farm, eight sets of observations lasting 5 minutes were made. Four of these were within 50m of the main farm buildings, and four at least 50m from the buildings, scanning away from them for a distance of up to 500m. The vantage points used for these observations were marked on a sketch map of the farm and its surroundings.

In addition to date, time of day and weather conditions, the following data were recorded:
- birds (species and number) present at farm or within a distance of 50 m
- birds (species and number) present near farm at distance of 50-500 m
- birds (species and number) flying over farm within 50 m
- birds (species and number) flying over farm at a distance of 50-500 m
- name of species, number seen to feed, type of food taken
- name of species, number seen to defaecate, distance from farm buildings
- name of species, number seen within 5 m of poultry
- details of all interactions between wild birds and poultry

See Annexes 3.1 and 3.2 for the protocol and recording form used.

3.3 Analysis of the data

The data obtained in February-March and in April-May were analysed separately. Because many species were seen in very small numbers, we reduced our data on bird presence by selecting
- the ten species of which the most individuals were seen in a particular country during a particular observation period
- the species seen at <50 m and/or >50 m from the poultry enclosures on 50% or more of the farms in a particular country during a particular observation period.

The results from different countries were then compared with each other and with the list of Bridge Species as identified in Chapter 2.

Data from second visits to farms (recording birds present during the breeding season) were analysed in a similar

fashion. Data on presence on wetlands on farms, presence within 5 m of poultry enclosures, interaction of wild birds with poultry, and defecation, were analysed in their entirety.

3.4 Information on the farms visited

There was great variation in the type of farms visited, poultry housing and poultry feeding, both within and between countries. There also was great variation between farms with respect to size, type and distance from wetlands. General farm locations are shown in Fig. 3.1. Data on farm types and observation dates are summarised in Table 3.1. For reasons of confidentiality precise details of individual farms are not presented.

In the UK the one intensive chicken farm had 269,000 chickens. The six extensive, free range egg producing farms still had between 8,000 - 32,000 chickens. Only the extensive farm that produced both free range eggs and meat held but 2,500 chickens. Several farms only had the chickens, the others also grew crops.

In Germany the four chicken farms selected generally had somewhat lower numbers of birds than in the UK: 2,800-20,000, one farm 84,000. More importantly, in Germany the birds at these farms were all kept indoors, as opposed to the mostly free range farms in the UK. One mixed organic farm had only 800 chickens, free range, and usually a few hundred geese. One farm only traded in chickens, had only 450 birds, and was intermediate between extensive and intensive. Birds at that farm partly ranged in outside aviaries. The remaining two farms focussed on turkeys: each had about 8,000 birds, all inside.

In Italy four of the farms were holiday farms receiving guests, two were mixed family farms, and two were private houses with a bit of land. At all of these only small numbers of birds were kept, usually less than 100, outside much of the time and of different species (chickens, ducks, geese, guineafowl, ostriches and others). There was one intensive turkey farm for meat (8,400 birds) monitored in Italy, and one intensive chicken farm with 21,000 laying hens.

In Turkey, as in Italy, there were some small mixed farms and one home with some land, all with less than 100 birds of different species (chickens, geese, turkeys, pigeons). There were three intensive chicken farms of 8,000-22,000 birds for meat or eggs, and one very big one with 300,000 birds for meat. In addition there was one turkey farm with 1,200 birds for meat, contracted by a large producer. And there was one lakeside restaurant with ten domestic geese.

Average farm size was greatest in Germany (67 ha) and the UK (59 ha), smallest in Turkey (7.5 ha) and intermediate in Italy (33 ha; mostly due to one large farm of 210 ha, otherwise the average in Italy would have been 12 ha).

For the farms selected, chances of contact between wild birds and domestic birds would appear to have been greatest in the UK (many large farms with large numbers of chickens outside part of the day), then in Italy (many farms with small numbers of birds outside part of the day), then in Turkey (a smaller proportion of farms with small numbers of birds outside part of the day). For the selected farms in Germany chances of contact would appear to have been lowest: only one farm with a (moderate) number of birds outside.

The selected farms in the UK and Italy also most often had a wetland within 1 km. In those countries a wetland was present within 1 km in almost all the cases, vs. in only one-third to one-half the cases in Turkey and Germany.

Table 3.1. *General information on the farms visited*

Country	Germany	Italy	Turkey	UK
first observation period	7/3 - 10/3	28/2 - 1/3	12/3 - 20/3	6/3 - 9/3
number of farms visited	8	10	10	8
second observation period	27/4 - 30/4	23/4 - 24/4	1/5 - 9/5	3/5 - 8/5
number of farms visited	8	10	9	8
farm size range (ha)	1-260	0.1-210	0.2-30	2.5-350
farm size average (ha)	67	33	7.5	59
intensive farms	6	2	5	1
extensive farms	1	7	5	7
farms with poultry indoors	6	2	2	1
farms with poultry outdoors	4	7	4	7
farms with poultry fed inside	?	?	?	3
farms with poultry fed outside	?	?	?	4
species of poultry kept*	C T	C G D T	C G D T	C
number of poultry (range)	450 – 84,000	40 – 84,000	20 – 300,000	2,500 – 269,000
farms with wetlands within 1 km	4	9	3	8
large wetlands at 1-10 km	4	4	2	7

* C=chicken, G=geese, D=ducks, T=turkeys

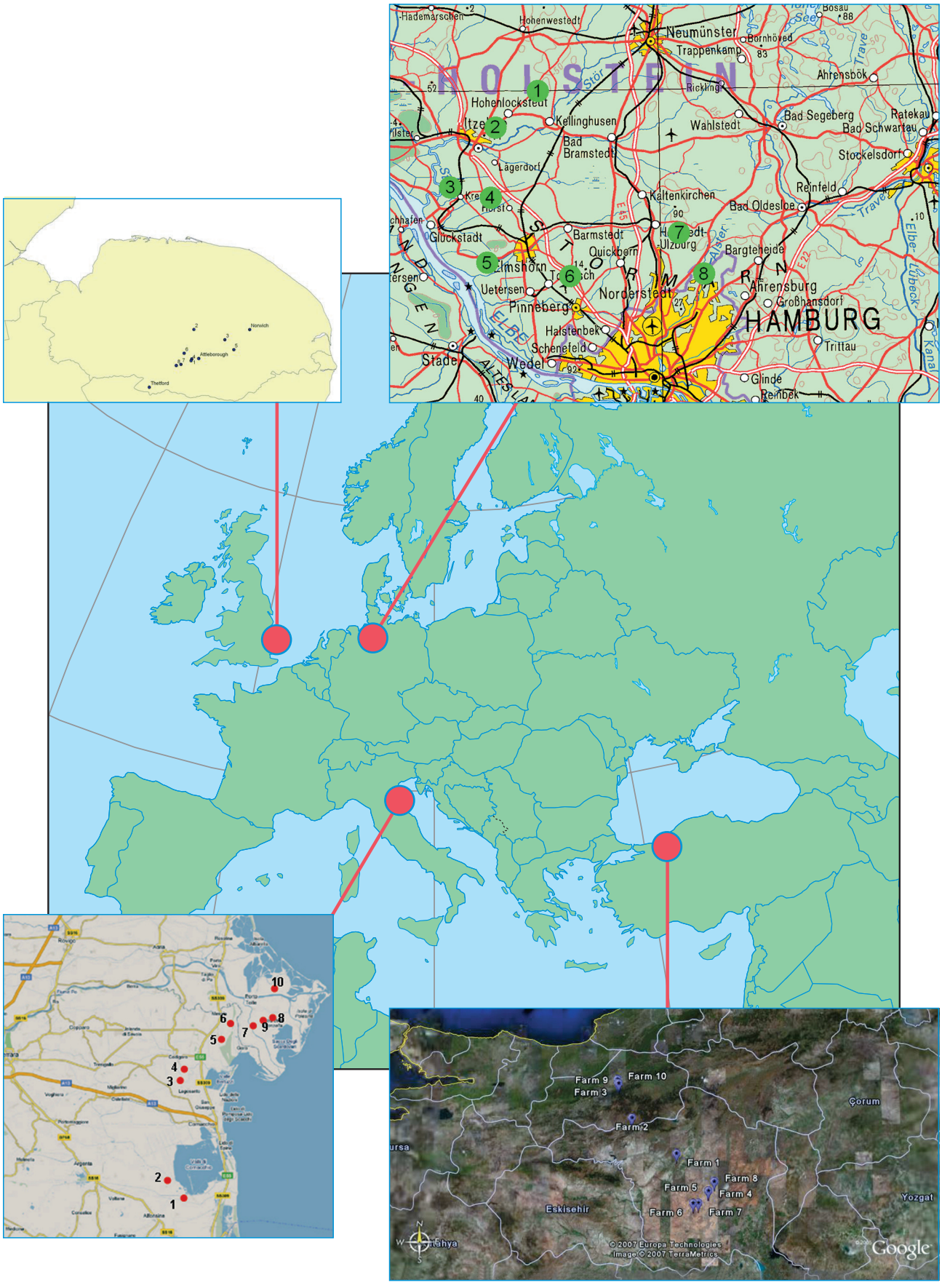


Figure 3.1. *Locations of farms in the United Kingdom, Germany, Italy and Turkey, where field observations were conducted.*

3.5 Results

3.5.1 Total numbers of species and of birds observed

A summary of numbers of species and numbers of birds seen near poultry farms in the different countries in presented in Table 3.2.

In all countries together 7134 birds of precisely 100 species were recorded in February-March (winter), and 4048 birds of 128 species in April-May (spring). *Bird* numbers *de*creased from winter to spring, not only overall but also in each individual country (though not so markedly in Turkey). *Species* number *in*creased from winter to spring, overall and in each country except Germany. Also striking is that the proportion of birds observed within 50 m of the poultry enclosures increased greatly from winter to spring, in all countries except Turkey.

Allowing for differences in average size of the farms selected for fieldwork in the four countries, these patterns can in part be explained by the fact that the fieldwork in Germany, Italy and the UK took place in regions where winter migrants congregate in considerable numbers, especially further away from the poultry enclosures. When the winter migrants leave and the summer migrants come and occupy their territories, the number of species increases but bird numbers (bird density) go down, especially further away from the farm buildings. It should be kept in mind, however, that differences in detectability may also have played a role: differences within individual species between winter and spring, as well as differences between winter migrants and summer migrants.

The fieldwork region in Turkey was further inland and in less of a winter migrant area, leading to a lesser difference in bird numbers between winter and spring, and a relatively great increase in bird species (38 in winter to 56 in spring).

3.5.2 Species abundance

Overall 153 species were observed in February-March and April-May combined. A full list of all the species observed, including scientific names, and totals per country per count date, are given in Annex 3.3.

The maximum number of individuals for a species in a single country in February-March was 1143, for the Wood pigeon in the UK. It made up almost half of the total number of birds observed at the eight farms in that country. The largest number for one species in one country in spring was also in the UK, with 397 Rooks.

For the purpose of the analysis of abundance and frequency of occurrence across the four countries, the following pairs of allotaxa with complementary distributions were lumped:

- Rock Dove (TR)/Feral Pigeon (DE, IT, UK);
- White Wagtail (DE, IT, TR)/Pied Wagtail (UK);
- Carrion Crow (DE, TR, UK)/Hooded Crow (IT, TR);
- House Sparrow (DE, TR, UK)/Italian Sparrow (IT).

To facilitate our analysis and not be distracted by those species of which only a couple of individuals were seen in a particular country, we selected for each country the top-10 most numerous species during each observation period, unless their numbers were 4 or less (i.e. less than 0,5 birds on average per farm for a particular country). The results are presented in Table 3.3.

One third of the species observed, i.e. 51 species and species pairs, figured at least once in the top 10 of the total counts in a country during winter or spring, at <50 m from poultry enclosures, at >50 m from poultry enclosures, or for these two distance classes combined. Almost half of these, 23, figured in the top 10 4 times or more. The following species and species pairs were in the top 10 at least once in three or four countries: Black-headed Gull, Feral Pigeon/Rock Dove, Barn Swallow, Carrion Crow/Hooded Crow, Starling, House Sparrow/Italian Sparrow, Tree Sparrow and Chaffinch. Many species were in the top ten in only one country, sometimes during both the winter and the spring observation period.

Table 3.2. *Species and number of birds seen near poultry farms in the four countries.*

Country		farms	species	birds (n) <50m	birds (n) >50m	birds (n) total	
Germany	Feb-Mar	8	50	421	1204	1625	
	Apr-May	8	45	307	351	658	
Italy	Feb-Mar	10	44	418	1546	1964	
	Apr-May	10	52	408	522	930	
Turkey	Feb-Mar	10	38	581	434	1015	
	Apr-May	9	56	583	362	945	
UK	Feb-Mar	8	53	920	1610	2530	
	Apr-May	8	61	1303	212	1515	
Total	Feb-Mar	**36**	**100**	**2340**	**4794**	**7134**	
	Apr-May	**35**	**128**	**2601**	**1447**	**4048**	

Table 3.3. *Total numbers of individuals of various bird species observed, per distance class - country -observation period. All the totals that belong to the top 10 for a distance class, country, observation period combination, are marked in grey. Bridge species identified in Chapter 2 are indicated in the final column. Other species that should perhaps also be considered as higher risk Bridge Species (≥4x in top 10) are marked with a '?' in that column.*

	February–March												April–May															
	DE			IT			TR			UK			DE			IT			TR			UK			times in top-10 in winter	times in top-10 in spring	times in top-10 in winter and spring	selected as higher risk bridge species
	total <50m	total >50m	grand total	total <50m	total >50m	grand total	total <50m	total >50m	grand total	total <50m	total >50m	grand total	total <50m	total >50m	grand total	total <50m	total >50m	grand total	total <50m	total >50m	grand total	total <50m	total >50m	grand total				
Cattle Egret					25	25										0	15	15							2	1	3	BS
Whooper Swan		23	23																						1		1	
Egyptian Goose																						0	8	8		1	1	
Shelduck										4	6	10										0	2	2	1		1	
Mallard		6	6		25	25				6	1	7	1	9	10	2	11	13	0	5	5	3	6	9	2	2	4	BS
Tufted Duck											10	10										0	16	16	1	1	2	
Red-legged Partridge										2	6	8										3	3	6	1		1	
Moorhen				15	8	25				3	3	6	2	0	2	0	8	8	0	1	1	0	1	1	2		2	
Coot							65	4	69		4	4	0	1	1	0	5	5	67	0	67	0	4	4	2	2	4	BS
Black-winged Stilt																0	15	15								1	1	
Golden Plover		600	600																						2		2	
Lapwing	3	16	19		25	25					4	4	0	5	5							1	10	11	2	1	3	BS
Ruff																0	40	40								2	2	
Mediterranean Gull																0	33	33								2	2	
Black-headed Gull		17	17	2	41	43		31	31	15	459	474				0	5	5				0	2	2	6		6	BS
Common Gull		92	92																						2		2	
Yellow-legged Gull				2	123	125										0	38	38							2	2	4	?
Rock Dove/Feral Pigeon	27	4	31	79	107	186	150	149	299	7		7	12	3	15	58	23	81	15	12	27	22	2	24	7	7	14	?
Wood Pigeon	3	9	12							361	782	1143	7	22	29	0	4	4				175	37	212	3	5	8	BS
Collared Dove	1		1	21	15	36	3	2	5	6		6	4	0	4	21	14	35	1	8	9	6	0	6	2	3	5	BS
Cuckoo																0	3	3				0	6	6		1	1	
Swift																0	4	4	0	32	32	52	4	56		4	4	?
Calandra Lark								11	11										2	18	20				1	2	3	
Crested Lark							10	11	21							0	1	1	2	8	10				3	2	5	?
Skylark		7	7		2	2				47	5	52	0	13	13				0	1	1	32	5	37	2	4	6	?
Sand Martin																			0	9	9	1	0	1		1	1	
Barn Swallow													55	14	69	15	16	31	272	36	308	21	0	21		9	9	BS
House Martin																						50	2	52		2	2	
Yellow Wagtail	39	14	53					1		4		5	0	1	1	3	8	11	2	4	6				2		2	
White/Pied Wagtail	15	9	24		4	4	15	12	27	17	3	20	21	10	31							15	0	15	4	2	6	?
Wren													2	3	5							32	5	37		3	3	
Blackbird	10	9	19		7	7	1	2	3	39	3	42	15	19	34	0	2	2	0	1	1	69	7	76	2	6	8	
Fieldfare										1	109	110													2		2	
Songthrush													1	1	2							5	5	10		1	1	
Blackcap													11	18	29	1	4	5	0	1	1	3	1	4		3	3	
Chiffchaff													6	33	39							5	1	6		2	2	
Willow Warbler													0	13	13				4	1	5	7	1	8		2	2	
Blue Tit	15	22	37		1	1		2	2	29		29	11	10	21							10	2	12	4	1	5	?
Great Tit	18	20	38		2	2		3	3	28	3	31	7	12	19	1	4	5	4	4	8	17	1	18	4	1	5	?
Magpie				3	24	27	22	44	66	11	2	13	0	1	1	2	16	18	1	25	26	5	0	5	5	5	10	BS
Jackdaw		24	24				36		36	81	3	84							0	5	5	153	10	163	5	3	8	BS
Rook		5	5					7	7	66	96	162										372	25	397	3	3	6	BS
Carrion/Hooded Crow	13	137	150		19		2	10	12	20	23	43	5	24	29	0	7	7	0	1	1	13	3	16	8	2	10	BS
Starling	136	3	139	3	973	976	59	8		3	32	35	31	14	45	12	58	70	24	13	37	52	2	54	8	11	19	BS
House/Italian Sparrow	65	24	89	272	75	347	203	58	261	9		9	46	23	69	265	110	375	168	84	252	0	2	2	9	9	18	BS
Tree Sparrow	22	37	59	11	6	17	7	1	8				15	9	24	16	7	23	2	0	2				5	3	8	?
Chaffinch	12	34	46	4	1	5	2	15	17	49	10	59	20	39	59							60	4	64	6	5	11	BS
Greenfinch	15	12	27							23	3	26	7	10	17							30	4	34	2		2	
Goldfinch	3	3	6	1	1	2	1	17	18	8	4	12	0	4	4	3	3	6	4	4	8	2	0	2	2	2	4	?
Linnet													12	8	20							0	3	3		1	1	
Corn Bunting							1	10	11							0	1	1	1	21	22				1	2	3	

Table 3.4. *Number of farms that species were observed at, per distance class, country and observation period. Includes only those species that were observed on ≥50% of the farms for at least one distance class – country - observation period combination; the cells concerned are marked in grey. Bridge Species are indicated in the final column. Other species that should perhaps also be considered as higher risk bridge species (≥4x on ≥50% of the farms) are marked with a '?' in that column.*

