



BREEDING NUMBERS OF GREAT CORMORANTS *PHALACROCORAX CARBO*

IN THE WESTERN PALEARCTIC, 2012-2013

IUCN/Wetlands International Cormorant Research Group Report

Scientific Report from DCE - Danish Centre for Environment and Energy

No. 99

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- Abstract: This report presents the status of the breeding population of Great Cormorants *Phalacrocorax carbo* in Europe and neighbouring countries in 2012. It gives an overview of numbers and distribution and describes changes since 2006. It compiles 38 detailed national and sub-national reports on breeding numbers, colony sizes, colony distribution and the extent of human intervention in breeding colonies.
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Preface and acknowledgements

This report presents the results from the project 'Cormorant counts in the Western Palearctic'. The project was conducted in collaboration between the European Commission project 'Sustainable management of Cormorant populations' (with the acronym 'CorMan'), the IUCN/Wetlands International Cormorant Research Group and relevant national organizations, institutions and individual key persons.

The main objective of the project was to organize surveys of the breeding populations of Great Cormorants *Phalacrocorax carbo* in the Western Palearctic. The focus has been on the continental sub-species of the Great Cormorant *P. c. sinensis*.

The size and distribution of the breeding population of the sub-species *P. c. sinensis* was monitored in all countries in Europe including Belarus, Ukraine, Armenia, Russia (10 regions) and parts of Azerbaijan and Turkey. The survey took place in 2012 except in a few countries where the survey was conducted in 2013.

More than 1,200 people were involved in the counts and they provided information about nest numbers in more than 1,400 breeding colonies.

The first chapter in the report gives an overview of the results describing numbers and distribution. The overview includes a description of the trends in the development of breeding numbers based on a comparison with a previous Pan-European count of breeding colonies in 2006.

The following 38 chapters are a collection of national and sub-national reports from 32 of the participating countries.

More information about the project 'Cormorant counts in the Western Palearctic', the EC project 'CorMan' and former counts organized by the IUCN/Wetlands International Cormorant Research Group can be found at:

- http://ec.europa.eu/environment/nature/cormorants/home_en.htm
- <http://cormorants.freehostia.com/index.htm>

Success in achieving the objectives of the counts depended entirely on the commitment from the National Coordinators and their counting teams, of which many have been highly motivated volunteers. Therefore, we warmly thank them for their valuable contribution. We would also like to acknowledge the contribution from the National Coordinators of which many found the time to collaborate with us in preparing the country by country presentations included in this report.

We are pleased that the European Commission was able to collaborate with The IUCN/Wetlands International Cormorant Research Group and the individual countries through the EC funded 'CorMan' project. The CorMan project facilitated meetings of the Counts Steering Group, helped with communication, collation of count results, writing up of results and support during the preparation of the reports from the individual countries.

Summary

This report gives an overview of the size and distribution of the breeding population of Great Cormorants *Phalacrocorax carbo* in the Western Palearctic in 2012 as well as detailed descriptions of the status for the breeding populations in 38 of the areas (countries or parts of countries) included in the survey. The national and sub-national surveys were conducted in coordination with and facilitated by the project 'Cormorant counts in the Western Palearctic' lead by the IUCN/Wetlands International Cormorant Research Group and the European Commission project 'CorMan' contracted by Aarhus University, Denmark and the Centre for Ecology & Hydrology, United Kingdom. The counts project gave guidance on methods, developed web-based tools, collated details from the counts, compiled an overview at the Pan-European level and provided support during the writing up of national results.

Highest priority was given to ensure that all breeding colonies were counted in areas where the continental sub-species *P. c. sinensis* was breeding. Attention was also given to assess the size of the breeding populations in countries from where Great Cormorants migrate to EU Member States. To obtain information about recent trends in population development in different parts of Europe, comparisons were made with breeding numbers recorded during a similar Pan-European count in 2006.

The size of the breeding population of Great Cormorants in the Western Palearctic was estimated to be between 406,000 and 421,000 breeding pairs in 2012 (excluding some regions in Russia and the western part of Kazakhstan). It is estimated that around 42,500 breeding pairs belonged to the Atlantic sub-species *P. c. carbo* and around 371,000 to the continental sub-species *P. c. sinensis*. Approximately 294,000 pairs of the *sinensis* sub-species bred west of the western borders of Russia and Turkey (Kaliningrad and the Russian part of the Gulf of Finland included). Within this area the 28 EU Member States had 214,800 breeding pairs of the continental sub-species.