	February–March												April–May															
	DE			IT			TR			UK			DE			IT			TR			UK			times at ≥ 50% of farms in winter	times at ≥ 50% of farms in spring	times at ≥ 50% of farms in winter and spring	selected as higher risk bridge species
	<50m from farm	>50m from farm	all distances	<50m from farm	>50m from farm	all distances	<50m from farm	>50m from farm	all distances	<50m from farm	>50m from farm	all distances	<50m from farm	>50m from farm	all distances	<50m from farm	>50m from farm	all distances	<50m from farm	>50m from farm	all distances	<50m from farm	>50m from farm	all distances				
Mallard		2	2		7	7				4	1	5	1	3	3	1	4	5	0	1	1	3	2	6	4	2	6	BS
Buzzard		6	6		2	2		1	1				0	2	2										2		2	
Pheasant													0	2	2	1	3	4				4	2	5		2	2	
Moorhen				2	2	4				2	2	4	1	0	1	0	3	3	0	1	1	0	1	1	1		1	
Yellow-legged Gull				1	5	6										0	3	3							2		2	
Rock Dove/Feral Pigeon				4	3	6	7	7	8				2	1	2	5	4	6	4	2	6	2	1	2	4	3	7	?
Wood Pigeon	3	5	6							8	8	8	5	4	7	0	3	3				8	7	8	5	6	11	BS
Collared Dove	1		1	3	6	7	1	2	3	2		2	3	0	3	4	6	8	1	2	3	4	0	4	2	4	6	BS
Calandra Lark								6	6										2	4	5				2	1	3	
Crested Lark							4	6	7							0	1	1	2	4	5				2	1	3	
Skylark		4	4		2	2				4	3	6	0	3	3				0	1	1	6	3	7	4	2	6	?
Barn Swallow													6	5	7	6	3	8	4	6	8	2	0	2		7	7	BS
Meadow Pipit		2	2		4	4				4	1	4	0	1	1										2		2	
Yellow Wagtail													0	1	1	3	4	6	2	2	4					1	1	
White/Pied Wagtail	5	5	7		4	4	3	5	6	7	2	7	6	6	8							6	1	7	7	5	12	?
Wren	3	2	4		1	1				4	3	5	1	2	3							8	2	8	3	2	5	?
Dunnock													1	2	2							4	0	2		1	1	
Robin	2	1	3	2	2	4	2		2	7	2	7	0	1	1							3	1	4	2	1	3	
Nightingale																1	7	7	1	3	4					2	2	
Black Redstart													5	2	5											2	2	
Blackbird	5	5	7		7	7	1	2	3	7	3	7	7	7	8	0	2	2	0	1	1	8	3	8	7	5	12	?
Song Thrush	1	4	4							1	1	2	1	1	1							2	4	5	2	2	4	?
Redwing		1	1							4	1	5													2		2	BS
Cetti's Warbler				1	5	6		1	1							0	3	3	1	1	2				2		2	
Fan-Tailed Warbler																1	7	7								2	2	
Lesser Whitethroat													1	4	4							2	0	2		2	2	
Whitethroat													0	2	2	0	2	2	1	2	3	5	2	5		2	2	
Blackcap													5	6	7	1	3	3	0	1	1	3	1	4		4	4	?
Chiffchaff													5	8	8							3	1	4		4	4	?
Willow Warbler													0	5	5				1	1	2	2	1	3		2	2	
Long-tailed Tit	1		1							2	2	4										3	0	3	1		1	
Blue Tit	6	8	8		1	1		2	2	7		7	4	6	8							4	2	6	3	5	8	
Great Tit	6	6	7		2	2		1	1	8	2	8	4	6	7	1	4	5	2	4	6	5	1	5	5	7	12	
Magpie				2	8	8	3	7	7	6	2	6	0	1	1	2	8	10	1	5	5	4	0	4	6	6	12	BS
Jackdaw		3	3				1		1	4	3	5							0	3	3	5	1	5	2	2	4	BS
Rook		1	1					2	2	3	6	7										4	3	4	2	2	4	BS
Carrion/Hooded Crow	2	7	7		5	5	1	3	3	7	6	8	2	6	6	0	4	4	0	1	1	3	2	5	7	3	10	BS
Starling	5	2	5	1	5	5	3	2	4	2	3	4	5	4	7	5	4	6	4	4	8	3	1	3	5	6	11	BS
House/Italian Sparrow	5	3	6	8	4	10	7	7	9	2		2	7	4	7	10	9	10	5	4	9	0	1	1	6	7	13	BS
Tree Sparrow	5	4	7	4	2	5	1	1	2				3	3	5	3	6	6	1	0	1				2	3	5	?
Chaffinch	5	6	6	2	1	3	1	4	5	6	7	8	5	8	8							8	2	8	7	5	12	BS
Greenfinch	4	5	6							4	2	5	3	6	7							6	1	6	5	4	9	?
Goldfinch	1	1	1	1	1	2	1	4	4	4	2	4	0	2	2	3	2	5	1	1	2	1	0	1	2	1	3	
Linnet	2	3	4					1	1	1		1	3	4	6							0	1	1	1	2	3	
Yellowhammer	3	5	5					1		2		3	2	2	3							4	1	4	2	2	4	?
Ortolan Bunting																			1	5	6					2	2	
Corn Bunting																0	1	1	1	5	5					2	2	

3.5.3 Species present at a large number of farms
Table 3.4 gives an overview of the 47 species and species pairs observed in one or more distance classes during one of the observation periods at 50% or more of the farms visited in one or more countries (4 or more farms in the UK and Germany, 5 or more in Turkey and Italy). Of these species and species pairs, almost half, 24, were observed at ≥50% of the farms 4 times or more. The following species and species pairs were observed at ≥50% of the farms at least once in three or four countries: Barn Swallow, Blackbird, Great Tit, Magpie, Carrion Crow/Hooded Crow, Starling, House Sparrow/Italian Sparrow and Chaffinch.

3.5.4 Breeding species general
An overview of all breeding data is presented in Table 3.5. A total of 95 species and species pairs was observed to be definitely, probably or possibly breeding, on or near the selected farms in the four countries. The total number of breeding cases for the German, Italian and Turkish farms was 1329. On the UK farms breeding was only noted at the species level (all 61 species observed to be present in spring), not at the individual case level.

In Germany all definite, probable and possible breeding cases were noted, separately at <50 m and at >50 m from the poultry enclosures. Of the 45 species observed in spring 42 were noted as definite, probable or possible breeders, giving rise to 381 cases.

In Italy all probable breeding cases were registered, with no further subdivison. Breeding was considered probable for 28 of the 52 species observed in spring, with a total of 624 cases.

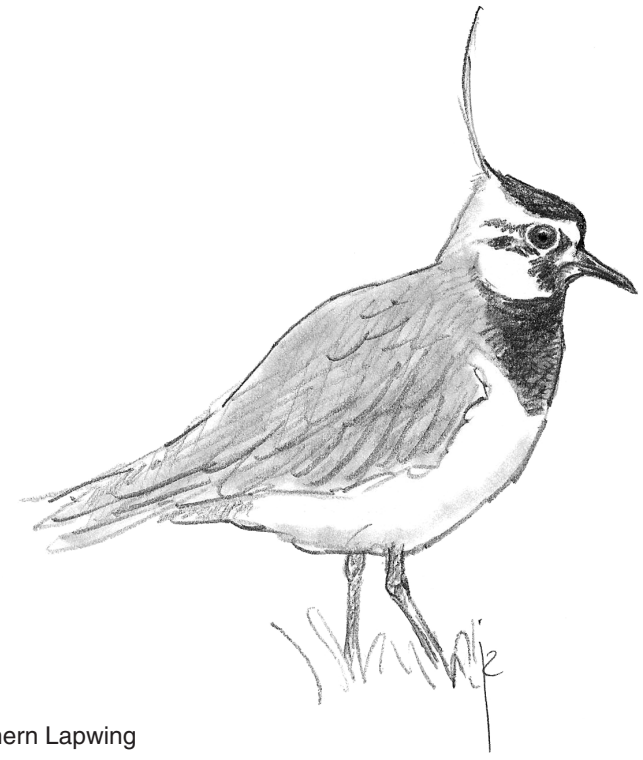
In Turkey all potential breeding cases were noted, with no further subdivison. The total of 324 cases involved 36 of the 58 species observed in spring.

In Italy and Turkey there were apparently still quite a few local or long-distance migrants present in the breeding season, hence the lower percentage of species present for which probable or potential breeding cases were noted, in comparison with Germany and the UK.

3.5.5 Breeding abundance
Of the 95 breeding species and species pairs, 31 figured at least once in the top 10 of most numerous breeders, for a country-distance combination. Only six of these figured in the top 10 four times or more. Only Barn Swallow, Starling and House Sparrow/Italian Sparrow did so in all three countries for which there are detailed data (Germany, Italy and Turkey), and Rock Dove/Feral Pigeon, Nightingale and Magpie in two out of three countries.

3.5.6 Species present at a large number of farms
Table 3.6 gives an overview of the 24 species and species pairs considered to be breeding at 50% or more of the farms surveyed in one or more of the distance class-country combinations countries (4 or more farms in Germany; 5 or more in Turkey and Italy; no data available for the UK).

Of these species and species pairs, Barn Swallow, Starling and House/Italian Sparrow, probably bred at ≥50% of the farms in all three countries with data (Germany, Italy and Turkey). Rock Dove/Feral Pigeon, Magpie and Tree Sparrow did so in two of the three countries.



Northern Lapwing

Table 3.5. *Total number of breeding cases noted around the 8-10 farms in each country in spring 2007. All the totals that belong to the top 10 for a distance class – country - observation period combination, are marked in grey. Bridge species are indicated in the final column.*

	DE			IT			TR			UK		
	total 0-50 m	total 50-500 m	grand total 0-500 m	Potentially breeding <50 m	Potentially breeding 50-500 m	Potentially breeding total	Potentially breeding <50 m	Potentially breeding 50-500 m	Potentially breeding total	Potential breeder	times in top-10	selected as higher risk bridge species
Little Grebe										y		
Great Crested Grebe							0	2	2			
Mute Swan										y		
Greylag Goose										y		
Canada Goose										y		
Egyptian Goose										y		
Shelduck										y		
Gadwall										y		
Mallard	0	4	4	0	4	4				y		BS
Garganey							0	1	1			
Tufted Duck										y		
Kestrel	0	1	1	0	2	2				y		
Red-legged Partridge										y		
Grey Partridge										y		
Quail							0	4	4			
Peacock										y		
Pheasant	0	2	2	0	5	5				y		
Moorhen	0	1	1	0	8	8	0	1	1	y	2	
Coot	0	1	1				0	30	30	y	2	BS
Oystercatcher	0	1	1							y		
Little Ringed Plover										y		
Lapwing	0	3	3							y		BS
Black-headed Gull										y		BS
Herring Gull										y		
Rock Dove/Feral Pigeon				61	2	63	8	4	12	y	5	
Stock Dove										y		BS
Wood Pigeon	3	3	6	0	1	1				y		BS
Collared Dove	3	0	3	19	16	35	3	2	5	y	3	BS
Great Spotted Cuckoo							0	2	2			
Cuckoo				0	1	1				y		
Swift										y		
Kingfisher				0	1	1						
Hoopoe							0	6	6		1	
Syrian Woodpecker							0	1	1			
Calandra Lark							2	15	17		3	
Crested Lark							1	9	10		2	
Skylark	0	9	9				0	1	1	y	1	
Sand Martin										y		
Barn Swallow	22	3	25	9	19	28	10	15	25	y	8	BS
House Martin										y		
Meadow Pipit	0	2	2									
Yellow Wagtail				0	11	11	0	1	1		2	
White/Pied Wagtail	10	8	18							y	2	
Wren	1	3	4							y		
Dunnock	1	2	3							y		
Robin	0	1	1							y		
Nightingale				1	11	12	2	2	4		4	
Black Redstart	5	2	7								1	
Common Redstart	0	1	1									
Stonechat				0	2	2						
Isabelline Wheatear							0	2	2			
Wheatear							0	1	1			
Black-eared Wheatear							2	0	2		1	

Table 3.5. *Continued*

	DE			IT			TR			UK		
	total 0-50 m	total 50-500 m	grand total 0-500 m	Potentially breeding <50 m	Potentially breeding 50-500 m	Potentially breeding total	Potentially breeding <50 m	Potentially breeding 50-500 m	Potentially breeding total	Potential breeder	times in top-10	selected as higher risk bridge species
Blackbird	11	16	27	0	2	2	0	1	1	y	3	
Songthrush	1	1	2							y		
Mistle Thrush	0	1	1							y		
Cetti's Warbler				0	4	4						
Fan-Tailed Warbler				0	7	7						
Reed Warbler							0	1	1	y		
Great Reed Warbler				0	3	3						
Ea Olivaceous Warbler							0	3	3			
Lesser Whitethroat	1	2	3							y		
Whitethroat	0	2	2	0	3	3	1	4	5	y		
Garden Warbler										y		
Blackcap	8	16	24	0	5	5				y	3	
Chiffchaff	6	29	35							y	3	
Willow Warbler	0	11	11							y	1	
Goldfinch	0	1	1									
Goldcrest	2	0	2									
Long-tailed Tit										y		
Coal Tit							0	2	2			
Blue Tit	5	8	13							y	1	
Great Tit	4	11	15	0	5	5				y	2	
Short-toed Treecreeper	2	0	2									
Golden Oriole							0	1	1			
Jay				0	4	4				y		
Magpie	0	1	1	0	16	16	2	16	18	y	5	BS
Jackdaw							0	2	2	y		BS
Rook										y		BS
Carrion/Hooded Crow	1	9	10	0	5	5	0	1	1	y	1	BS
Raven	0	1	1									
Starling	8	7	15	7	15	22	11	7	18	y	8	BS
House/Italian Sparrow	18	16	34	215	140	355	69	40	109	y	9	BS
Spanish Sparrow							1	0	1			
Tree Sparrow	8	4	12	0	17	17	1	0	1		3	
Chaffinch	15	32	47							y	3	BS
Greenfinch	5	9	14							y	3	
Goldfinch				0	2	2	0	4	4	y		
Linnet	3	6	9							y		
Bullfinch										y		
Yellow Hammer	2	4	6							y		
Ortolan Bunting							1	6	7		2	
Reed Bunting	0	2	2									
Black-headed Bunting							0	1	1			
Corn Bunting				0	1	1	1	21	22		2	
no. of breeding species	24	39	42	6	28	28	15	33	36	61		
no. of breeding cases	145	236	381	312	312	624	115	209	324			

Table 3.6. *Number of farms that species were considered to breed at, in each country except the UK (no data available at farm level). Includes only those species that were observed on ≥50% of the farms for at least one distance class – country - observation period combination; the cells concerned are marked in grey. Bridge Species are indicated in the final column.*

	DE	IT	TR	no. of countries where on ≥50% of farms	selected as higher risk bridge species
Rock Dove/Feral Pigeon		5	4	2	
Wood Pigeon	4	1		1	BS
Collared Dove	3	7	2	1	BS
Hoopoe			5	1	
Syrian Woodpecker			1		
Calandra Lark			6	1	
Crested Lark			5	1	
Barn Swallow	7	7	3	3	BS
Yellow Wagtail		6	1	1	
White/Pied Wagtail	8			1	
Nightingale		7	1	1	
Black Redstart	6			1	
Blackbird	8	2	1	1	
Fan-Tailed Warbler		7		1	
Blackcap	6	3		1	
Chiffchaff	8			1	
Willow Warbler	4			1	
Blue Tit	7			1	
Great Tit	6	4	4	1	
Magpie	1	7	6	2	BS
Carrion/Hooded Crow	5	2	1	1	BS
Starling	7	5	7	3	BS
House/Italian Sparrow	7	10	9	3	BS
Tree Sparrow	5	6	1	2	
Chaffinch	8			1	BS
Greenfinch	7			1	
Linnet	5			1	
Yellow Hammer	4			1	
Corn Bunting			6	1	

3.5.7 Species feeding near farms

There were large differences in the number of birds recorded to be feeding near the farms, with number varying as follows (all species within 50m of all farms):

Germany	20
Italy	12
Turkey	334
United Kingdom	239

These marked differences appeared to be related to differences in the interpretation of “feeding”. Some observers classified all birds showing foraging behaviour within this category, whereas others only noted individuals picking up food. UK observers said that unless flying over all birds were actively foraging at the sites. It was therefore concluded that feeding was not a very useful record and the data were not analysed.

3.5.8 Species defaecating near farms

The only species seen defaecating was House Sparrow (>1individual) in Turkey.

3.5.9 Contact between wild birds and poultry

In Table 3.7 are shown the bird species that were observed to interact with domestic poultry during the fieldwork for this project, or that were said to do so by the farmers involved. Of the 16 species or species pairs concerned, 11 have been identified in Chapter 2 as higher risk Bridge Species, and a further four should perhaps now be considered as such: Moorhen, Rock Dove/Feral Pigeon, Skylark and White/Pied Wagtail. House Sparrows were observed or mentioned in three countries, ducks and ‘pigeons and doves’ in two.

In Germany six out of the eight farmers spoken to said that mixing of wild birds with their poultry was impossible, in Turkey four of the eight, in Italy two of the ten, in the UK none. This was due to the closed nature of the poultry enclosures on the farms concerned. In the UK and Italy more ‘open’ farms had been selected, in Turkey and especially Germany more ‘closed’ farms.

3.5.10 Species at wetlands on or near farms

Species seen at wetlands on or near farms are presented in Table 3.8. It should be noted that these are more or less incidental observations: the observers in the four countries were asked to keep a look out for birds at wetlands on or near the farms they monitored, but it was not a primary aim of the study, nor a criterion in the selection of the farms. The Kestrel, Swallows and Swift were foraging at or over the wetlands, the other birds were almost all on the water, or on the ground or in the vegetation next to the wetland.

In total 34 species were seen on or over wetlands on or near the selected farms, involving 1238 birds and 123 observations. Few were seen in Germany, because of the lack of wetlands on or near the selected farms. Similar numbers of observations (37-40) of birds at wetlands were made in Italy, Turkey and the UK: in the case of Italy and the UK because of wetlands close to most of the farms, in the case of Turkey because of one farm being on a lake.

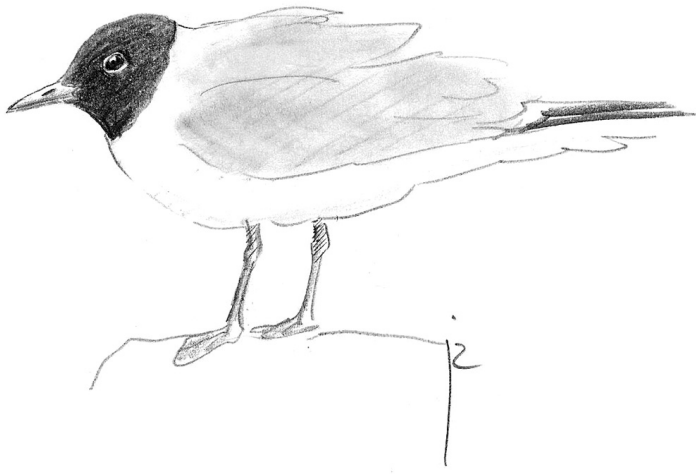
Bird numbers on wetlands at or near the farms were greatest in the UK (617, mostly because of one group of 400 Black-headed Gulls), then Turkey (483, mostly because of one group of 250 Barn Swallows), then Italy (129, largest group 40 Coots).

Only the Pochard and Coots in Turkey in spring were seen to have contact with, or mix with, the domestic poultry.

Of the 34 species involved, 15 had earlier been identified as Bridge Species, accounting for three-quarters (933) of the birds concerned.

Table 3.7. *Bird species observed to mix with domestic poultry, or said to do so by the farmers involved. Bridge species are indicated in the final column. Other species that should perhaps also be included as higher risk Bridge Species are marked with a '?' in that column. This is the case if the species concerned was observed to mix with domestic poultry at least twice, during the fieldwork and/or by one or more farmers.*

	DE			IT			TR			UK					
	winter	spring	farmers n=8	winter	spring	farmers n=10	winter	spring	farmers n=8	winter	spring	farmers n=7	total observ.	farmers n=33	selected as higher risk bridge species
Mallard						2								2	BS
Pochard								1x, 1					1		
"Ducks"			1									3		4	
Pheasant						1						1		2	?
Moorhen						2								2	?
Coot								1x, 45					1		BS
"Gulls"						1						4		5	
"Pigeons"						3						5		8	
Wood Pigeon										1x, 6			1		BS
Collared Dove						6								6	BS
Skylark											1x, 1	1	1	1	
White/Pied Wagtail										5x, 1-2			5		?
Meadow Pipit										1x, 1			1		
"Swallows"									1					1	
Blackbird						3				1x, 1			1		
Jackdaw										4x, 2-40	5x, 20-50		9		BS
Rook										5x, 2-4	6x, 20-80	2	11	2	BS
"Crows"												3		3	
Starling						1					1x, 3		1	1	BS
House/Italian Sparrow	>1		(1)			5	>1		1	1x, 1			3	7	BS
Chaffinch										1x, 1			1		BS
unspecified wild birds						1			2					3	



Black-headed Gull

Table 3.8. *Total numbers of individuals of various bird species observed on wetlands at or near farms, per distance class from poultry enclosures, country and observation period. All the observations within 5 m from an enclosure are marked in grey. Bridge species are indicated in the final column. The total number of distance classes gives the number of distance class-country-season combinations for which there were observations for that species. Three distance classes (<5, 5-50, >50), maximum score therefore 24.*

	February–March								April–May								total		total no. of distance classes	selected as higher risk bridge species
	<50m (<5m)				>50m				<50m (<5m)				>50m				<50m	>50m		
	DE	IT	TR	UK	DE	IT	TR	UK	DE	IT	TR	UK	DE	IT	TR	UK				
MLittle Grebe						1									3	2, 1		7	3	
Great Crested Grebe							2				1				2		1	4	3	
Cormorant						1, 7												8	1	
Pygmy Cormorant						1								1				2	2	
Squacco Heron														1				1	1	
Cattle Egret														5				5	1	BS
Little Egret						1												1	1	
Great White Egret						1												1	1	
Grey Heron						1								1				2	1	BS
Mute Swan																3		3	1	BS
Egyptian Goose																8		8	1	
Ruddy Shelduck						2									1, 3			6	2	
Shelduck								6							2	2		10	3	
Gadwall																2		2	1	
Teal				4			5										4	5	2	BS
Mallard					1	1, 1				3			2	2	5	2, 2	3	16	7	BS
Garganey															1			1	1	
Red-crested Pochard							2, 2											4	1	
Pochard											1						1		1	
Tufted Duck								10								16		26	2	
Marsh Harrier							2											2	1	
Kestrel																1		1	1	
Moorhen		1, 2		1		2, 2, 4		2	1, 1				2	5, 1, 1	1	1	7	21	10	
Coot			30, 35			4	4				22, 45		1	5		4	132	18	7	BS
Oystercatcher								2								1		3	2	
Black-winged Stilt														15				15	1	
Little Ringed Plover																3		3	1	
Ringed Plover														1				1	1	
Lapwing							2									4		6	2	BS
Ruff														40				40	1	
Redshank								1										1	1	
Green Sandpiper							2							1				3	2	
Wood Sandpiper														2				2	1	
Common Sandpiper											2						2		1	
Little Gull														1				1	1	
Black-headed Gull		2					13, 20	1, 8, 400						4			2	446	4	
BS																				
Common Tern														2				2	1	
Whiskered Tern															7			7	1	
Rock Dove/Feral Pigeon			2				6										2	6	2	
Collared Dove			1														1		1	BS
Cuckoo														1				1	1	
Swift												50				4		54	2	
Kingfisher														1				1	1	
Sand Martin															9			9	1	
Barn Swallow											250					20	250	20	2	BS
House Martin												50				2	50	2	2	
White/Pied Wagtail			1	1									1				2	1	3	
Blackbird			1	3													4		2	
Song Thrush												1					1		2	

4 Synthesis

4.1 Discussion

4.1.1 Comparing desk study and field study results

In chapter 2 we identified HRS on the basis of ecology and behaviour. From among the HRS we selected so-called Bridge Species, being species with (1) an assumed relatively high risk of being infected with H5N1 because of habitat use, gregariousness and degree of mixing, like the other HRS, but also (2) an estimated relatively high risk of coming into contact with poultry. This was done on the basis of data from the literature, if available, and expert judgement.

The need was felt to do a first check on the selection of Bridge Species through fieldwork. In chapter 3 we have analysed the data of this field study with the following questions in mind:

- do the Bridge Species identified in chapter 2 indeed have a relatively high risk of coming into contact with poultry, and
- do observations near poultry farms lead to the conclusion that species not earlier identified as Bridge Species should be added to this category?

Our analysis of data obtained near poultry farms has focussed on:
1. abundance: the number of individuals of a species present near the farms (table 3.3)
2. presence: the number of farms where a species was observed (table 3.4)
3. abundance as a breeding bird: the number of individuals of a species considered to be a breeding bird near the farms (table 3.5)
4. presence as a breeding bird: the number of farms where a species was considered to be breeding (table 3.6)
5. mixing with poultry: species observed to mix with poultry (table 3.7)
6. occurrence at wetlands: species observed at wetlands near farms (table 3.8)

To evaluate the efficacy of the Bridge Species identification, one should compare the outcome of that identification not just with single parameters from field studies, as in Tables 3.3 to 3.8 above, but with all of the important parameters at the same time. These parameters comprise the information on presence and abundance in Tables 3.3 and 3.4, and the information on mixing of wild birds with poultry in Table 3.7. The breeding information in Tables 3.5 and 3.6 does not really add much to the information on presence and abundance in Tables 3.3 and 3.4, and the information on presence at wetlands in Table 3.8 is also left out, because that information was not a prime objective of the fieldwork and was therefore not collected systematically. The resulting overview is presented in Table 4.1.

The basis of Table 4.1 is the list of Bridge Species in Table 2.6. We added to this list species that had not been identified as higher risk Bridge Species, but which had a relatively high score in Table 3.3, 3.4 and/or 3.7, i.e. those indicated with a question mark in the Bridge Species column in those tables. Their names have been given a grey background. After each species in the table its scores in the second last columns of Tables 3.3, 3.4 and 3.7 are included. The maximum scores are 24 in Tables 3.3 and 3.4 (abundance and number of farms at which a species was present respectively, per country-distance class-season combination). Because we considered our observations on mixing with poultry as at least as important as mere presence on the farms, the mixing observations were multiplied by 2 to have the same maximum of just over 20 as the abundance and presence scores. In the final column of Table 4.1 a total fieldwork score for each species is calculated. The species in Table 4.1 have been sorted in descending value of their total field study score, which ranges from 41 to 0.

4.1.2 Bridge Species identified in Chapter 2

As our fieldwork focussed on contact between wild birds and poultry, our summary Table 4.1 only includes those Bridge Species that are considered to pose a risk for contact with poultry. The Greater Canada Goose, which is assumed to only pose a risk for contact with humans, is therefore not included. When in adddition Carrion Crow and Hooded Crow are combined (see section 3.5.2), there remain 27 Bridge Species and Bridge Species pairs in Table 4.1. Seventeen out of these 27 have a positive score in Table 4.1, which means that they were prominently present on the group of study farms in at least one of the four countries of our study. Eight of these species had a relatively high score (21-41), of which four (House/Italian Sparrow, Common Starling, Rook and Eurasian Jackdaw) had highest scores of all species observed.

The absence near the farms of seven other Bridge Species can easily be explained by their (limited) geographical distribution and seasonal occurrence. These seven species do not normally occur in our four study regions, or do not normally do so during the seasons of our field study (February-March and April-May). This leaves only three Bridge Species out of 27 unaccounted for.

The above results indicate that the desk study method for identifying higher risk Bridge Species that may transfer the Avian Influenza virus to poultry farms was fairly reliable, at least in this limited first field test.

4.1.3 Species not identified as Bridge Species in Chapter 2

Table 4.1 also includes nineteen species that were not identified as Bridge Species in Chapter 2. These species are shaded grey in Table 4.1. The questions need to be addressed why they were not initially selected as higher risk Bridge Species, and if they should be so classified in the light of the findings of the field study.

Table 4.1. *Evaluation of Bridge Species on the basis of contact risk with poultry as assessed in the field study. Contact risk (= total score) has been calculated using the results presented in Table 3.3, 3.4 and 3.7 (see text). The species included in this table are the Bridge Species selected by means of the HRS analysis in chapter 2, and the species prominently featuring in the aforementioned tables, where they have been indicated with a question mark in the BS column at least once. Species not identified as HRS in the desk study are given in bold.*

English name	Scientific name	Bridge Species	H5N1confirmed	Abundance, Table 3.3	Number of farms, Table 3.4	Interactioin poultry, Table 3.7 , no.of obs x 2	Interaction poultry, Table 3.7 , no. of farmers	Total field study score
House/Italian Sparrow	*Passer domesticus*	BS		18	13	10		41
Common Starling	*Sturnus vulgaris*	BS	(X)	19	11	2	1	33
Rook	*Corvus frugilegus*	BS		6	4	22		32
Eurasian Jackdaw	*Corvus monedula*	BS	X	8	4	18		30
White/Pied Wagtail	*Motacilla alba*	?		6	12	10		28
Chaffinch	*Fringilla coelebs*	BS		11	12	2		25
Blackbird	*Turdus merula*	?		8	12	2		22
Black-billed Magpie	*Pica pica*	BS		10	12			22
Carrion/Hooded Crow	*Corvus corone (cornix)*	BS	X*	10	10		1	21
Rock Dove/Feral Pigeon	*Columba livia*	?		14	7			21
Common Wood Pigeon	*Columba palumbus*	BS		8	11	2		21
Barn Swallow	*Hirundo rustica*	BS		9	7			16
Eurasian Collared Dove	*Streptopelia decaocto*	BS		5	6		4	15
Skylark	*Alauda arvensis*	?		6	6	2	1	15
Tree Sparrow	*Passer montanus*	?		8	5			13
Mallard	*Anas platyrhynchos*	BS	X	4	6		1	11
Yellowhammer	*Emberiza citrinella*	?			9			9
Crested Lark	*Galerida cristata*	?		5	3			8
Wren	*Troglodytes troglodytes*	?		3	5			8
Chiffchaff	*Phylloscopus collybita*	?		3	4			7
Common Coot	*Fulica atra*	BS	X	4		2		6
Black-headed Gull	*Larus ridibundus*	BS	(X)	6				6
Yellow-legged Gull	*Larus michahellis*	?		4	2			6
Blackcap	*Sylvia atricapilla*	?		2	4			6
Greenfinch	*Carduelis chloris*	?		2	4			6
Song Thrush	*Turdus philomelos*	?		1	4			5
Blue Tit	*Cyanistes caeruleus*	?		5				5
Great Tit	*Parus major*	?		5				5
Moorhen	*Gallinula chloropus*	?		2	1		1	4
Pheasant	*Phasianus colchicus*	?			2		2	4
Swift	*Apus apus*	?		4				4
Goldfinch	*Carduelis carduelis*	?		4				4
Cattle Egret	*Bubulcus ibis*	BS		3				3
Northern Lapwing	*Vanellus vanellus*	BS		3				3
Fieldfare	*Turdus pilaris*	BS		2				2
Redwing	*Turdus iliacus*	BS			2			2
Grey Heron	*Ardea cinerea*	BS	X					0
White Stork	*Ciconia ciconia*	BS	X					0
Mute Swan	*Cygnus olor*	BS	X					0
Greater White-fronted Goose	*Anser albifrons albifrons*	BS	(X)					0
Greylag Goose	*Anser anser*	BS	X					0
Eurasian Wigeon	*Anas penelope*	BS						0
Common Teal	*Anas crecca*	BS						0
Stock Dove	*Columba oenas*	BS						0
Spotless Starling	*Sturnus unicolor*	BS						0
Spanish Sparrow	*Passer hispaniolensis*	BS						0

* refers to Hooded Crow

Six species (Wren, Chiffchaff, Blackcap, Blue Tit, Great Tit and Swift) were not included in our Bridge Species analysis because they belonged to taxonomic groups assumed to be less relevant for the spread of avian influenza. These species indeed do not meet the criteria for being selected as HRS because of their habitat use (wooded areas or being completely aerial) and often, their low level of gregariousness. Among the taxa considered in the HRS selection process, a further seven species do not meet the HRS criteria set for habitat use, gregariousness and mixing, and should remain off the list of Bridge Species: Blackbird, Tree Sparrow, Yellowhammer, Greenfinch, Song Thrush, Goldfinch and Pheasant.

The situation regarding the remaining not-previously-selected species in Table 4.1 is more complex. These are Rock Dove/Feral Pigeon, White/Pied Wagtail, Skylark, Crested Lark, Yellow-legged Gull and Moorhen.

Rock Dove/Feral Pigeon is included in Table 4.1 because of the Feral Pigeon, which was not included in the HRS analysis of Chapter 2 because of doubts as to its being a wild species in most of Europe. Given its high total score in Table 4.1, and the fact that 'pigeons' were mentioned by eight farmers in both Italy and the UK as mixing with poultry, we prefer to include Rock Dove/Feral Pigeon in the final list.

White/Pied Wagtail has received a high total score. This species was not selected because of the low degree of mixing it exhibits, but it would qualify as a Bridge Species on other counts. Considering its high score in Table 4.1 and the reasons for not selecting it as a higher risk Bridge Species in Chapter 2, we prefer to add the White/Pied Wagtail to the Bridge Species list.

Skylark and Crested Lark have intermediate total field study scores in Table 4.1. Both species were not pre-selected as Bridge Species because of low gregariousness and low degree of mixing. However, being ground dwelling, and potentially occurring in poultry pens as well as along the open edges of ponds, makes them of interest for further Bridge Species studies. The same holds for Yellow-legged Gull and Moorhen, which did not receive a high total score, but which are of interest because of their habitat use (freshwater/agricultural land) and behaviour on farms. We have not included these species in our 'preliminary' listing of higher risk Bridge Species in Table 4.2

Table 4.2. *Complete preliminary list of higher risk Bridge Species for poultry farms, based on a combination of the HRS analysis (chapter 2) and fieldwork (chapter 3).*

English name	Scientific name
Cattle Egret	*Bubulcus ibis*
Grey Heron	*Ardea cinerea*
White Stork	*Ciconia ciconia*
Mute Swan	*Cygnus olor*
Greater White-fronted Goose	*Anser albifrons albifrons*
Greylag Goose	*Anser anser*
Eurasian Wigeon	*Anas penelope*
Common Teal	*Anas crecca*
Mallard	*Anas platyrhynchos*
Common Coot	*Fulica atra*
Northern Lapwing	*Vanellus vanellus*
Black-headed Gull	*Larus ridibundus*
Rock Dove/Feral Pigeon	*Columba livia*
Stock Dove	*Columba oenas*
Common Wood Pigeon	*Columba palumbus*
Eurasian Collared Dove	*Streptopelia decaocto*
Barn Swallow	*Hirundo rustica*
Pied/White Wagtail	*Motacilla alba*
Fieldfare	*Turdus pilaris*
Redwing	*Turdus iliacus*
Black-billed Magpie	*Pica pica*
Eurasian Jackdaw	*Corvus monedula*
Rook	*Corvus frugilegus*
Carrion Crow	*Corvus corone*
Hooded Crow	*Corvus cornix*
Common Starling	*Sturnus vulgaris*
Spotless Starling	*Sturnus unicolor*
House/Italian Sparrow	*Passer domesticus*
Spanish Sparrow	*Passer hispaniolensis*
Chaffinch	*Fringilla coelebs*

4.2 Conclusions and recommendations

The final (but still 'preliminary' given the limitations of the study) list of higher risk Bridge Species with respect to transfer of the Avian Influenza virus to poultry farms, resulting from the desk study and the limited field study, is presented in Table 4.2. Twenty seven species and species pairs have been selected on the basis of the HRS analysis described in chapter 2. Two species pairs, Rock Dove/Feral Pigeon and Pied/White Wagtail, have been added as a result of field observations. According to the results of this first field evaluation, the desk study seems to have been fairly effective at identifying species with a higher risk of mixing with poultry and thus bridging the gap between wild birds that may bring HPAI into a region, and domestic poultry.

It should be recognised that both the desk study and the fieldwork approaches have their limitations. The HRS analysis consisted of a straightforward, very generalized analysis of ecological and behavioural characteristics of species. It was to a large extent based on expert judgement rather than published facts, because precise field information is lacking. The field study was also limited, because of the small number of farms included in only four countries, and because monitoring only took place during two short visits in two seasons of one year.

These limitations mean that the list presented in Table 4.2 should be regarded as preliminary. For a better understanding of potential transfer of HPAI into and out of poultry farms, more detailed field studies are needed. Such studies may lead to adjustment of the list of species presented in Table 4.2, as well as to insights into the magnitude of the threat each species poses to poultry farms in different parts of the EU and in different seasons.

We recommend that further research on Bridge Species in relation to Highly Pathogenic Avian Influenza should:

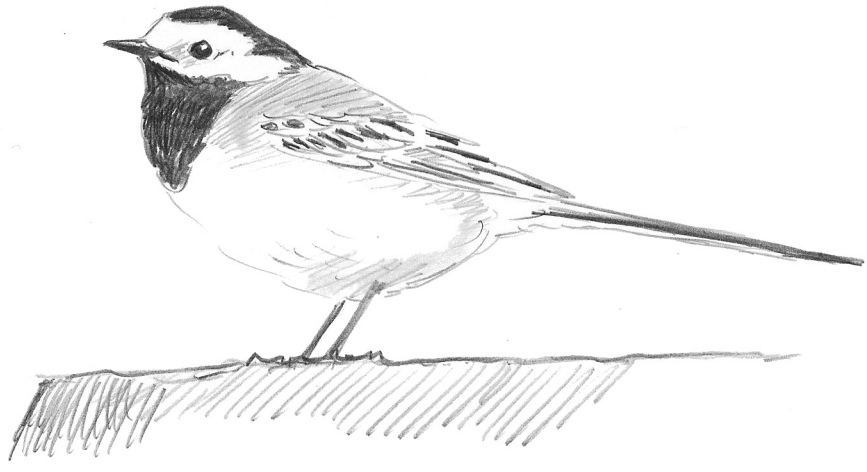
- concentrate on field studies dealing with contact risk between wild birds and poultry

- differentiate between species that may pose a local risk and those that may pose a risk over wider areas

- include many more farms, with wider geographic and seasonal coverage and more time spent on individual farms

- include a study of contacts between farms and wetland areas, through waterbirds as well as terrestrial birds

- give special attention to the higher risk Bridge Species identified in Table 4.2, but also to species that just missed selection and are listed only in Table 4.1.



White Wagtail

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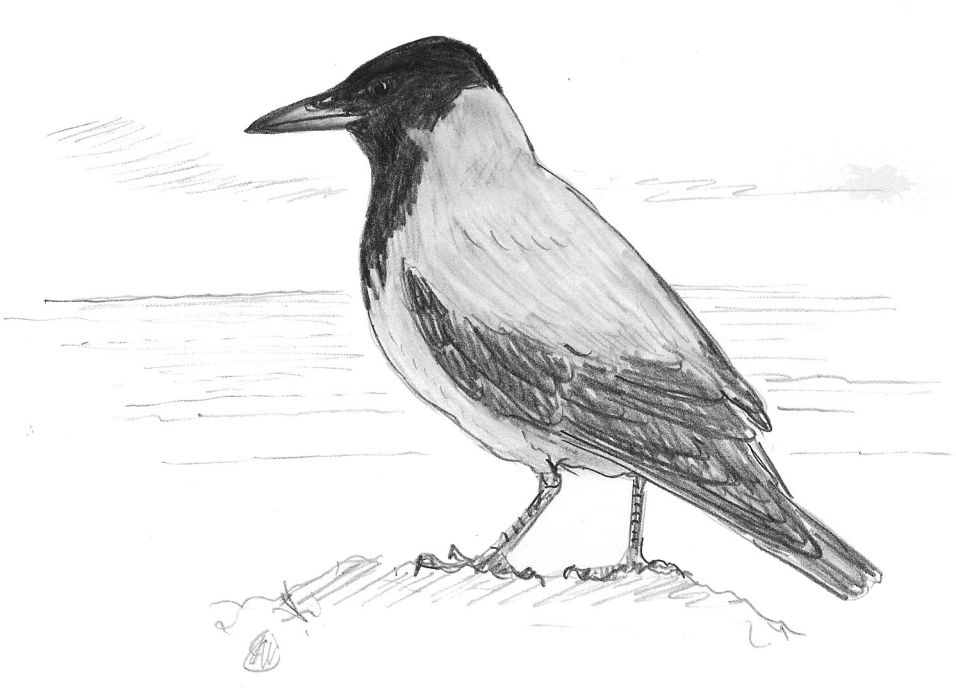

Hooded Crow

Annex 2.1 Overview of criteria used to select Higher Risk Species

The following overview explains the criteria which have been used for assessing aspects of behaviour and ecology of European birds species which have been included in an analysis to identify Higher Risk Species with respect to the introduction and spread of H5N1 in the European Union. The results of application of these criteria to species from 13 orders of birds are presented in Annex 2.2.