The species was recorded breeding in almost all the countries in Europe in 2012. While 50 % of all *sinensis* birds were breeding in large colonies with more than 1,000 nests, most breeding colonies had fewer than 100 nests. The largest colony was found in Ukraine and had 18,000 nests. Most other large colonies with more than 1,000 nests were found around the Baltic Sea, the Black Sea, the Sea of Azov, the Caspian Sea and in The Netherlands.

The 38 national or sub-national presentations of the current status refer to 2012 except for four countries where the descriptions refer to 2013 or to historical records of breeding. Each of these presentations includes descriptions of the total size and distribution of the breeding population and presents information about numbers and sizes of breeding colonies, as well as the extent of human intervention in them. Some of the descriptions also include information about trends in population development. Each of the national or sub-national presentations is introduced by a summary.

The following paragraphs describe the status of the breeding population in 2012 and the change in numbers from 2006 to 2012 within each of four major areas within the Western Palearctic:



A male Great Cormorant bringing seaweed to increase the strength of the nest, Vorsø, Denmark. Photo: Kim Biledgaard.

The North-East Atlantic. This area includes most countries along the north-eastern coasts of the Atlantic Ocean (countries that have coasts along the Baltic Sea are not included). The Atlantic sub-species *P. c. carbo* as well as the continental sub-species *P. c. sinensis* are breeding in this area.

The North-East Atlantic – P. c. carbo. Out of the 42,500 breeding pairs most bred along the coast of Norway (ca. 19,000 pairs). For the United Kingdom (UK) and France breeding numbers could not be determined with certainty because some of the colonies in these countries had both sub-species breeding, and the proportion of each sub-species was not known for all colonies. It was estimated that the UK had 6,500 breeding pairs along the coast and 955 pairs of the *carbo* sub-species in inland colonies, and the UK was thus the second most important breeding area for the Atlantic sub-species in Europe. France had 8,673 breeding pairs of which about 3,000 were estimated to be *carbo* birds. Iceland had 4,772 breeding pairs and the estimate for the coasts of Ireland was 4,366 pairs. It was further estimated that the Barents Sea and White Sea coasts had around 4,600 breeding pairs in 2012, but these estimates were uncertain due to incomplete coverage.

The data on trends indicated that breeding numbers of *P. c. carbo* had declined markedly in Norway, by around 11,000 pairs (-37 %) from 2006 to 2012. A declining trend was also recorded along the coast of the UK. Breeding numbers had either remained stable or increased in Iceland, the Barents Sea (the Russian Federation) and Ireland, as well as in France and in inland areas in the UK.

The North-East Atlantic – P. c. sinensis. It was estimated that the continental sub-species had 36,900 breeding pairs in this area. The majority of these –

23,556 pairs – bred in The Netherlands where the highest densities were found around Lake IJsselmeer. France was the second most important breeding area – 5,700 breeding pairs estimated to belong to the *sinensis* sub-species. The other breeding areas included inland areas in the UK (estimated at 2,809 pairs), the southern coast of Norway (2,500 pairs), Spain (1,605 pairs) and Belgium (1,584 pairs). Great Cormorants were not breeding in Portugal, Luxembourg and Monaco in 2012.

Comparison with 2006 showed that noticeable increases had occurred in Spain (an increase of 1,300 pairs, 453 %), in inland areas in France (by 2,500 pairs, 62 %) and in southern Norway (by 1,100 pairs, 87 %). Numbers had remained unchanged in The Netherlands and Belgium.

The Baltic Sea – P. c. sinensis. This area covers the countries along the Baltic Sea and the Russian part of the Gulf of Finland and Kaliningrad. Total breeding numbers were 167,700 pairs, and this region constituted the most important breeding area in Europe for the continental sub-species. The highest numbers were recorded in Sweden (40,598 pairs), Denmark (27,237 pairs), Poland (26,600 pairs) and Germany (22,550 pairs). Together with The Netherlands, these countries constituted the core breeding area for the continental sub-species in Europe for more than 35 years. However, during and after the 1990s the breeding population expanded eastwards in the Baltic Sea.

The other countries around the Baltic Sea had the following breeding numbers in 2012: Finland (17,258 pairs), Estonia (13,000 pairs), Kaliningrad (9,535 pairs), the Russian part of the Gulf of Finland (4,605 pairs), Lithuania (3,200 pairs) and Latvia (3,106 pairs). The largest concentrations of breeders were found in association with the large and highly eutrophic lagoons in the southern Baltic, i.e. Vistula Lagoon, Odra Lagoon and the Curonian Lagoon.