Published sources for much of the information used are listed in Annex 2.2 as well. Where published information on aspects of behaviour and ecology was lacking, the expert opinion of three ornithologists was used: Phil Atkinson (BTO), Simon Delany (Wetlands International) and Jan Veen (VEDA consultancy).

List of information included in separate columns.

Factor	Coding
1. English name	
2. Scientific name	
3. Migratory status	LD,SD,R
4. Does species migrate to EU?	Y, N
5. Migration (propensity to undertake cold-weather movements)	H,M,L,O or 3,2,1,0*
6. Preferred habitat in breeding season	See below
7. Preferred habitat during migration and wintering	See below
8. Gregariousness in breeding season	See below
9. Gregariousness during migration and wintering	See codes
10. Degree of mixing during migration and wintering	H,M,L,O or 3,2,1,0*
11. Specific risk related to colonial breeding	H,M,L,O or 3,2,1,0*
12. Specific risk related to social roosting	H,M,L,O or 3,2,1,0*
13. Specific risk related to moulting concentrations	Y, N
14. Specific risk related to predation behaviour	H,M,L,O or 3,2,1,0*
15. Specific risk related to scavenging behaviour	H,M,L,O or 3,2,1,0*
16. Occurrence on farmland	H,M,L,O or 3,2,1,0*
17. Occurrence at wetlands	H,M,L,O or 3,2,1,0*
18. Contact risk with humans	H,M,L,O or 3,2,1,0*
19. Contact risk with poultry	H,M,L,O or 3,2,1,0*
20. H5N1 in Europe	W,C,E
21. H5N1 worldwide	W,C,E

* For practical reasons figures have been used for coding in the spreadsheet, whereas letters have been used in the tables presented in the main text.

1. English name

English name

2. Scientific name

Scientific name

3. Migratory status

LD = long-distance migrant (important part of population migrates over distance of more than 1000 km)
SD = short distance migrant (important part of population migrates over shorter distances)
R = resident (no migratory movements in the above sense)

4. Is species migratory?

Answers the question whether a species is migratory in the sense that a significant part of the population moves from outside the EU to within EU borders or vice versa.

Y = yes
N = no

5. Propensity to undertake cold-weather movements

Coding on the following relative scale:

H (3) = High
M (2) = Medium
L (1) = Low
O (0) = Absent

6. Preferred habitat in breeding season and

7. Preferred habitat during migration and wintering

This refers to the species main habitat. Many species make use of different habitats during breeding and migration/wintering. Therefore, both periods are listed in different columns. If a species uses a variety of habitats multiple coding has be used with the most commonly used habitat given first.

A = agricultural land
F = freshwater
M = marine
L = littoral zone (including salt marshes)
N = freshwater marsh habitat
Sal = Salinas
O = other habitat types, such as urban areas, woodland, etc.

Some examples:
A - agricultural land
AN - agricultural land and freshwater marsh habitat
FA - freshwater and agricultural land
FAL - freshwater, agricultural land, littoral zone
F - freshwater
FL - freshwater and littoral zone
FM - freshwater and marine
FN - freshwater and freshwater marsh habitat
L - littoral zone
LA - littoral zone and agricultural land
M - marine
MA - marine and agricultural land
MF - marine and freshwater
ML - marine and littoral
O - other land habitat
Sal - salinas

8. Gregariousness in breeding season

9. Gregariousness during migration and wintering

Codes for gregariousness have been given for the breeding season and for the migration/wintering period. Gregariousness has been indicated by two letters, which denote group size and group density, respectively. The following coding has been applied:

Group size
L = Large: often several hundreds to thousands of individuals
M = Medium: often several tens to a few hundred individuals
S = Small: often up to a few tens of birds
O = Usually solitary or a few birds together

Density
H = High density: often less than 2 m between individuals
M = Medium density: often between 2-5 m between individuals
L = Low density: often more than 5 m between individuals
O = (near) solitary, or in pairs, or very small (family) groups (usually < 10 indiv.)

10. Degree of mixing during migration/wintering periods

This behavioral factor is only given for the migration and wintering period, when many species tend to be in mixed species flocks. Degree of mixing with other species (mixed foraging, mixed roosts, mixing at moulting areas, etc) has been indicated as follows:

H (3) = High degree
M (2) = Medium degree
L (1) = Low degree
O (0) = Hardly any mixing

11. Colonial breeding

The potential risk of spreading H5N1 in breeding colonies. Species have been considered with respect to the following aspects of colonial breeding which are thought to contribute to the risk of spreading H5N1: colony size, nest density, defecation near nest, and mixed nesting with other species.

H (3) = High risk: colonies usually dense and large and with accumulated faeces near nests
M (2) = Medium risk: colonies usually of medium density, with or without accumulated faeces
L (1) = Low risk: more loose breeding aggregations, usually without accumulated faeces
O (0) = does not breed in colonies

12. Roosting concentrations

The potential risk of spreading H5N1 in large concentrations of roosting birds, either through contact between birds (especially in large and dense roosts) or through contact with faeces accumulated at traditional roosting sites.

H (3) = High risk: roosts are usually large, dense, sometimes mixed with other species and with accumulation of faeces or spread of faeces in water at roosting site
M (2) = Medium risk: roosts usually smaller and less dense, but they may also be: (1) large, dense and mixed, but without accumulation of faeces

or (2) smaller and less dense but with accumulation of faeces

L (1) = roosts relatively small and no assumed (large) risk of transmission of H5N1 through accumulation of faeces

O (0) = no significant roosting in the above sense

13. Moulting concentrations

This refers to whether or not the species concentrates in large (and often dense) groups for moulting. It especially applies to most of the anatidae (swans, geese and ducks), which concentrate at special moulting sites after breeding.

Y = forms large and often dense moulting aggregations

N = no such aggregations

14. Preying upon HRS and associated waterbirds

The risk of spreading H5N1 because the species is a (potential) predator on HRS and associated waterbirds in freshwater habitats.

H (3) = regular predator

M (2) = less regular predator

L (1) = potential/incidental predator

O (0) = no predator in the above sense

15. Scavenging on carcasses of HRS and associated waterbirds

The risk of spreading H5N1 because the species is a (potential) scavenger on carcasses of HRS and associated waterbirds.

H (3) = regular scavenger

M (2) = less regular scavenger

L (1) = potential/incidental scavenger

O (0) = no scavenger in the above sense

16. Occurring on farmland

The propensity of a species to occur on farmland (meadows, fields).

H (3) = very often on farmland

M (2) = frequently on farmland

L (1) = less frequently on farmland

O (0) = (normally) does not occur on farmland

17. Occurring at wetlands

The propensity of a species to occur in wetland habitat (lakes, rivers, marshes, littoral zone), where it may come in contact with water and waterbirds. Marine species normally occurring in deeper water have been excluded.

H (3) = very often or exclusively in wetlands

M (2) = frequently in wetlands

L (1) = less frequently in wetlands

O (0) = (normally) does not occur in wetlands

18. Contact risk with humans

This score is related to the risk that humans come in contact with a particular bird species, through feathers, faeces, nests etc. because of the species occurrence in/near human habitation.

H (3) = very often near human habitation

M (2) = frequently near human habitation

L (1) = less frequently near human habitation

O (0) = not near humans

19. Contact risk with poultry

This score is related to the risk that poultry come in contact with a particular wild bird species (interactions through feeding, presence of feathers, faeces, etc.) because of the species' occurrence on poultry farms. For the Anatidae and Charadriidae contact risk with poultry was assessed during phase 1 of this project using data provided by members of the Ornis Committee for eight EU countries (see Delany et al. 2006). These data were also used for the present analysis. For all other species data were based on expert knowledge provided within the framework of the present project.

H = high contact risk with poultry

M = medium contact risk with poultry

L = low contact risk with poultry

O = no contact risk with poultry

20. H5N1 in Europe

21. H5N1 worldwide

Information on whether a bird species has been confirmed carrying H5N1 in Europe or worldwide (Europe included).

W = H5N1 confirmed in birds in the wild

C = H5N1 confirmed in birds in captivity

E = H5N1 confirmed in birds during experiments

? = data insufficient

Annex 2.2 Evaluation of species with higher risk of carrying H5N1

Results of the application of the criteria defined in Annex 2.1, to wild bird species of 13 orders occurring in the European Union, in order to identify the Higher Risk Species in relation to the introduction and spread of the H5N1 avian influenza virus into and within the European Union. The way in which species have been selected as HRS is explained in section 2.4.

* Information on migration behaviour is based on expert knowledge and data drawn from Pavlov et al. 1979, 1985, 1989, 1997, Cramp & Simmons 1977, 1980, 1983, 1985, 1988, 1992, 1993, 1994a and 1994b, Roggeman et al. 1995, Scott & Rose 1996, Snow & Perrins 1998, Madsen et al. 1999, Fransson & Pettersson 2001, Wetlands International 2002, Werhham et al. 2002, Bakken et al. 2003, Kear 2004, Stroud et al. 2004, Veen et al. 2005

** Information on habitat, gregariousness, mixing and specific risk factors (colonial breeding, moult concentrations, predator behaviour and scavenging) has mainly be based on expert judgement. i.e. information provided by Phil Atkinson (BTO), Simon Delany (Wetlands International) and Jan Veen (….), and on ornithological handbooks, principally Cramp & Simmons 1977, 1980, 1983, 1985, 1988, 1992, 1993, 1994a and 1994b.

*** Information with respect to occurrence on farmland and at wetlands and contact risk with humans and poultry has mainly be based on expert judgement (information of at least three experts) and on ornithological handbooks, principally Cramp & Simmons 1977, 1980, 1983, 1985, 1988, 1992, 1993, 1994a and 1994b. Information on contact risk with poultry for the Anseriformes and Charadriiformes is based on expert judgement provided by the members of the EC Birds Directive's Ornis Committee from the United Kingdom, Ireland, Portugal, Czech Republic, Slovenia, Austria, Germany, The Netherlands and Estonia.

**** Information on H5N1 infection has been drawn from a list of the United States Geological survey (2006) and data files managed by BTO and Wetlands International, the latter being based on relevant data sources for each individual case of infection.

		Migration behaviour*			Preferred Habitat**		Gregariousness**		Mixing degree		Specific Risk factors**				0ccurrence and contact risk***				H5N1 confirmed****	
English name	Scientific name	Migratory status	Does species migrate to EU?	Cold-weather movements	In breeding season	During migration & winter	In breeding season	During migration & winter	During migration & winter	Colonial breeding	Roosting concentrations	Moult concentrations	Predator behaviour	Scavenging	On farmland	At wetlands	Contact risk with humans	Contact risk with poultry	Europe	Wordwide
Red-throated Diver	*Gavia stellata*	LD	Y	2	FM	M	OO	SL	1	0	0.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Black-throated Diver	*Gavia arctica*	LD	Y	2	F	M	OO	OO	1	0	0.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Great Northern Diver	*Gavia immer*	LD	Y	1	F	M	OO	OO	1	0	0.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Yellow-billed Diver	*Gavia adamsii*	LD	Y	0	F	M	OO	OO	1	0	0.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Little Grebe	*Tachybaptus ruficollis*	SD	N	1	F	F	SL	SL	2	0	1.0	N	0.0	0.0	0.0	3.0	0.0	1.0	W?	W
Great Crested Grebe	*Podiceps cristatus*	SD	Y	1	F	FM	SL	ML	2	0	1.0	Y	0.0	0.0	0.0	3.0	0.0	1.0	W?	W
Red-necked Grebe	*Podiceps grisegena*	LD	N	2	F	FM	SL	SL	2	0	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Slavonian Grebe	*Podiceps auritus*	SD	N	2	F	FM	SL	SL	1	0	1.0	?	0.0	0.0	0.0	3.0	0.0	0.0		
Black-necked Grebe	*Podiceps nigricollis*	SD	Y	2	F	FM	SL	SL	2	0	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Northern Gannet	*Morus bassanus*	LD	Y	0	M	M	LH	ML	2	3	0.5	N	0.0	0.0	0.0	0.0	0.0	0.0	?	?
Great Cormorant	*Phalacrocorax carbo*	SD	Y	0	FM	FM	LH	MM	3	3	3.0	N	0.0	0.0	0.0	3.0	0.3	2.0		W
Pygmy Cormorant	*Phalacrocorax pygmeus*	SD	Y	0	F	FM	MH	MM	2	3	3.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
European Shag	*Phalacrocorax aristotelis*	R	N	0	M	M	MH	ML	1	3	1.5	N	0.0	0.0	0.0	0.0	0.0	0.0		
White pelican	*Pelecanus onocrotalus*	LD	Y	0	FM	FM	MH	MM	1	3	2.5	?	0.0	0.0	0.0	3.0	0.0	0.0		
Dalmatian Pelican	*Pelecanus crispus*	LD	Y	0	FM	FM	MH	MM	1	3	2.5	?	0.0	0.0	0.0	3.0	0.0	0.0		
Great Bittern	*Botaurus stellaris*	SD	N	3	FN	FN	OO	OO	0	0	0.3	N	0.0	0.3	0.0	3.0	0.0	0.0		
Little Bittern	*Ixobrychus minutus*	LD	Y	0	FN	FN	OO	OO	0	0	0.5	N	0.0	0.0	0.0	3.0	0.0	0.0		
Black-crowned Night Heron	*Nycticorax nycticorax*	LD	Y	0	FN	FN	MM	SL	1	3	3.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Squacco Heron	*Ardeola ralloides*	LD	Y	0	FN	FN	MM	SL	1	3	2.5	N	0.0	0.0	0.5	3.0	0.0	0.0		
Cattle Egret	*Bubulcus ibis*	LD	Y	0	FNA	FAN	MM	MM	2	3	3.0	N	0.0	0.0	2.5	3.0	1.5	3.0		
Little Egret	*Egretta garzetta*	SD	Y	1	FNL	FNL	MM	MM	2	3	3.0	N	0.0	0.0	0.7	3.0	0.0	1.0	W?	W
Great White Egret	*Ardea alba*	SD	Y	0	FN	FN	ML	SL	1	2	2.5	N	0.0	0.0	0.0	3.0	0.0	0.0		
Grey Heron	*Ardea cinerea*	SD	Y	2	FNAL	FNAL	MM	SL	2	2	2.3	N	0.3	0.7	1.3	3.0	1.0	2.0	W?	W
Purple Heron	*Ardea purpurea*	LD	Y	0	FN	FN	SM	SL	1	2	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Black Stork	*Ciconia nigra*	LD	Y	0	FO	FN	OO	ML	1	0	0.5	N	0.0	0.0	1.0	3.0	0.0	0.0		
White Stork	*Ciconia ciconia*	LD	Y	0	FA	FA	SL	LL	2	2	0.5	N	0.0	0.5	3.0	2.5	2.5	1.5	W	W
Glossy Ibis	*Plegadis falcinellus*	LD	Y	0	F	FL	MM	MM	2	2	2.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Eurasian Spoonbill	*Platalea leucorodia*	LD	Y	0	FNL	FL	MM	MM	2	3	2.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Greater Flamingo	*Phoenicopterus ruber*	LD	Y	0	SalL	SalL	LH	LH	2	3	3.0	N	0.0	0.0	0.0	3.0	0.0	0.0		C
Mute Swan	*Cygnus olor*	SD	Y	2	FA	FA	OO	ML	2	0	2.0	Y	0.0	0.0	2.3	3.0	2.0	2.0	W	W
Bewick's Swan	*Cygnus columbianus*	LD	Y	1	NF	FA	OO	ML	2	0	2.5	Y	0.0	0.0	3.0	3.0	0.3	1.0		
Whooper Swan	*Cygnus cygnus*	LD	Y	2	NF	FA	OO	SL	2	0	2.5	Y	0.0	0.0	3.0	3.0	0.3	1.0	W?	W
Bean Goose	*Anser fabalis*	LD	Y	1	N	FA	OO	LM	3	0	3.0	Y	0.0	0.0	3.0	3.0	0.7	1.0		
Pink-footed Goose	*Anser brachyrhynchus*	LD	Y	1	N	FA	OO	LH	2	0	3.0	Y	0.0	0.0	3.0	3.0	0.7	1.0		
Greater White-fronted Goose	*Anser albifrons albifrons*	LD	Y	1	N	FA	LO	LH	3	0	3.0	Y	0.0	0.0	3.0	3.0	0.7	2.0		W
Greenland White-fronted Goose	*Anser albifrons flavirostris*	LD	Y	1	N	FA	LO	MH	1	0	3.0	Y	0.0	0.0	3.0	3.0	0.7	0.0		
Lesser White-fronted Goose	*Anser erythropus*	LD	Y	1	N	FA	OO	LH	2	0	2.5	Y	0.0	0.0	3.0	3.0	0.7	0.0		
Greylag Goose	*Anser anser*	LD	Y	1	FN	FA	MM	LH	3	0	3.0	Y	0.0	0.0	2.3	3.0	1.3	2.0	W	W
Greater Canada Goose	*Branta canadensis*	SD	N	1	FN	FA	SL	MM	3	0	3.0	Y	0.0	0.0	2.0	3.0	1.7	1.0	WC	C
Barnacle Goose	*Branta leucopsis*	LD	Y	1	NL	FAL	MM	LH	3	1	3.0	Y	0.0	0.0	3.0	3.0	0.3	1.0	W	W
Brent Goose	*Branta bernicla*	LD	Y	1	NL	FAL	ML	LH	2	1	2.5	Y	0.0	0.0	2.3	3.0	0.3	1.0		
Red-breasted Goose	*Branta ruficollis*	LD	Y	1	N	AL	LL	MH	3	0	1.5	Y	0.0	0.0	3.0	3.0	0.7	1.0	W	W
Egyptian Goose	*Alopochen aegyptiaca*	R	N	0	FNA	FA	OO	SM	1	0	2.0	Y	0.0	0.0	2.0	3.0	1.3	1.0		
White-headed Duck	*Oxyura leucocephala*	SD	Y	1	F	F	OO	SM	2	0	1.0	Y	0.0	0.0	0.0	3.0	0.0	0.0		
Ruddy Duck	*Oxyura jamaicensis*	SD	N	0	F	F	OO	SM	2	0	1.5	Y	0.0	0.0	0.0	3.0	0.0	0.0		
Ruddy Shelduck	*Tadorna ferruginea*	LD	Y	0	NF	F	SO	SM	?	0	2.0	?	0.0	0.0	1.0	3.0	0.0	1.0		W
Common Shelduck	*Tadorna tadorna*	SD	Y	1	LFNA	LFA	SL	ML	1	0	3.0	Y	0.0	0.0	1.7	3.0	0.3	1.0		
Eurasian Wigeon	*Anas penelope*	LD	Y	3	FN	FAL	SL	LH	3	0	2.5	Y	0.0	0.0	3.0	3.0	0.3	2.0		
Gadwall	*Anas strepera*	LD	Y	3	FN	F	SL	SM	3	0	2.5	Y	0.0	0.0	0.3	3.0	0.0	2.0	W	W
Common Teal	*Anas crecca*	LD	Y	3	FN	FAL	SL	MH	3	0	2.5	Y	0.0	0.0	1.3	3.0	0.3	2.0		E
Mallard	*Anas platyrhynchos*	LD	Y	2	FNA	FAL	SL	MH	3	0	3.0	Y	0.0	0.0	1.7	3.0	2.3	3.0	W	CE

		Migration behaviour*			Preferred Habitat**		Gregarious-ness**		Mixing degree		Specific Risk factors**				0ccurrence and contact risk***				H5N1 con-firmed****	
English name	Scientific name	Migratory status	Does species migrate to EU?	Cold-weather movements	In breeding season	During migration & winter	In breeding season	During migration & winter	During migration & winter	Colonial breeding	Roosting concentrations	Moult concentrations	Predator behaviour	Scavenging	On farmland	At wetlands	Contact risk with humans	Contact risk with poultry	Europe	Wordwide
Northern Pintail	*Anas acuta*	LD	Y	3	FN	FAL	SL	MH	3	0	2.5	Y	0.0	0.0	0.0	3.0	0.0	1.0	W	E
Garganey	*Anas querquedula*	LD	Y	0	FN	F	SL	MM	3	0	2.5	Y	0.0	0.0	0.0	3.0	0.0	1.0		
Northern Shoveler	*Anas clypeata*	LD	Y	3	FN	FL	SL	MH	3	0	2.5	Y	0.0	0.0	0.0	3.0	0.0	1.0		
Marbled Teal	*Marmaronetta angustirostris*	R	Y	0	FN	F	SL	MM	3	0	2.0	?	0.0	0.0	0.0	3.0	0.0	0.0		
Red-crested Pochard	*Netta rufina*	LD	Y	1	FN	F	SL	MM	?	0	2.0	Y	0.0	0.0	0.0	3.0	0.0	1.0	C?	C
Common Pochard	*Aythya ferina*	LD	Y	2	FN	F	SL	MH	3	0	2.5	Y	0.0	0.0	0.0	3.0	0.3	1.0	W	W
Ferruginous Duck	*Aythya nyroca*	LD	Y	1	FN	F	SL	OM	?	0	2.0	Y	0.0	0.0	0.0	3.0	0.0	1.0		
Tufted Duck	*Aythya fuligula*	LD	Y	2	FN	F	SL	MH	3	0	2.5	Y	0.0	0.0	0.0	3.0	0.7	1.0	W	W
Greater Scaup	*Aythya marila*	LD	Y	0	FN	MF	?	LH	3	0	1.0	Y	0.0	0.0	0.0	3.0	0.0	0.0	W	W
Common Eider	*Somateria mollissima*	SD	Y	2	LM	M	MM	LH	2	0	2.0	Y	0.0	0.0	0.0	3.0	0.3	0.0		
King Eider	*Somateria spectabilis*	SD	Y	1	L	M	?	SH	1	0	1.0	Y	0.0	0.0	0.0	3.0	0.0	0.0		
Steller's Eider	*Polysticta stelleri*	LD	Y	1	L	M	?	SH	1	0	1.0	Y	0.0	0.0	0.0	3.0	0.0	0.0		
Harlequin Duck	*Histrionicus histrionicus*	R	N	1	FN	MF	?	MM	1	0	1.0	?	0.0	0.0	0.0	3.0	0.0	0.0		
Long-tailed Duck	*Clangula hyemalis*	LD	Y	1	FN	M	?	MM	1	0	2.0	Y	0.0	0.0	0.0	3.0	0.0	0.0		
Common Scoter	*Melanitta nigra*	LD	Y	0	F	M	SL	LH	2	0	1.0	Y	0.0	0.0	0.0	3.0	0.0	0.0	W	W
Velvet Scoter	*Melanitta fusca*	LD	Y	0	F	M	?	SM	3	0	1.0	?	0.0	0.0	0.0	3.0	0.0	0.0		
Common Goldeneye	*Bucephala clangula*	LD	Y	1	F	FM	SL	SM	2	0	2.0	Y	0.0	0.0	0.0	3.0	0.3	1.0		
Barrow's Goldeneye	*Bucephala islandica*	R	N	1	F	M	?	SM	2	0	1.0	?	0.0	0.0	0.0	3.0	0.0	0.0		
Smew	*Mergellus albellus*	LD	Y	3	F	F	?	MH	1	0	2.0	?	0.0	0.0	0.0	3.0	0.0	0.0	W	W
Red-breasted Merganser	*Mergus serrator*	LD	Y	1	FL	M	OO	MM	2	0	1.0	?	0.0	0.0	0.0	3.0	0.0	0.0		
Goosander	*Mergus merganser*	LD	Y	2	FL	FM	OO	MM	1	0	2.0	Y	0.0	0.0	0.0	3.0	0.0	1.0	W	W
European Honey-buzzard	*Pernis apivorus*	LD	Y	0	O	O	OO	OO	0	0	0.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Black-winged Kite	*Elanus caeruleus*	R	N	0	O	O	OO	?	0	0	0.0	N	0.0	0.5	0.0	0.5	0.0	0.0		
Black Kite	*Milvus migrans*	LD	Y	0	O	O	OO	SL	1	0	1.0	N	2.0	3.0	1.0	1.0	0.5	0.3		
Red Kite	*Milvus milvus*	SD	N	1	OA	O	OO	SL	1	0	1.0	N	1.0	2.3	2.3	0.5	0.0	0.3		
White-tailed Eagle	*Haliaeetus albicilla*	SD	N	1	OA	OA	OO	OO	1	0	0.7	N	3.0	2.3	1.0	1.0	0.0	0.0		
Lamergeier	*Gypaetus barbatus*	R	N	0	O	O	OO	OO	1	0	0.0	N	0.0	1.5	0.0	0.0	0.0	0.0		
Egyptian Vulture	*Neophron percnopterus*	R	N	0	O	O	SH	OO	2	0	0.0	N	0.0	1.5	0.0	0.0	0.0	0.0		
Griffon Vulture	*Gyps fulvus*	R	N	0	O	O	SH	OO	2	1	0.5	N	0.0	1.5	0.0	0.0	0.0	0.0		
Black Vulture	*Aegypius monachus*	R	N	0	O	O	SH	OO	2	0	0.0	N	0.0	1.5	0.0	0.0	0.0	0.0		
Short-toed Eagle	*Circaetus gallicus*	LD	Y	0	O	O	OO	OO	0	0	0.0	N	0.5	0.3	0.0	0.0	0.0	0.0		
Eurasian Marsh Harrier	*Circus aeruginosus*	LD	Y	0	FN	FNA	OO	OO	1	0	0.7	N	2.0	0.7	1.3	2.0	0.0	0.0		
Hen Harrier	*Circus cyaneus*	LD	N	0	O	OA	OO	OO	1	0	1.0	N	1.0	0.3	1.7	1.3	0.0	0.3	W	W
Pallid Harrier	*Circus macrourus*	LD	Y	0	OA	O	OO	OO	0	0	0.0	N	0.5	0.3	1.5	0.5	0.0	0.0		
Montagu's Harrier	*Circus pygargus*	LD	Y	0	A	OA	OO	OO	0	0	0.0	N	0.7	0.3	2.3	0.7	0.0	0.0		
Northern Goshawk	*Accipiter gentilis*	SD	N	0	O	O	OO	OO	0	0	0.3	N	2.3	0.3	1.3	0.3	0.0	0.3	W	W
Eurasian Sparrowhawk	*Accipiter nisus*	SD	N	0	O	O	OO	OO	0	0	0.3	N	1.7	0.3	2.0	0.7	0.7	0.3		
Levant Sparrowhawk	*Accipiter brevipes*	LD	Y	0	OA	O	OO	ML	0	0	0.5	N	0.5	0.0	1.0	0.5	0.0	0.0		
Common Buzzard	*Buteo buteo*	SD	N	1	OA	AO	OO	OO	0	0	0.5	N	1.3	2.0	2.7	0.7	0.3	0.3	W	W
Long-legged Buzzard	*Buteo rufinus*	SD	Y	0	OA	OA	OO	OO	0	0	0.5	N	1.0	0.5	2.0	1.0	0.0	0.5		
Rough-legged Buzzard	*Buteo lagopus*	LD	N	1	OA	OA	OO	OO	0	0	0.7	N	1.3	1.7	2.0	0.7	0.0	0.3	W	W
Lesser-spotted Eagle	*Aquila pomarina*	LD	Y	0	ON	ON	OO	OO	0	0	0.5	N	1.0	0.5	1.0	1.0	0.0	0.0		
Greater Spotted Eagle	*Aquila clanga*	LD	Y	0	ON	ON	OO	OO	0	0	0.5	N	2.0	1.0	1.0	1.5	0.0	0.0		
Imperial Eagle	*Aquila heliaca*	SD	N	0	OFN	OFN	OO	OO	0	0	0.0	N	2.5	1.5	1.0	1.0	0.0	0.0		
Golden Eagle	*Aquila chrysaetos*	R	N	0	O	O	OO	OO	0	0	0.3	N	1.7	2.0	1.0	0.3	0.0	0.0		
Booted eagle	*Hieraaetus pennatus*	LD	Y	0	OA	O	OO	OO	0	0	0.0	N	0.5	0.5	2.0	0.5	0.0	0.0		
Bonelli's Eagle	*Hieraaetus fasciatus*	R	N	0	O	O	OO	OO	0	0	0.0	N	1.0	0.5	1.0	0.5	0.0	0.0		
Osprey	*Pandion haliaetus*	LD	Y	0	FL	FL	OO	OO	0	0	0.7	N	0.0	0.0	0.0	3.0	0.0	0.0		
Lesser Kestrel	*Falco naumanni*	LD	Y	0	O	O	SL	OO	0	1	0.0	N	0.5	0.0	1.0	0.0	1.5	0.5		
Common Kestrel	*Falco tinnunculus*	SD	N	2	AO	AO	OO	OO	0	0	0.7	N	0.3	0.0	2.7	0.7	0.7	0.3	W	W
Red-footed Falcon	*Falco vespertinus*	LD	Y	0	O	O	OO	OO	0	0	0.0	N	0.5	0.0	2.0	0.0	0.0	0.0		
Merlin	Falco columbarius	LD	Y	1	O	OAL	OO	OO	0	0	0.3	N	0.3	0.0	1.7	1.0	0.0	0.3		

		Migration behaviour*			Preferred Habitat**		Gregariousness**		Mixing degree		Specific Risk factors**				0ccurrence and contact risk***				H5N1 confirmed****	
English name	Scientific name	Migratory status	Does species migrate to EU?	Cold-weather movements	In breeding season	During migration & winter	In breeding season	During migration & winter	During migration & winter	Colonial breeding	Roosting concentrations	Moult concentrations	Predator behaviour	Scavenging	On farmland	At wetlands	Contact risk with humans	Contact risk with poultry	Europe	Wordwide
Eurasian Hobby	*Falco subbuteo*	LD	Y	0	OAF	OAF	OO	OO	0	0	0.3	N	0.3	0.0	2.0	0.7	0.0	0.3		
Eleonora's Falcon	*Falco eleonorae*	LD	Y	0	O	L	SL	OO	0	0	0.0	N	0.3	0.0	0.5	0.0	0.0	0.0		
Lanner	*Falco biarmicus*	R	N	0	O	O	OO	OO	0	0	0.0	N	3.0	0.0	1.0	1.0	0.0	0.0		
Saker	*Falco cherrug*	LD	Y	0	O	ON	OO	OO	0	0	0.0	N	3.0	0.0	1.0	1.0	0.0	0.0		C
Gyr Falcon	*Falco rusticolus*	SD	N	0	O	O	OO	OO	0	0	0.0	N	3.0	0.0	0.5	1.0	0.0	0.0		
Peregrine Falcon	*Falco peregrinus*	LD	N	0	O	OFL	OO	OO	0	0	0.3	N	3.0	0.0	2.0	2.0	0.3	0.0	W	WC
Hazel Grouse	*Bonasa bonasia*	R	N	0	O	O	OO	OO	1	0	0.5	N	0.0	0.0	0.0	0.0	0.0	0.0		
Willow grouse and Red Grouse	*Lagopus lagopus*	R	N	0	O	O	SL	SL	1	0	0.7	N	0.0	0.0	0.0	0.0	0.0	0.0		
Rock Ptarmigan	*Lagopus mutus*	R	N	0	O	O	SL	SL	1	0	0.7	N	0.0	0.0	0.0	0.0	0.0	0.0		
Black Grouse	*Lyrurus tetrix*	R	N	0	AO	O	SM	SL	1	0	0.7	N	0.0	0.0	0.7	0.0	0.0	0.0		
Western Capercaillie	*Tetrao urogallus*	R	N	0	O	O	SL	SL	1	0	0.7	N	0.0	0.0	0.0	0.0	0.0	0.0		
Rock Partridge	*Alectoris graeca*	R	N	0	O	O	SL	SL	1	0	0.5	N	0.0	0.0	0.0	0.0	0.0	0.0		
Red-legged Partridge	*Alectoris rufa*	R	N	0	A	A	SL	SL	1	0	0.7	N	0.0	0.0	3.0	0.0	1.0	2.0		
Barbary partridge	*Alectoris barbara*	R	N	0	O	O	?	SL	1	0	0.5	N	0.0	0.0	?	0.0	0.0	0.0		
Grey Partridge	*Perdix perdix*	R	N	0	A	A	SL	SL	1	0	0.7	N	0.0	0.0	3.0	0.0	1.0	1.7		
Quail	*Coturnix coturnix*	LD	Y	0	A	OA	SL	SL	1	0	0.5	N	0.0	0.0	3.0	0.0	1.0	0.5		
Pheasant	*Phasianus colchicus*	R	N	0	A	AO	OO	OO	1	0	0.7	N	0.0	0.0	2.7	0.0	1.7	3.0		E
Water Rail	*Rallus aquaticus*	SD	N	3	FN	FN	OO	OO	1	0	0.3	N	0.0	1.0	0.7	3.0	0.0	0.0		
Spotted Crake	*Porzana porzana*	LD	Y	0	FN	FN	OO	OO	1	0	0.3	N	0.0	0.0	0.3	3.0	0.0	0.0		
Little Crake	*Porzana parva*	LD	Y	0	FN	FN	OO	OO	0	0	0.0	N	0.0	0.0	0.5	3.0	0.0	0.0		
Baillon's Crake	*Porzana pusilla*	LD	Y	0	FN	FN	OO	OO	0	0	0.0	N	0.0	0.0	0.5	3.0	0.0	0.0		
Corn Crake	*Crex crex*	LD	Y	0	AN	OA	OO	OO	0	0	0.3	N	0.0	0.0	3.0	1.3	0.3	0.3		
Common Moorhen	*Gallinula chloropus*	SD	N	2	FNA	FNA	SL	SL	2	0	1.3	N	0.0	0.7	1.7	3.0	2.0	2.0	W?	W
Purple Gallinule	*Porphyrio porphyrio*	SD	N	0	FN	FN	SL	SL	1	0	0.5	N	0.0	0.0	0.0	3.0	0.0	0.0		W
Common Coot	*Fulica atra*	LD	Y	2	FN	FN	SL	LH	3	0	2.5	Y	0.0	0.7	1.3	3.0	1.3	2.0	W?	W
Crested Coot	*Fulica cristata*	R	N	0	FN	FN	SL	MM	2	0	0.5	?	0.0	0.0	?	3.0	0.0	0.0		
Common Crane	*Grus grus*	LD	Y	1	ANF	AFN	SL	LH	1	0	1.5	N	0.0	0.3	2.7	2.7	0.3	0.3		
Little Bustard	*Tetrax tetrax*	SD	N	0	AO	AO	SL	SM	0	0	0.0	N	0.0	0.0	2.0	0.0	0.0	0.0		
Great Bustard	*Otis tarda*	R	N	0	AO	AO	SL	SM	0	0	0.0	N	0.0	0.0	2.0	0.0	0.0	0.0		
Eurasian Oystercatcher	*Haematopus ostralegus*	LD	Y	1	FAL	LFA	SL	LH	3	0	3.0	N	0.0	0.0	2.3	3.0	0.3	1.0		
Black-winged Stilt	*Himantopus himantopus*	LD	Y	0	Nsal	FLN	SL	SL	2	1	1.0	N	0.0	0.0	0.0	3.0	0.0	1.0		
Pied Avocet	*Recurvirostra avosetta*	LD	Y	2	FLN	LFN	SL	SM	2	1	2.5	N	0.0	0.0	0.0	2.0	0.0	0.0		
Stone-curlew	*Burhinus oedicnemus*	LD	Y	0	OA	AN	OO	OO	1	0	0.0	N	0.0	0.0	2.0	0.5	0.0	0.0		
Cream-coloured Courser	*Cursorius cursor*	SD	N	0	O	O	OO		1	0	0.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Collared Pratincole	*Glareola pratincola*	LD	Y	0	NF	ANF	SL	SL	?	1	1.0	N	0.0	0.0	1.0	3.0	0.0	0.0		
Black-winged Pratincole	*Glareola nordmanni*	LD	Y	0	ON	ON FA	SL		1	1	1.0	N	0.0	0.0	1.0	3.0	0.0	0.0		
Northern Lapwing	*Vanellus vanellus*	LD	Y	3	FNA	FA	SL	MH	2	0	2.5	N	0.0	0.0	3.0	2.3	0.3	2.0		
Sociable Lapwing	*Vanellus gregarius*	LD	Y	0	ON	AN	SL	?	1	0	0.0	N	0.0	0.0	2.0	2.0	0.0	0.0		
European Golden Plover	*Pluvialis apricaria*	LD	Y	3	ON	AN	SL	LH	2	0	2.5	N	0.0	0.0	3.0	2.3	0.3	1.0		
Grey Plover	*Pluvialis squatarola*	LD	Y	1	N	L	SL	MH	3	0	3.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Little Ringed Plover	*Charadrius dubius*	LD	Y	0	FN	FN	OO	OL	1	0	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Great Ringed Plover	*Charadrius hiaticula*	LD	Y	1	FL NA	LA	SL	SM	3	0	2.5	N	0.0	0.0	1.0	3.0	0.0	0.0		
Kentish Plover	*Charadrius alexandrinus*	LD	Y	0	LN	L	SL	SM	2	0	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Caspian Plover	*Charadrius asiaticus*	LD	Y	0	ON	FAN	SL	SM	1	0	1.0	N	0.0	0.0	?	2.0	0.0	0.0		
Eurasian Dotterel	*Charadrius morinellus*	LD	Y	0	O	AN	SL	OL	1	0	0.0	N	0.0	0.0	1.0	1.0	0.0	0.0		
Eurasian Woodcock	*Scolopax rusticola*	LD	Y	2	O	O	OO	OL	1	0	0.0	N	0.0	0.0	1.3	0.0	0.0	0.0		
Jack Snipe	*Lymnocryptes minimus*	LD	Y	2	ONF	FN	OO	OL	1	0	1.0	N	0.0	0.0	1.7	3.0	0.0	1.0		
Great Snipe	*Gallinago media*	LD	Y	0	NF	FAN	SL	OL	1	0	1.0	N	0.0	0.0	1.0	3.0	0.0	0.0		
Common Snipe	*Gallinago gallinago*	LD	Y	2	NAF	FA	OO	SL	1	0	1.3	N	0.0	0.0	1.7	3.0	0.0	1.0		
Black-tailed Godwit	*Limosa limosa*	LD	Y	1	ANF	FAL	SL	MM	3	0	3.0	N	0.0	0.0	2.3	3.0	0.3	1.0		