Compared with 2006 breeding numbers had increased by 17,000 pairs (28 %) along the eastern coast of the Baltic Sea and decreased by 15,000 pairs (-19 %) in the western part of the Baltic Sea. The most marked increase was recorded in Finland (an increase of 11,500 pairs, 199 %), and the highest decrease was recorded in Denmark (a decline of 10,800 pairs, -28 %).

Central Europe and Mediterranean – P. c. sinensis. The area includes the countries in central Europe and in the central and eastern Mediterranean. The total numbers of breeders were 20,839 pairs, of which 40 % were found in only four colonies. The largest colony had 4,730 nests and was located at Kerkin Lake in northern Greece. The three other large colonies had 1,000-1,200 nests and were found in FYRO Macedonia, Montenegro and Italy.

At the national level, Greece had the highest number of breeding pairs (6,978 pairs), followed by Italy (3,914 pairs) and Hungary (2,700 pairs). The five other countries that had more than 1,000 breeding pairs were Switzerland (1,037 pairs), Croatia (1,331 pairs), Serbia (1,900-2,100 pairs), Montenegro (1,156 pairs) and FYRO Macedonia (1,130 pairs). The lowest numbers of breeders were recorded in the Czech Republic (297 pairs), Bosnia-Herzegovina (171 pairs), Slovakia (99 pairs) and Austria (65 pairs). Great Cormorants were not recorded breeding in Slovenia, Kosovo and Albania in 2012.

From 2006 to 2012 noticeable increases were recorded in Greece (by 2,400 pairs, 53 %), Italy (by 1,800 pairs, 83 %), Serbia (by 1,100 pairs, 113 %) and Switzerland (by 800 pairs, 385 %). Declines between 2006 and 2012 were rec-

ordered in Montenegro (by 850 pairs, -42 %), Croatia (by 830 pairs, -38 %) and Hungary (by 540 pairs, -17 %).

Black Sea and Sea of Azov – P. c. sinensis. This area includes Belarus, the countries that border the Black Sea and several Russian regions between the Sea of Azov and the Caspian Sea as well as Georgia, Azerbaijan and Armenia. Some parts of this area were not well covered during the survey, and in some cases estimates were thus based on older data or even (in a few cases) best guesses.

It is estimated that this area had between 138,000 and 153,300 breeding pairs in 2012. The most important breeding areas were the Danube Delta, the Ukrainian coast of the Black Sea, the coasts of the Sea of Azov and the Volga Delta in the northwest end of the Caspian Sea. The vast majority of breeders were found in colonies with >1,000 nests.

At the national level, the Russian areas between the Sea of Azov and the Caspian Sea had the highest number of breeding pairs (60-68,000 pairs), followed by Ukraine (46,500 pairs) and Romania (13-15,000 pairs). Other countries with more than 2,000 breeding pairs were Turkey (6,500-8,500 pairs), Georgia (4,000-6,000 pairs), Belarus (3,250 pairs) and Bulgaria (2,775 pairs). Lower breeding numbers were estimated for Azerbaijan (1,000-2,000 pairs) and Moldova (700-1,500 pairs). Armenia had 10 breeding pairs.

From 2006 to 2012 numbers declined markedly in the north-western area of the Black Sea (the Danube Delta in Romania and Ukraine as well as the Ukrainian coasts of the Black Sea and the Sea of Azov): from 84,200 pairs in 2006 to 49,200 pairs in 2012 (-42 %). In the Danube Delta alone breeding numbers declined by 11,100 pairs (-51 %). Increases from 2006 to 2012 were reported in both Belarus (by 1,100 pairs, 52 %) and Bulgaria (by 790 pairs, 39 %). Breeding numbers had also increased in the Russian areas between the Sea of Azov and the Caspian Sea but the extent of increase could not be estimated with certainty.

A Great Cormorant of the *sinensis* sub-species incubating in the Vorsø colony, Denmark. Photo: Kim Biledgaard.



Introduction

There continues to be considerable interest in Great Cormorants and their numbers in the Western Palearctic. This is partly due to the fact that increasing populations of the continental sub-species *Phalacrocorax carbo sinensis* have been seen as a factor putting pressure on fisheries, aquaculture and angling activities. The interactions between the birds' activities and human interests have created various types of social and socioeconomic conflicts. On the basis of the concerns from the various social and economic sectors affected, the European Parliament requested in 2008 the European Commission to take action.

A basic understanding of the status, trends and distribution of the Great Cormorant throughout the Member States is fundamental to resolving management and conflict issues within the European Union. Based on this, the Commission decided as one of its actions to hire a contractor to collaborate with the IUCN/Wetlands International Cormorant Research Group and the individual countries, in order to monitor the breeding and wintering population of cormorants in Europe. It was decided that determining the population size and distribution of the continental *sinensis* sub-species should be given priority.