		Migration behaviour*			Preferred Habitat**		Gregarious-ness**		Mixing degree		Specific Risk factors**				0ccurrence and contact risk***				H5N1 con-firmed****	
English name	Scientific name	Migratory status	Does species migrate to EU?	Cold-weather movements	In breeding season	During migration & winter	In breeding season	During migration & winter	During migration & winter	Colonial breeding	Roosting concentrations	Moult concentrations	Predator behaviour	Scavenging	On farmland	At wetlands	Contact risk with humans	Contact risk with poultry	Europe	Wordwide
Bar-tailed Godwit	*Limosa lapponica*	LD	Y	1	N	L	SL	LH	3	0	3.0	N	0.0	0.0	0.5	3.0	0.0	0.0		
Whimbrel	*Numenius phaeopus*	LD	Y	0	N	FAL	OO	SL	2	0	2.0	N	0.0	0.0	1.0	3.0	0.0	1.0		
Slender-billed Curlew	*Numenius tenuirostris*	LD	Y	0	ON	FN	OO	OL	1	0	0.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Eurasian Curlew	*Numenius arquata*	LD	Y	2	NAF	LFA	SL	MM	3	0	2.5	N	0.0	0.0	2.0	3.0	0.3	1.0		
Spotted Redshank	*Tringa erythropus*	LD	Y	0	FN NA	FLN	SL	SL	2	0	1.5	N	0.0	0.0	0.0	3.0	0.0	1.0		
Common Redshank	*Tringa totanus*	LD	Y	2	FL	LFA	SL	MM	3	0	3.0	N	0.0	0.0	2.0	3.0	0.0	1.0		
Marsh Sandpiper	*Tringa stagnatilis*	LD	Y	0	N	FN	SL	SL	2	0	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Common Greenshank	*Tringa nebularia*	LD	Y	0	ON	LF	OO	SL	2	0	2.0	N	0.0	0.0	0.3	3.0	0.0	1.0		
Green Sandpiper	*Tringa ochropus*	LD	Y	0	N	FN	OO	OL	1	0	0.5	N	0.0	0.0	0.0	3.0	0.0	1.0		W
Wood Sandpiper	*Tringa glareola*	LD	Y	0	N	FN	SL	OL	1	0	1.0	N	0.0	0.0	0.0	3.0	0.0	1.0		
Terek Sandpiper	*Xenus cinereus*	LD	Y	0	NF	FLN	SL	OL	2	0	0.5	N	0.0	0.0	0.0	3.0	0.0	0.0		
Common Sandpiper	*Actitis hypoleucos*	LD	Y	0	NF	FLN	SL	OL	0	0	1.0	N	0.0	0.0	0.0	3.0	0.0	1.0		
Ruddy Turnstone	*Arenaria interpres*	LD	Y	0	O	L	SL	SM	3	0	2.5	N	0.0	0.7	0.0	2.0	0.0	0.0		
Red Knot	*Calidris canutus*	LD	Y	1	O	L	OO	LH	3	0	3.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Sanderling	*Calidris alba*	LD	Y	0	O	L	OO	MH	2	0	2.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Little Stint	*Calidris minuta*	LD	Y	0	O	FN	SL	SL	2	0	1.5	N	0.0	0.0	0.0	2.3	0.0	0.0		
Temminck's Stint	*Calidris temminckii*	LD	Y	0	O	FN	SL	SL	2	0	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Purple Sandpiper	*Calidris maritima*	LD	Y	0	O	L	OO	SM	2	0	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Dunlin	*Calidris alpina*	LD	Y	0	NAF	L	SL	LH	3	0	3.0	N	0.0	0.0	0.3	2.3	0.0	1.0		
Curlew Sandpiper	*Calidris ferruginea*	LD	Y	0	O	L	OO	MM	3	0	2.0	N	0.0	0.0	0.0	2.3	0.0	0.0		
Broad-billed Sandpiper	*Limicola falcinellus*	LD	Y	0	O	FLN	OO	SL	1	0	2.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Ruff	*Philomachus pugnax*	LD	Y	0	NF	FA	MM	MM	2	0	2.0	N	0.0	0.0	2.3	3.0	0.3	1.0		
Red-necked Phalarope	*Phalaropus lobatus*	LD	Y	0	NF	M	OO	SL	1	0	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Grey Phalarope	*Phalaropus fulicarius*	LD	Y	0	NF	M	OO	ML	1	0	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Pomarine Skua	*Stercorarius pomarinus*	LD	Y	0	MO	M	SL	OO	0	1	0.0	N	1.0	0.5	0.0	0.0	0.0	0.0		
Arctic Skua	*Stercorarius parasiticus*	LD	Y	0	MO	M	SL	OO	0	1	0.0	N	1.0	0.5	0.0	0.0	0.0	0.0		
Long-tailed Skua	*Stercorarius longicaudus*	LD	Y	0	MO	M	SL	OO	0	1	0.0	N	1.0	0.5	0.0	0.0	0.0	0.0		
Great Skua	*Stercorarius skua*	LD	Y	0	MO	M	SL	OO	0	1	0.0	N	1.5	1.0	0.0	0.0	0.0	0.0		
Pallas's Gull	*Larus ichthyaetus*	LD	Y	0	LFN	LFM	MH	SM	2	3	3.0	N	1.0	1.0	0.0	3.0	0.0	0.0		WC
Mediterranean Gull	*Larus melanocephalus*	LD	Y	0	LFN	MA	MH	SM	3	3	2.5	N	0.0	1.3	0.3	3.0	0.0	0.0		
Little Gull	*Larus minutus*	LD	Y	0	FN	MF	SM	SL	2	1	2.0	N	0.0	0.3	0.0	3.0	0.0	0.0		
Sabine's Gull	*Larus sabini*	LD	Y	0	FO	M	SL	OO	0	1	1.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Black-headed Gull	*Larus ridibundus*	LD	Y	1	FL NA	FAL	LH	LM	3	3	3.0	N	0.0	1.3	2.7	3.0	1.7	3.0		W
Slender-billed Gull	*Larus genei*	LD	Y	0	LFM	FA LM	LH	SL	3	3	3.0	N	0.0	0.5	1.0	3.0	0.0	0.0		
Audouin's Gull	*Larus audouinii*	LD	Y	0	LFM	ML	SL	SL	1	2	1.5	N	0.0	1.5	0.0	3.0	0.0	0.0		
Common Gull	*Larus canus*	LD	Y	1	LFM	FAL	MM	MM	3	2	3.0	N	0.0	1.3	2.3	3.0	1.0	1.0	W	W
Lesser Black-backed Gull	*Larus fuscus*	LD	Y	1	LFM	MA	LM	MM	3	2	3.0	N	0.3	1.7	2.3	3.0	1.0	1.0		
Yellow-legged Gull	*Larus michahellis*	LD	Y	0	LFM	MFA	LM	ML	3	2	2.0	N	0.3	1.7	2.3	3.0	0.3	1.0		
Herring Gull	*Larus argentatus*	LD	Y	1	LFM	LA	LM	MM	3	2	3.0	N	0.3	1.7	2.7	3.0	1.3	1.0		
Iceland Gull	*Larus glaucoides*	LD	Y	2	LFM	ML	?	SL	2	2	1.0	N	0.0	1.7	0.0	3.0	0.0	0.0		
Glaucous Gull	*Larus hyperboreus*	LD	Y	2	LFM	ML	?	SL	2	2	1.0	N	0.3	2.0	0.0	3.0	0.0	0.0		
Great Black-backed Gull	*Larus marinus*	LD	Y	0	LFM	ML	ML	SM	3	2	2.5	N	1.0	2.3	1.0	3.0	0.0	0.0		
Ross's Gull	*Rhodostethia rosea*	LD	Y	0	LFM	LM	SL	OO	1	1	0.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Black-legged Kittiwake	*Rissa tridactyla*	LD	Y	0	MO	M	LH	SL	1	3	1.0	N	0.0	0.0	0.0	0.0	0.7	0.0		
Ivory Gull	*Pagophila eburnea*	LD	Y	0	LFM	LM	SM	?	1	1	0.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Gull-billed Tern	*Gelochelidon nilotica*	LD	Y	0	LFM	MF	MM	SL	1	1	1.5	N	0.0	0.0	0.0	3.0	0.0	0.0		
Caspian Tern	*Hydroprogne caspia*	LD	Y	0	LFM	MF	MH	SL	1	3	2.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Lesser Crested Tern	*Sterna bengalensis*	LD	Y	0	LM	ML	MH	SL	1	3	2.0	N	0.0	0.0	0.0	3.0	0.0	0.0		
Sandwich Tern	*Sterna sandvicensis*	LD	Y	0	LM	ML	LH	SL	1	3	2.3	N	0.0	0.0	0.0	3.0	0.0	0.0		
Roseate Tern	*Sterna dougallii*	LD	Y	0	LM	ML	MH	SL	1	2	2.0	N	0.0	0.0	0.0	3.0	0.0	0.0		

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		Migration behaviour*			Preferred Habitat**		Gregariousness**		Mixing degree		Specific Risk factors**				0ccurrence and contact risk***				H5N1 confirmed****	
English name	Scientific name	Migratory status	Does species migrate to EU?	Cold-weather movements	In breeding season	During migration & winter	In breeding season	During migration & winter	During migration & winter	Colonial breeding	Roosting concentrations	Moult concentrations	Predator behaviour	Scavenging	On farmland	At wetlands	Contact risk with humans	Contact risk with poultry	Europe	Wordwide
Common Tern	*Sterna hirundo*	LD	Y	0	LFM	MF	LH	SM	1	2	2.3	N	0.0	0.0	0.0	3.0	0.0	0.0		
Arctic Tern	*Sterna paradisaea*	LD	Y	0	LFM	ML	LH	SL	1	2	2.3	N	0.0	0.0	0.0	0.0	0.0	0.0		
Little Tern	*Sterna albifrons*	LD	Y	0	LFM	MF	MM	SL	1	1	1.5	N	0.0	0.0	0.0	3.0	0.0	0.0		
Whiskered Tern	*Chlidonias hybrida*	LD	Y	0	FN	F	MM	?	?	1	1.5	N	0.0	0.0	0.0	3.0	0.0	0.0		
Black Tern	*Chlidonias niger*	LD	Y	0	FN	FM	MM	SM	1	1	1.5	N	0.0	0.0	0.0	3.0	0.0	0.0		
White-winged Tern	*Chlidonias leucopterus*	LD	Y	0	FN	F	MM	SM	1	1	1.5	N	0.0	0.0	0.0	3.0	0.0	0.0		
Common Guillemot	*Uria aalge*	LD	Y	0	ML	M	LH	MM	2	3	1.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Brünnich's Guillemot	*Uria lomvia*	SD	Y	0	ML	M	LH	?	1	3	1.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Razorbill	*Alca torda*	LD	Y	0	ML	M	MM	MM	2	3	1.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Black Guillemot	*Cepphus grylle*	SD	Y	0	ML	M	ML	SL	1	1	1.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Little Auk	*Alle alle*	LD	Y	0	ML	M	LH	SL	1	3	1.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Atlantic Puffin	*Fratercula arctica*	LD	Y	0	ML	M	LH	MM	2	3	1.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Rock Pigeon	*Columba livia*	R	N	0	LAO	OA	SL	MH	2	0	1.0	N	0.0	0.0	1.0	0.0	2.0	2.0		
Stock Dove	*Columba oenas*	SD	N	0	A	A	OO	SH	2	0	1.0	N	0.0	0.0	3.0	0.3	1.0	2.7		
Common Wood Pigeon	*Columba palumbus*	SD	N	1	A	A	OO	LH	2	0	2.5	N	0.0	0.0	3.0	0.3	1.7	3.0		
Eurasian Collared Dove	*Streptopelia decaocto*	R	N	0	AO	AO	OO	MH	2	0	1.5	N	0.0	0.0	2.7	0.0	2.7	3.0		
European Turtle Dove	*Streptopelia turtur*	LD	Y	0	OA	OA	OO	OO	1	0	1.0	N	0.0	0.0	2.5	0.0	0.0	1.0		
Dupont's Lark	*Chersophilus duponti*	R	N	0	O	O	?	?	1	0	1.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Calandra Lark	*Melanocorypha calandra*	R	N	1	OA	OA	?	MM	1	0	1.0	N	0.0	0.0	2.0	0.0	1.0	1.0		
Short-toed Lark	*Calandrella brachydactyla*	LD	Y	0	O	O	SL	MM	2	0	1.0	N	0.0	0.0	1.0	0.0	1.0	1.0		
Lesser Short-toed Lark	*Calandrella rufescens*	R	N	0	O	O	?	MM	2	0	1.0	N	0.0	0.0	1.0	0.0	1.0	1.0		
Crested Lark	*Galerida cristata*	R	N	0	AO	AO	OO	OO	1	0	1.0	N	0.0	0.0	1.5	0.5	1.5	1.0		
Thekla Lark	*Galerida theklae*	R	N	0	OA	OA	?	OO	1	0	1.0	N	0.0	0.0	1.5	0.5	1.0	1.0		
Wood Lark	*Lullula arborea*	SD	N	0	O	OA	OO	SL	1	0	1.0	N	0.0	0.0	1.3	0.0	0.3	0.3		
Sky Lark	*Alauda arvensis*	SD	N	2	AO	AO	OO	SM	2	0	1.5	N	0.0	0.0	3.0	0.3	1.0	2.0		
Horned Lark	*Eremophila alpestris*	SD	N	2	O	OL	OO	MM	2	0	1.0	N	0.0	0.0	0.3	0.3	0.3	0.0		
Sand Martin	*Riparia riparia*	LD	Y	0	F	NF	MH	MM	1	2	3.0	N	0.0	0.0	1.0	3.0	1.0	0.0		
Eurasian Crag Martin	*Ptyonoprogne rupestris*	SD	N	0	O	O	MM	ML	1	1	2.0	N	0.0	0.0	0.5	1.5	0.5	0.0		
Barn Swallow	*Hirundo rustica*	LD	Y	0	FA	NAF	SH	LH	2	2	3.0	N	0.0	0.0	2.0	3.0	3.0	2.3		
Red-rumped Swallow	*Cecropis daurica*	LD	Y	0	OA	OA	?	SM	2	1	?	N	0.0	0.0	1.0	?	?	?		
House Martin	*Delichon urbica*	LD	Y	0	OA	OAF	MH	MM	1	3	2.5	N	0.0	0.0	1.3	2.7	3.0	2.0		
Tawny Pipit	*Anthus campestris*	LD	Y	0	O	O	OO	OO	1	0	1.0	N	0.0	0.0	1.0	1.0	0.5	0.5		
Tree Pipit	*Anthus trivialis*	LD	Y	0	O	O	OO	OO	1	0	1.0	N	0.0	0.0	0.7	0.3	0.7	0.0		
Meadow Pipit	*Anthus pratensis*		N	0	AO	AO	OO	SM	2	0	1.5	N	0.0	0.0	3.0	0.5	0.7	2.0		
Red-throated Pipit	*Anthus cervinus*	LD	Y	0	O	O	OO	SL	1	0	1.0	N	0.0	0.0	1.0	1.0	0.5	0.5		
Rock Pipit	*Anthus petrosus*		N	0	L	L	OO	SL	1	0	1.0	N	0.0	0.0	0.7	1.7	0.3	0.0		
Water Pipit	*Anthus spinoletta*	SD	N	0	ON	OF	OO	OO	1	0	1.0	N	0.0	0.0	1.0	2.7	0.3	0.3		
Yellow Wagtail	*Motacilla flava*	LD	Y	0	NAF	OF	OO	MM	1	0	3.0	N	0.0	0.0	2.7	2.3	0.7	0.7		
Citrine Wagtail	*Motacilla citreola*	LD	Y	0	NAF	OF	OO	SL	1	0	1.0	N	0.0	0.0	1.5	2.5	1.0	1.0		
Grey Wagtail	*Motacilla cinerea*	SD	N	1	F	OF	OO	OO	1	0	0.5	N	0.0	0.0	1.0	3.0	1.0	0.5		
Pied/White Wagtail	*Motacilla alba*	SD	N	1	AFO	AOF	OO	MM	1	0	2.0	N	0.0	0.0	2.7	2.3	2.3	2.7		
Rufous-tailed Rock Thrush	*Monticola saxatilis*	LD	Y	0	O	O	OO	OO	0	0	0.5	N	0.0	0.0	0.0	0.0	0.0	0.0		
Blue Rock Thrush	*Monticola solitarius*	SD	N	0	O	O	OO	OO	0	0	0.5	N	0.0	0.0	0.0	0.0	0.0	0.0		
Ring Ouzel	*Turdus torquatus*	LD	Y	0	O	O	OO	OO	1	0	0.5	N	0.0	0.0	0.5	0.0	0.0	0.0		
Common Blackbird	*Turdus merula*	SD	N	2	OA	OA	OO	SL	2	0	1.3	N	0.0	0.0	2.3	0.3	2.7	1.7		
Fieldfare	*Turdus pilaris*	LD	N	2	OA	AO	OO	MM	2	1	1.3	N	0.0	0.0	3.0	0.3	0.7	2.0		
Song Thrush	*Turdus philomelos*	SD	N	2	OA	AO	OO	SL	2	0	1.0	N	0.0	0.0	2.3	0.3	1.7	1.7		
Redwing	*Turdus iliacus*	LD	N	2	OA	AO	OO	MM	2	0	2.0	N	0.0	0.0	2.7	0.3	0.7	2.0		
Mistle Thrush	*Turdus viscivorus*	SD	N	1	OA	AO	OO	OO	2	0	0.7	N	0.0	0.0	2.3	0.3	1.7	1.0		
Red-backed Shrike	*Lanius collurio*	LD	Y	0	OA	OA	OO	OO	0	0	0.5	N	1.0	0.0	1.5	0.0	0.5	0.0		
Lesser Grey Shrike	*Lanius minor*	LD	Y	0	OA	OA	OO	OO	0	0	0.5	N	1.0	0.0	1.0	0.0	0.5	0.0		
Great Grey Shrike	*Lanius excubitor*	SD	Y	0	OA	OA	OO	OO	0	0	0.5	N	1.0	0.0	1.0	0.0	0.5	0.0		
Woodchat Shrike	*Lanius senator*	LD	Y	0	OA	OA	OO	OO	0	0	0.5	N	1.0	0.0	1.5	0.0	0.5	0.0		
Masked Shrike	*Lanius nubicus*	LD	Y	0	OA	OA	OO	OO	0	0	0.5	N	1.0	0.0	1.0	0.0	0.5	0.0		

		Migration behaviour*			Preferred Habitat**		Gregariousness**		Mixing degree		Specific Risk factors**				0ccurrence and contact risk***				H5N1 confirmed****	
English name	Scientific name	Migratory status	Does species migrate to EU?	Cold-weather movements	In breeding season	During migration & winter	In breeding season	During migration & winter	During migration & winter	Colonial breeding	Roosting concentrations	Moult concentrations	Predator behaviour	Scavenging	On farmland	At wetlands	Contact risk with humans	Contact risk with poultry	Europe	Wordwide
Eurasian Jay	*Garrulus glandarius*	R	N	0	OA	OA	OO	OO	1	0	0.7	N	0.0	0.7	1.3	0.0	1.0	0.3		
Siberian Jay	*Perisoreus infaustus*	R	N	2	OA	OA	?	OO	1	0	0.5	N	0.0	0.0	0.0	0.0	0.0	0.0		
Azure-winged Magpie	*Cyanopica cyaneus*	R	N	0	O	O	?	OO	?	1	0.5	N	0.0	?	1.0	0.0	0.0	?		
Black-billed Magpie	*Pica pica*	R	N	0	AO	OA	OO	SL	1	0	1.0	N	0.0	2.0	2.3	0.3	1.7	3.0		
Spotted Nutcracker	*Nucifraga caryocatactes*	R	N	0	O	O	OO	OO	1	0	0.5	N	0.0	0.0	0.0	0.0	0.0	0.0		
Yellow-billed Chough	*Pyrrhocorax graculus*	R	N	0	O	O	ML	MM	1	1	1.0	N	0.0	0.0	1.0	0.0	1.0	1.0		
Red-billed Chough	*Pyrrhocorax pyrrhocorax*	R	N	0	AO	AO	ML	MM	1	0	1.0	N	0.0	1.0	2.3	0.0	0.0	0.0		
Eurasian Jackdaw	*Corvus monedula*	SD	N	0	AO	AO	MM	MM	3	1	2.7	N	0.0	1.7	3.0	0.3	2.7	3.0		W
Rook	*Corvus frugilegus*	R	N	1	A	A	LH	LM	3	2	2.7	N	0.0	1.0	3.0	0.3	1.7	2.0		
Carrion Crow	*Corvus corone*	R	N	0	A	A	OO	SL	3	0	2.3	N	0.0	2.3	3.0	1.0	1.7	2.0		
Hooded Crow	*Corvus cornix*	SD	N	0	OA	AO	OO	SL	3	0	2.3	N	0.0	2.3	3.0	1.0	1.7	2.0		W
Common Raven	*Corvus corax*	R	N	0	OA	OA	OO	OO	1	0	2.0	N	0.0	2.7	3.0	0.7	0.3	1.0		
Common Starling	*Sturnus vulgaris*	LD	N	2	AO	AO	SL	LH	3	0	3.0	N	0.0	0.7	2.7	1.3	3.0	3.0	E	WE
Spotless Starling	*Sturnus unicolor*	R	N	0	AO	AO	?	MH	3	0	3.0	N	0.0	0.0	2.5	1.0	3.0	3.0		
Rosy Starling	*Sturnus roseus*	LD	Y	0	?	OA	?	MH	?	0	?	N	0.0	0.0	2.0	1.0	?	?		
House Sparrow	*Passer domesticus*	R	N	0	AO	AO	MH	MM	3	0	3.0	N	0.0	0.0	2.3	0.0	3.0	3.0		C
Spanish Sparrow	*Passer hispaniolensis*	R	N	0	AO	AO	MH	MM	3	0	3.0	N	0.0	0.0	2.0	0.0	3.0	3.0		
Eurasian Tree Sparrow	*Passer montanus*	R	N	0	OA	OA	SM	SM	3	0	2.5	N	0.0	0.0	2.3	0.0	1.3	2.0	W	W
Rock Sparrow	*Petronia petronia*	R	N	0	O	O	OO	MH	2	0	1.0	N	0.0	0.0	0.5	0.0	0.0	0.0		
Chaffinch	*Fringilla coelebs*	SD	N	1	OA	AO	OO	MM	3	0	2.0	N	0.0	0.0	2.3	0.3	2.3	2.3		
Brambling	*Fringilla montifringilla*	SD	N	3	OA	A	OO	MH	3	0	2.0	N	0.0	0.0	2.0	0.0	1.0	0.7		
European Serin	*Serinus serinus*	SD	N	0	OA	OA	OO	SM	2	0	0.0	N	0.0	0.0	1.0	0.0	2.0	0.0		
Citril Finch	*Serinus citrinella*	SD	N	1	O	O	OO	SM	2	0	0.0	N	0.0	0.0	0.5	0.0	1.0	0.0		
Corsican Finch	*Serinus corsicana*	R	N	0	O	O	OO	SM	1	0	0.0	N	0.0	0.0	1.0	0.0	1.0	?		
European Greenfinch	*Carduelis chloris*	SD	N	1	AO	AO	OO	SM	3	0	2.0	N	0.0	0.0	2.3	0.0	2.3	1.7		
European Goldfinch	*Carduelis carduelis*	SD	N	1	AO	AO	OO	SM	2	0	1.5	N	0.0	0.0	2.3	0.7	1.7	1.0		
Eurasian Siskin	*Carduelis spinus*	SD	N	1	OA	OA	OO	MM	2	0	1.5	N	0.0	0.0	0.7	0.0	1.3	0.7		
Common Linnet	*Carduelis cannabina*	SD	N	2	OA	OA	OO	MM	3	0	2.0	N	0.0	0.0	2.3	0.3	0.3	1.3		
Twite	*Carduelis flavirostris*	SD	N	1	OA	OL	OO	MM	2	0	1.0	N	0.0	0.0	1.7	1.0	0.3	0.0		
Common Redpoll	*Carduelis flammea*	SD	N	1	O	OA	OO	MM	3	0	1.5	N	0.0	0.0	1.0	0.3	0.3	0.0		
Arctic Redpoll	*Carduelis hornemanni*	SD	N	1	O	OA	OO	SM	1	0	0.0	N	0.0	0.0	1.0	0.5	0.5	0.0		
Two-barred Crossbill	*Loxia leucoptera*	R	N	1	O	O	OO	SL	1	0	0.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Common Crossbill	*Loxia curvirostra*	R	N	1	O	O	OO	SL	1	0	0.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Scottish Crossbill	*Loxia scotica*	R	N	1	O	O	OO	SL	1	0	0.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Parrot Crossbill	*Loxia pytyopsittacus*	R	N	0	O	O	OO	SL	1	0	0.0	N	0.0	0.0	0.0	0.0	0.0	0.0		
Trumpeter Finch	*Bucanetes githagineus*	R	N	0	O	O	OO	SL	2	0	0.0	N	0.0	0.0	0.5	0.0	1.0	0.0		
Scarlet Rosefinch	*Carpodacus erythrinus*	LD	Y	0	ON	O	OO	OO	1	0	0.0	N	0.0	0.0	0.0	1.0	1.0	0.0		
Pine Grosbeak	*Pinicola enucleator*	SD	N	0	O	O	OO	OO	1	0	0.0	N	0.0	0.0	1.0	0.0	0.5	0.0		
Common Bullfinch	*Pyrrhula pyrrhula*	SD	N	0	OA	O	OO	OO	1	0	0.0	N	0.0	0.0	1.0	0.0	1.0	0.0		
Hawfinch	*Coccothraustes coccothraustes*	SD	N	0	O	O	OO	OO	0	0	0.0	N	0.0	0.0	0.5	0.0	1.0	0.0		
Lapland Longspur	*Calcarius lapponicus*	SD	N	1	O	LO	OO	SL	2	0	0.0	N	0.0	0.0	0.5	1.0	0.0	0.0		
Snow Bunting	*Plectrophenax nivalis*	SD	N	1	O	LO	OO	SL	2	0	0.0	N	0.0	0.0	0.5	1.0	0.0	0.0		
Yellowhammer	*Emberiza citrinella*	SD	N	1	AO	A	OO	SM	2	0	1.5	N	0.0	0.0	2.7	0.0	0.3	1.7		
Cirl Bunting	*Emberiza cirlus*	R	N	0	AO	A	OO	SL	2	0	1.5	N	0.0	0.0	2.7	0.0	0.5	0.5		
Rock Bunting	*Emberiza cia*	R	N	0	O	O	OO	SL	2	0	0.0	N	0.0	0.0	0.5	0.0	0.0	0.0		
Cinereous Bunting	*Emberiza cineracea*	SD	N	0	O	O	OO	OO	2	0	0.0	N	0.0	0.0	0.5	0.0	0.0	0.0		
Ortolan Bunting	*Emberiza hortulana*	LD	Y	0	AO	AO	OO	OO	1	0	0.0	N	0.0	0.0	2.5	0.0	0.5	1.0		
Cretzschmar's Bunting	*Emberiza caesia*	LD	Y	0	AO	AO	OO	OO	1	0	0.0	N	0.0	0.0	1.5	0.0	1.0	0.0		
Rustic Bunting	*Emberiza rustica*	LD	Y	0	O	O	OO	OO	2	0	0.0	N	0.0	0.0	1.0	0.0	0.0	0.0		
Little Bunting	*Emberiza pusilla*	LD	Y	0	O	O	OO	OO	1	0	0.0	N	0.0	0.0	0.5	0.0	0.0	0.0		
Yellow-breasted Bunting	*Emberiza aureola*	LD	Y	0	ON	O	OO	OO	1	0	0.0	N	0.0	0.0	1.0	0.0	0.0	0.0		
Reed Bunting	*Emberiza schoeniclus*	SD	N	1	NA	NAF	OO	SM	2	0	1.5	N	0.0	0.0	2.3	2.3	0.3	0.3		
Black-headed Bunting	*Emberiza melanocephala*	LD	Y	0	OA	OA	OO	OO	2	0	?	N	0.0	0.0	1.5	0.0	1.0	1.0		
Corn Bunting	*Miliaria calandra*	SD	N	0	A	A	OO	SM	2	0	1.5	N	0.0	0.0	2.7	0.0	0.3	0.0		

Annex 2.3 Colonial Breeding as a Risk Factor

European bird species with a higher risk of spreading H5N1 as a consequence of colonial breeding, as assessed by 3 experts. Higher Risk Species identified on the basis of colonial breeding have been given bold codes (see also Table 2.3). The meanings of the codes used are as follows: Habitat code: A = agricultural, F = freshwater, M = marine, L = littoral, N = freshwater marsh, O = other land habitat, sal = Salinas. Risk code: H = high risk, M = medium risk, L = low risk.

English name	Scientific name	Habitat code	Risk code
Northern Gannet	*Morus bassanus*	M	H
Great Cormorant	*Phalacrocorax carbo*	**FM**	**H**
Pygmy Cormorant	*Phalacrocorax pygmeus*	**F**	**H**
European Shag	*Phalacrocorax aristotelis*	M	H
White pelican	*Pelecanus onocrotalus*	**FM**	**H**
Dalmatian Pelican	*Pelecanus crispus*	**FM**	**H**
Black-crowned Night Heron	*Nycticorax nycticorax*	**FN**	**H**
Squacco Heron	*Ardeola ralloides*	**FN**	**H**
Cattle Egret	*Bubulcus ibis*	**FNA**	**H**
Little Egret	*Egretta garzetta*	**FNL**	**H**
Great White Egret	*Ardea alba*	**FN**	**M**
Grey Heron	*Ardea cinerea*	**FNAL**	**M**
Purple Heron	*Ardea purpurea*	**FN**	**M**
White Stork	*Ciconia ciconia*	**FA**	**M**
Glossy Ibis	*Plegadis falcinellus*	**F**	**M**
Eurasian Spoonbill	*Platalea leucorodia*	**FNL**	**H**
Greater Flamingo	*Phoenicopterus ruber*	SalL	H
Barnacle Goose	*Branta leucopsis*	NL	L
Brent Goose	*Branta bernicla*	NL	L
Griffon Vulture	*Gyps fulvus*	O	L
Lesser Kestrel	*Falco naumanni*	O	L
Black-winged Stilt	*Himantopus himantopus*	Nsal	L
Pied Avocet	*Recurvirostra avosetta*	FLN	L
Collared Pratincole	*Glareola pratincola*	NF	L
Black-winged Pratincole	*Glareola nordmanni*	ON	L
Pomarine Skua	*Stercorarius pomarinus*	MO	L
Arctic Skua	*Stercorarius parasiticus*	MO	L
Long-tailed Skua	*Stercorarius longicaudus*	MO	L
Great Skua	*Stercorarius skua*	MO	L
Pallas's Gull	*Larus ichthyaetus*	LFN	H
Mediterranean Gull	*Larus melanocephalus*	LFN	H
Little Gull	*Larus minutus*	FN	L
Sabine's Gull	*Larus sabini*	FO	L
Black-headed Gull	*Larus ridibundus*	**FLNA**	**H**
Slender-billed Gull	*Larus genei*	LFM	H
Audouin's Gull	*Larus audouinii*	LFM	M
Common Gull	*Larus canus*	LFM	M
Lesser Black-backed Gull	*Larus fuscus*	LFM	M
Yellow-legged Gull	*Larus michahellis*	LFM	M
Herring Gull	*Larus argentatus*	LFM	M
Iceland Gull	*Larus glaucoides*	LFM	M
Glaucous Gull	*Larus hyperboreus*	LFM	M
Great Black-backed Gull	*Larus marinus*	LFM	M
Ross's Gull	*Rhodostethia rosea*	LFM	
LBlack-legged Kittiwake	Rissa tridactyla	MO	H
Ivory Gull	Pagophila eburnea	LFM	L
Gull-billed Tern	Gelochelidon nilotica	LFM	L
Caspian Tern	Hydroprogne caspia	LFM	H
Lesser Crested Tern	Sterna bengalensis	LM	H
Sandwich Tern	Sterna sandvicensis	LM	H
Roseate Tern	Sterna dougallii	LM	M
Common Tern	Sterna hirundo	LFM	M
Arctic Tern	Sterna paradisaea	LFM	M
Little Tern	Sterna albifrons	LFM	L
Whiskered Tern	Chlidonias hybrida	FN	L
Black Tern	Chlidonias niger	FN	L
White-winged Tern	Chlidonias leucopterus	FN	L
Common Guillemot	Uria aalge	ML	H
Brünnich's Guillemot	Uria lomvia	ML	H
Razorbill	Alca torda	ML	H
Black Guillemot	Cepphus grylle	ML	L
Little Auk	Alle alle	ML	H
Atlantic Puffin	Fratercula arctica	ML	H
Sand Martin	Riparia riparia	**F**	**M**
Eurasian Crag Martin	Ptyonoprogne rupestris	O	L
Barn Swallow	Hirundo rustica	**FA**	**M**
Red-rumped Swallow	Cecropis daurica	OA	L
House Martin	Delichon urbica	OA	H
Fieldfare	Turdus pilaris	OA	L
Azure-winged Magpie	Cyanopica cyaneus	O	L
Yellow-billed Chough	Pyrrhocorax graculus	O	L
Eurasian Jackdaw	Corvus monedula	AO	L
Rook	Corvus frugilegus	**A**	**M**

Annex 2.4 Contact Risk with Humans

European wild bird species with a higher risk of contact with humans (Risk code H=high, M=medium, L=low), as assessed by 3 experts. Species qualifying for HRS have been indicated in the last column. The meanings of the codes used for HRS are as follows: M = migratory, n-M = non-migratory, C = colonial breeding, P = predators, S = scavengers.

English name	Scientific name	Risk code	HRS
Cattle Egret	*Bubulcus ibis*	M	M,C
Grey Heron	*Ardea cinerea*	L	C
White Stork	*Ciconia ciconia*	H	M,C
Mute Swan	*Cygnus olor*	M	M
Bean Goose	*Anser fabalis*	L	M
Pink-footed Goose	*Anser brachyrhynchus*	L	M
Greater White-fronted Goose	*Anser albifrons albifrons*	L	M
Greenland White-fronted Goose	*Anser albifrons flavirostris*	L	
Lesser White-fronted Goose	*Anser erythropus*	L	M
Greylag Goose	*Anser anser*	L	M
Greater Canada Goose	*Branta canadensis*	M	n-M
Red-breasted Goose	*Branta ruficollis*	L	M
Egyptian Goose	*Alopochen aegyptiaca*	L	
Mallard	*Anas platyrhynchos*	M	M
Tufted Duck	*Aythya fuligula*	L	M
Eurasian Sparrowhawk	*Accipiter nisus*	L	P
Lesser Kestrel	*Falco naumanni*	M	
Common Kestrel	*Falco tinnunculus*	L	
Red-legged Partridge	*Alectoris rufa*	L	
Grey Partridge	*Perdix perdix*	L	
Quail	*Coturnix coturnix*	L	
Pheasant	*Phasianus colchicus*	M	
Common Moorhen	*Gallinula chloropus*	M	
Common Coot	*Fulica atra*	L	M
Black-headed Gull	*Larus ridibundus*	M	M,C
Common Gull	*Larus canus*	L	M
Lesser Black-backed Gull	*Larus fuscus*	L	S
Herring Gull	*Larus argentatus*	L	S
Black-legged Kittiwake	*Rissa tridactyla*	L	
Rock Pigeon	*Columba livia*	M	
Stock Dove	*Columba oenas*	L	n-M
Common Wood Pigeon	*Columba palumbus*	M	n-M
Eurasian Collared Dove	*Streptopelia decaocto*	H	n-M
Calandra Lark	*Melanocorypha calandra*	L	
Short-toed Lark	*Calandrella brachydactyla*	L	
Lesser Short-toed Lark	*Calandrella rufescens*	L	
Crested Lark	*Galerida cristata*	M	
Thekla Lark	*Galerida theklae*	L	
Sky Lark	*Alauda arvensis*	L	
Sand Martin	*Riparia riparia*	L	C
Barn Swallow	*Hirundo rustica*	H	C
House Martin	*Delichon urbica*	H	
Tree Pipit	*Anthus trivialis*	L	
Meadow Pipit	*Anthus pratensis*	L	
Yellow Wagtail	*Motacilla flava*	L	
Citrine Wagtail	*Motacilla citreola*	L	
Grey Wagtail	*Motacilla cinerea*	L	
Pied/White Wagtail	*Motacilla alba*	M	
Common Blackbird	*Turdus merula*	H	
Fieldfare	*Turdus pilaris*	L	n-M
Song Thrush	*Turdus philomelos*	M	
Redwing	*Turdus iliacus*	L	n-M
Mistle Thrush	*Turdus viscivorus*	M	
Eurasian Jay	*Garrulus glandarius*	L	
Black-billed Magpie	*Pica pica*	M	S
Yellow-billed Chough	*Pyrrhocorax graculus*	L	
Eurasian Jackdaw	*Corvus monedula*	H	n-M,S
Rook	*Corvus frugilegus*	M	n-M,C
Carrion Crow	*Corvus corone*	M	S
Hooded Crow	*Corvus cornix*	M	S
Common Starling	*Sturnus vulgaris*	H	n-M
Spotless Starling	*Sturnus unicolor*	H	n-M
House Sparrow	*Passer domesticus*	H	n-M
Spanish Sparrow	*Passer hispaniolensis*	H	n-M
Eurasian Tree Sparrow	*Passer montanus*	L	
Chaffinch	*Fringilla coelebs*	M	n-M
Brambling	*Fringilla montifringilla*	L	n-M
European Serin	*Serinus serinus*	M	
Citril Finch	*Serinus citrinella*	L	
Corsican Finch	*Serinus corsicana*	L	
European Greenfinch	*Carduelis chloris*	M	
European Goldfinch	*Carduelis carduelis*	M	
Eurasian Siskin	*Carduelis spinus*	L	
Trumpeter Finch	*Bucanetes githagineus*	L	
Scarlet Rosefinch	*Carpodacus erythrinus*	L	
Common Bullfinch	*Pyrrhula pyrrhula*	L	
Hawfinch	*Coccothraustes coccothraustes*	L	
Cretzschmar's Bunting	*Emberiza caesia*	L	
Black-headed Bunting	*Emberiza melanocephala*	L	

Annex 2.5 Contact Risk with Poultry

European wild bird species with a higher risk of contact with poultry (Risk code H=high, M=medium, L=low), as assessed by 3 experts. Species qualifying for HRS are indicated in the last column. The meanings of the codes used for HRS are as follows M = migratory, n-M = non-migratory, C = colonial breeding, P = predators, S = scavengers.

English name	Scientific name	Risk code	HRS
Little Grebe	*Tachybaptus ruficollis*	L	
Great Crested Grebe	*Podiceps cristatus*	L	M
Great Cormorant	*Phalacrocorax carbo*	M	
Cattle Egret	*Bubulcus ibis*	H	M,C
Little Egret	*Egretta garzetta*	L	M,C
Grey Heron	*Ardea cinerea*	M	C
White Stork	*Ciconia ciconia*	M	M,C
Mute Swan	*Cygnus olor*	M	M
Bewick's Swan	*Cygnus columbianus*	L	M
Whooper Swan	*Cygnus cygnus*	L	
Bean Goose	*Anser fabalis*	L	M
Pink-footed Goose	*Anser brachyrhynchus*	L	M
Greater White-fronted Goose	*Anser albifrons albifrons*	M	M
Greylag Goose	*Anser anser*	M	M
Greater Canada Goose (Introduced)	*Branta canadensis*	L	n-M
Barnacle Goose	*Branta leucopsis*	L	M
Brent Goose	*Branta bernicla*	L	M
Red-breasted Goose	*Branta ruficollis*	L	M
Egyptian Goose (Introduced)	*Alopochen aegyptiaca*	L	
Ruddy Shelduck	*Tadorna ferruginea*	L	
Common Shelduck	*Tadorna tadorna*	L	
Eurasian Wigeon	*Anas penelope*	M	M
Gadwall	*Anas strepera*	M	
Common Teal	*Anas crecca*	M	M
Mallard	*Anas platyrhynchos*	H	M
Northern Pintail	*Anas acuta*	L	M
Garganey	*Anas querquedula*	L	M
Northern Shoveler	*Anas clypeata*	L	M
Red-crested Pochard	*Netta rufina*	L	M
Common Pochard	*Aythya ferina*	L	M
Ferruginous Duck	*Aythya nyroca*	L	
Tufted Duck	*Aythya fuligula*	L	M
Common Goldeneye	*Bucephala clangula*	L	
Goosander	*Mergus merganser*	L	
Red-legged Partridge	*Alectoris rufa*	M	
Grey Partridge	*Perdix perdix*	M	
Pheasant	*Phasianus colchicus*	H	
Common Moorhen	*Gallinula chloropus*	M	
Common Coot	*Fulica atra*	M	M
Eurasian Oystercatcher	*Haematopus ostralegus*	L	
Black-winged Stilt	*Himantopus himantopus*	L	
Northern Lapwing	*Vanellus vanellus*	M	M
European Golden Plover	*Pluvialis apricaria*	L	M
Jack Snipe	*Lymnocryptes minimus*	L	
Common Snipe	*Gallinago gallinago*	L	
Black-tailed Godwit	*Limosa limosa*	L	M
Whimbrel	*Numenius phaeopus*	L	
Eurasian Curlew	*Numenius arquata*	L	
Spotted Redshank	*Tringa erythropus*	L	
Common Redshank	*Tringa totanus*	L	
Common Greenshank	*Tringa nebularia*	L	
Green Sandpiper	*Tringa ochropus*	L	
Wood Sandpiper	*Tringa glareola*	L	
Common Sandpiper	*Actitis hypoleucos*	L	
Dunlin	*Calidris alpina*	L	
Ruff	*Philomachus pugnax*	L	M
Black-headed Gull	*Larus ridibundus*	H	M,C
Common Gull	*Larus canus*	L	M
Lesser Black-backed Gull	*Larus fuscus*	L	S
Yellow-legged Gull	*Larus michahellis*	L	S
Herring Gull	*Larus argentatus*	L	S
Rock Pigeon	*Columba livia*	M	
Stock Dove	*Columba oenas*	H	n-M
Common Wood Pigeon	*Columba palumbus*	H	n-M
Eurasian Collared Dove	*Streptopelia decaocto*	H	n-M
European Turtle Dove	*Streptopelia turtur*	L	
Calandra Lark	*Melanocorypha calandra*	L	
Short-toed Lark	*Calandrella brachydactyla*	L	
Lesser Short-toed Lark	*Calandrella rufescens*	L	
Crested Lark	*Galerida cristata*	L	
Thekla Lark	*Galerida theklae*	L	
Sky Lark	*Alauda arvensis*	M	
Barn Swallow	*Hirundo rustica*	M	C
House Martin	*Delichon urbica*	M	
Meadow Pipit	*Anthus pratensis*	M	
Yellow Wagtail	*Motacilla flava*	L	
Citrine Wagtail	*Motacilla citreola*	L	
Pied/White Wagtail	*Motacilla alba*	H	
Common Blackbird	*Turdus merula*	M	
Fieldfare	*Turdus pilaris*	M	n-M
Song Thrush	*Turdus philomelos*	M	
Redwing	*Turdus iliacus*	M	n-M
Mistle Thrush	*Turdus viscivorus*	L	
Black-billed Magpie	*Pica pica*	H	S
Yellow-billed Chough	*Pyrrhocorax graculus*	L	
Eurasian Jackdaw	*Corvus monedula*	H	n-MS
Rook	*Corvus frugilegus*	M	n-MC
Carrion Crow	*Corvus corone*	M	S
Hooded Crow	*Corvus cornix*	M	S
Common Raven	*Corvus corax*	L	S
Common Starling	*Sturnus vulgaris*	H	n-M
Spotless Starling	*Sturnus unicolor*	H	n-M
House Sparrow	*Passer domesticus*	H	n-M
Spanish Sparrow	*Passer hispaniolensis*	H	n-M
Eurasian Tree Sparrow	*Passer montanus*	M	
Chaffinch	*Fringilla coelebs*	M	n-M
Brambling	*Fringilla montifringilla*	L	n-M
European Greenfinch	*Carduelis chloris*	M	
European Goldfinch	*Carduelis carduelis*	L	
Eurasian Siskin	*Carduelis spinus*	L	
Common Linnet	*Carduelis cannabina*	L	
Yellowhammer	*Emberiza citrinella*	M	
Ortolan Bunting	*Emberiza hortulana*	L	
Black-headed Bunting	*Emberiza melanocephala*	L	

Annex 3.1 Observation Protocol

Observation protocol for Wetlands International \ EURING contract with the European Commission, 2007: investigation of "Bridge species"

Observations will be made in four geographically separate parts of Europe: central Ukraine [became Central Turkey], NE Germany, E England and N Italy.

In each country, observers will select different types of poultry farm representative of the national poultry industry including:

- Intensive farms, with large numbers of birds kept indoors
- Smaller scale "backyard" or free-range farms, with smaller numbers of birds spending some time outdoors
- If appropriate, duck, goose and/or turkey farms of any type.

In each country, **one** of the farms selected should be of the intensive type where poultry are kept securely indoors and no contact with wild birds is possible. The rest of the farms in the study should be more extensive types, where contact with wild birds is possible.

Observers will research the locations of the farms during the preparation phase. Preparation should involve contacting the farmers they propose to visit by telephone. Telephone directories and veterinary records should be a good starting point for this preparation.
For logistical reasons, farms should be close enough together to allow four or (preferably) more to be visited on each day. Observers should aim to visit four to six farms per day for two days in February, and should make repeat visits to the same farms on two days in late April 2007. Farm visits should ideally be made on consecutive days in February and in April.

The data and information that should be collected at each farm are summarized on the recording form. If space does not allow all your observations, it may be necessary to use a spare sheet of paper, and to add them to the form after the visit. Recording forms completed electronically will be very welcome.

At each farm, observers should attempt to talk to the farmer to get the information required about the farm. If this is not possible, observers should use a map to get some of the information, and estimate the rest. In conversation with the farmer, observers should ask about his experience with wild birds entering the farm and mixing with poultry. This, however, should not take too much time and may not be possible on every visit. After speaking with the farmer, one hour should be spent observing the wild birds at the farm and making notes in a notebook. It is recommended that observers take the recording form with them on visits to remind them of which observations to make. It will probably usually be best to fill in the form in a few minutes immediately after the visit.

Please return completed recording forms to Wetlands International in two batches soon after each set of visits.

Many thanks, and best of luck with your observations!

Annex 3.2 Recording form for site visits

Wetlands International \ EURING investigation of "Bridge species"
Recording form for site visits

1. Information about the visit and the farm

Date and time of visit:

Air temperature and snow cover at time of visit, and any factors which might have reduced the efficiency of observations (disturbance, extreme weather, etc.):

Name and address of farm:

Name of proprietor:

Did you talk to the farmer? Give details of what he said about wild birds mixing with poultry:

Land area of farm (ha):

Central geographical coordinates (Latitude, longitude):

Type of farm – details of important crops grown and animals kept:

Number and type of poultry kept. Put exact totals given by farmer or enter estimates in brackets:
Chickens _____ Geese _____ Ducks _____ Turkeys _____ Other (specify)_____ _____

Poultry kept for (tick one or both boxes): eggs ○ meat ○

Poultry farming method: intensive ○ extensive ○ birds permanently indoors ○
Birds feed and range outdoors ○ birds are fed outside by the farmer ○

Presence of wetland habitats on the farm (type and extent). Note any sizeable lakes, marshes or rivers on the farm that seem likely to attract waterbirds

Distance from nearest wetland holding at least one concentration of one or more wild waterbird species

2. Species, numbers and disposition of wild birds at the farm

Observations at each farm should be conducted during a standard period of 1 hour

Birds (species and number) present at farm or within a distance of 50 m

Birds (species and number) present near farm (distance more than 50 m)

Birds (species and number) flying over farm within 50 m

Birds (species and number) flying over farm at distance more than 50 m, to 500m

Birds (species and number) present at wetlands on the farm (if appropriate)

3. Behaviour of wild birds at the farm

For each species:

Name of species, number seen to feed, type of food taken

Name of species, number seen to defaecate, distance of defecation from farm buildings

Name of species, number seen within 5m of poultry

Details of all direct interactions between wild birds of the same species, with different species and with poultry

In April, rapid assessment of species definitely, probably and possibly breeding within 50m of farm and >50m from farm, to 500m

Annex 3.3 Total Numbers of Birds

Total numbers of birds observed, per species, country and observation period.

		February–March					April–May				
		DE	IT	TR	UK	total	DE	IT	TR	UK	total
Little Grebe	*Tachybaptus ruficollis*		1			1				3	3
Great Crested Grebe	*Podiceps cristatus*			2		2			3		3
Cormorant	*Phalacrocorax carbo*		11			11					
Pygmy Cormorant	*Phalacrocorax pygmaeus*		1			1		1			1
Night Heron	*Nycticorax nycticorax*							1			1
Squacco Heron	*Ardeola ralloides*							1			1
Cattle Egret	*Bubulcus ibis*		25			25		15			15
Little Egret	*Egretta garzetta*		3			3		1			1
Great White Egret	*Ardea alba*		2			2					
Grey Heron	*Ardea cinerea*	1	5			6		7	1		8
Purple Heron	*Ardea purpurea*							2			2
White Stork	*Ciconia ciconia*			1		1					
Mute Swan	*Cygnus olor*				2	2				3	3
Whooper Swan	*Cygnus cygnus*	23				23					
Greylag Goose	*Anser anser*	1				1				2	2
Canada Goose	*Branta canadensis*				2	2				3	3
Egyptian Goose	*Alopochen aegyptiaca*				2	2				8	8
Ruddy Shelduck	*Tadorna ferruginea*		2			2			4		4
Shelduck	*Tadorna tadorna*				10	10				2	2
Gadwall	*Anas strepera*									2	2
Teal	*Anas crecca*		1	5	4	10					
Mallard	*Anas platyrhynchos*	6	25		7	38	10	13	5	9	37
Garganey	*Anas querquedula*								1		1
Red-crested Pochard	*Netta rufina*			4		4					
Pochard	*Aythya ferina*								1		1
Tufted Duck	*Aythya fuligula*				10	10				16	16
Short-toed Eagle	*Circaetus gallicus*								1		1
Marsh Harrier	*Circus aeruginosus*		1	2		3					
Sparrowhawk	*Accipiter nisus*	1		1	2	4					
Common Buzzard	*Buteo buteo*	14	2	1		17	2				2
Long-legged Buzzard	*Buteo rufinus*			2		2			1		1
Imperial Eagle	*Aquila heliaca*			2		2			1		1
Kestrel	*Falco tinnunculus*	2	3	1		6	1	2		1	4
Red-legged Partridge	*Alectoris rufa*				8	8				6	6
Grey Partridge	*Perdix perdix*				1	1				2	2
Quail	*Coturnix coturnix*								4		4
Peacock	*Pavo cristatus*									1	1
Pheasant	*Phasianus colchicus*		3		4	7	2	5		12	19
Moorhen	*Gallinula chloropus*		25		6	31	2	8	1	1	12
Coot	*Fulica atra*			69	4	73	1	5	67	4	77
Crane	*Grus grus*	1				1					
Oystercatcher	*Haematopus ostralegus*				2	2	1			3	4
Black-winged Stilt	*Himantopus himantopus*							15			15
Little Ringed Plover	*Charadrius dubius*									3	3
Ringed Plover	*Charadrius hiaticula*							1			1
Golden Plover	*Pluvialis apricaria*	600				600					
Lapwing	*Vanellus vanellus*	19	25		4	48	5			11	16
Ruff	*Philomachus pugnax*							40			40
Woodcock	*Scolopax rusticola*	2				2					
Redshank	*Tringa totanus*				1	1					
Green Sandpiper	*Tringa ochropus*				2	2		2			2
Wood Sandpiper	*Tringa glareola*							2			2
Common Sandpiper	*Actitis hypoleucos*								2		2
Mediterranean Gull	*Larus melanocephalus*							33			33
Little Gull	*Larus minutus*							1			1
Black-headed Gull	*Larus ridibundus*	17	43	31	474	565		5		2	7
Common Gull	*Larus canus*	92				92					
Herring Gull	*Larus argentatus*									3	3
Yellow-legged Gull	*Larus michahellis*		125			125		38			38

		February–March					April–May				
		DE	IT	TR	UK	total	DE	IT	TR	UK	total
Common Tern	*Sterna hirundo*							5			5
Whiskered Tern	*Chlidonias hybrida*								7		7
Rock Dove	*Columba livia*			299		299			27		27
Feral Pigeon	*Columba livia*	31	186		7	224	15	81		24	120
Stock Dove	*Columba oenas*				2	2				7	7
Wood Pigeon	*Columba palumbus*	12			1143	1155	29	4		212	245
Collared Dove	*Streptopelia decaocto*	1	36	5	6	48	4	35	9	6	54
Great Spotted Cuckoo	*Clamator glandarius*								2		2
Cuckoo	*Cuculus canorus*							3		6	9
Little Owl	*Athene noctua*				1	1					
Swift	*Apus apus*							4	32	56	92
Kingfisher	*Alcedo atthis*							1			1
Bee-eater	*Merops apiaster*								4		4
Hoopoe	*Upupa epops*							3	6		9
Wryneck	*Jynx torquilla*							1			1
Green Woodpecker	*Picus viridis*				2	2					
Great-spotted Wpecker	*Dendrocopos major*				3	3					
Syrian Woodpecker	*Dendrocopos minor*								1		1
Calandra Lark	*Melanocorypha calandra*			11		11			20		20
Crested Lark	*Galerida cristata*			21		21		1	10		11
Skylark	*Alauda arvensis*	7	2		52	61	13		1	37	51
Shore Lark	*Eremophila alpestris*			2		2					
Sand Martin	*Riparia riparia*								9	1	10
Barn Swallow	*Hirundo rustica*						69	31	308	21	429
Red-rumped Swallow	*Cecropis daurica*								1		1
House Martin	*Delichon urbicum*									52	52
Meadow Pipit	*Anthus pratensis*	4	4		10	18	2				2
Yellow Wagtail	*Motacilla flava*						1	11	6		18
White Wagtail	*Motacilla alba alba*	27	4			31	31			15	46
Pied Wagtail	*Motacilla alba yarrellii*				20	20					
Wren	*Troglodytes troglodytes*	8	1		16	25	5			37	42
Dunnock	*Prunella modularis*	2	1		8	11	4			4	8
Robin	*Erithacus rubecula*	5	4	4	18	31	1			6	7
Nightingale	*Luscinia megarhynchos*							12	4		16
Black Redstart	*Phoenicurus ochruros*	1	1			2	8				8
Common Redstart	*Phoenicurus phoenicurus*						2				2
Stonechat	*Saxicola torquatus*		2	4		6		2			2
Isabelline Wheatear	*Oenanthe isabellina*								3		3
Wheatear	*Oenanthe oenanthe*								2		2
Black-eared Wheatear	*Oenanthe hispanica*								2		2
Blackbird	*Turdus merula*	19	7	3	42	71	34	2	1	76	113
Fieldfare	*Turdus pilaris*				110	110					
Songthrush	*Turdus philomelos*	6			4	10	2			10	12
Redwing	*Turdus iliacus*	2			7	9					
Mistle Thrush	*Turdus viscivorus*	2			3	5	1			9	10
Cetti's Warbler	*Cettia cetti*		9	1		10		4	2		6
Fan-Tailed Warbler	*Cisticola juncidis*		2			2		9			9
Reed Warbler	*Acrocephalus scirpaceus*								1	1	2
Great Reed Warbler	*Acrocephalus arundinaceus*							4			4
Ea Olivaceous Warbler	*Hippolais pallida*								3		3
Lesser Whitethroat	*Sylvia curruca*						5			4	9
Whitethroat	*Sylvia communis*						2	3	5	17	27
Garden Warbler	*Sylvia borin*									1	1
Blackcap	*Sylvia atricapilla*		1			1	29	5	1	4	39
Wood Warbler	*Phylloscopus sibilatrix*							1			1
Chiffchaff	*Phylloscopus collybita*		1	1		2	39			6	45
Willow Warbler	*Phylloscopus trochilus*						13		5	8	26
Goldcrest	*Regulus regulus*	1		1	1	3	2				2
Spotted Flycatcher	*Muscicapa striata*							1	4		5

		February–March					April–May				
		DE	IT	TR	UK	total	DE	IT	TR	UK	total
Long-tailed Tit	*Aegithalos caudatus*	1			13	14				11	11
Marsh Tit	*Poecile palustris*	1			2	3					
Coal Tit	*Periparus ater*				1	1			2		2
Blue Tit	*Cyanistes caeruleus*	37	1	2	29	69	21			12	33
Great Tit	*Parus major*	38	2	3	31	74	19	5	8	18	50
Nuthatch	*Sitta europaea*	4				4					
Short-toed Treecreeper	*Certhia brachydactyla*	3				3	3				3
Golden Oriole	*Oriolus oriolus*								1		1
Red-backed Shrike	*Lanius collurio*								2		2
Lesser Grey Shrike	*Lanius minor*								1		1
Jay	*Garrulus glandarius*	6	1			7		4		2	6
Magpie	*Pica pica*		27	66	13	106	1	18	26	5	50
Jackdaw	*Corvus monedula*	24		36	84	144			5	163	168
Rook	*Corvus frugilegus*	5		7	162	174				397	397
Carrion Crow	*Corvus corone*	150		12	43	205	29			16	45
Hooded Crow	*Corvus cornix*		19			19		7	1		8
Raven	*Corvus corax*	2		4		6	2				2
Starling	*Sturnus vulgaris*	139	976	67	35	1217	45	70	37	54	206
House Sparrow	*Passer domesticus*	89		261	9	359	69		252	2	323
Italian Sparrow	*Passer domesticus italiae*		347			347		375			375
Spanish Sparrow	*Passer hispaniolensis*								2		2
Tree Sparrow	*Passer montanus*	59	17	8		84	24	23	2		49
Chaffinch	*Fringilla coelebs*	46	5	17	59	127	59			64	123
Greenfinch	*Carduelis chloris*	27			26	53	17			34	51
Goldfinch	*Carduelis carduelis*	6	2	18	12	38	4	6	8	2	20
Siskin	*Carduelis spinus*	13				13					
Linnet	*Carduelis cannabina*	10		3	3	16	20			3	23
Redpoll	*Carduelis flammea/cabaret*				1	1					
Common Crossbill	*Loxia curvirostra*	6				6					
Bullfinch	*Pyrrhula pyrrhula*				2	2				3	3
Yellow Hammer	*Emberiza citrinella*	53			5	58	7			12	19
Ortolan Bunting	*Emberiza hortulana*								7		7
Reed Bunting	*Emberiza schoeniclus*		2			2	3				3
Black-headed Bunting	*Emberiza melanocephala*								1		1
Corn Bunting	*Emberiza calandra*		11			11		1	22		23
total		**1625**	**1964**	**1015**	**2530**	**7134**	**658**	**930**	**945**	**1515**	**4048**