For these reasons, the IUCN/Wetlands International Cormorant Research Group (hereafter referred to as the Cormorant Research Group) has collaborated with the European Commission project 'CorMan' through its contractor, Aarhus University in Denmark and the NERC Centre for Ecology & Hydrology in the United Kingdom, in order to organize Pan-European counts of breeding colonies and of cormorants in their wintering areas. The name 'CorMan' is an acronym for the project 'Sustainable Management of Cormorant Populations' (Service Contract No. 07-0307/2010/575579/SER/B3, see also http://ec.europa.eu/environment/nature/cormorants/home_en.htm).

The Cormorant Research Group and the EC contractors formed a specific counts project '*Cormorant counts in the Western Palearctic*' to undertake this work. The Western Palearctic covers all of Europe (including the Russian Federation west of the Ural Mountains), North Africa and the northern and western parts of the Middle-East (Fig. 1.1 in Chapter 1). Ideally the project aimed to obtain information about the size of all breeding colonies of Great Cormorants in the Western Palearctic in 2012. However, the primary focus was to obtain information from the breeding areas of the birds that occur in the EU Member States on the European continent.

The counts project has been led by representatives from the Cormorant Research Group and the EC contractor. The project has provided support and guidance for all countries participating on how to organize and monitor the breeding colonies so that by the end of the project finally all results obtained could be aggregated on a Pan-European level. A project home page and a web-based tool offering facilities for entering count results directly and denoting the location of the counted site using Google Maps were also developed. Area Coordinators from the overall project were responsible for establishing and maintaining contact with National Coordinators in each country.

All countries in the Western Palearctic participated in the organized counts and/or supplied the counts project with the best and most recent data available in case there were areas which could not be covered in 2012 or 2013. From the autumn of 2012 onwards all National Coordinators were invited to present major results from their national count in a collation of national reports (Bregnballe et al. 2013) and/or in the present report. The vast majority of National Coordinators welcomed this opportunity and prepared a national chapter. The authors received a national report template and an example to provide direction on structure and relevant information. As one of the CorMan contractors, Aarhus University provided support throughout the process of preparing the national chapters. Standard figures were developed to illustrate the distribution of the breeding population. All text, figures and maps were approved by the authors and reviewed by at least two members of the Counts Steering Group before being checked by a referee from the Department of Bioscience, Aarhus University and a referee from the Danish Centre for Environment and Energy (DCE), Aarhus University.

Based on the counts of nests in breeding colonies in 2012 and/or 2013, the present report provides the most recent information available about the size and distribution of the Great Cormorant population in the Western Palearctic.

The first chapter gives an overview of the results from the counts of breeding colonies. It includes descriptions of (a) the coverage achieved, (b) the methods applied and (c) the development in breeding numbers since 2006 when a similar Pan-European count of breeding colonies took place. The results from this earlier count have been presented by the Cormorant Research Group in a leaflet (Wetlands International Cormorant Research Group 2008), as a paper (Bregnballe et al. 2011) and in one of the Final Reports from the 'INTERCAFE' COST Action (van Eerden et al. 2012).

The following chapters, 2-38, are national or sub-national reports from 23 of the countries that participated in the counts. These national presentations include descriptions of the total size of the breeding population and provide information about numbers, sizes and distribution of breeding colonies. Information is also given about the extent of human intervention in the breeding colonies. Some of the countries have also published results in national journals, newsletters or in reports, and references to these more detailed descriptions are given at the end of each national report.

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One of the Great Cormorant sub-colonies at Hirsholmene in northern Kattegat, 2008. Denmark. Photo: Kjeld T. Pedersen.

1 Status of the breeding population of Great Cormorants *Phalacrocorax carbo* in the Western Palearctic in 2012

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Summary

The breeding colonies of Great Cormorants in the Western Palearctic were monitored in 2012. The national surveys were conducted in coordination with, and facilitated by, a project called 'Cormorant counts in the Western Palearctic' lead by the European Commission project 'CorMan' undertaken in collaboration with the IUCN/Wetlands International Cormorant Research Group. Highest priority was given to ensure that all breeding colonies were counted in areas where the continental sub-species *P. c. sinensis* was breeding. Priority was also given to assess the size of the breeding populations in countries from where Great Cormorants migrate to EU Member States.

The species was found breeding in all countries in Europe except Luxembourg, Monaco, Portugal, Slovenia, Kosovo and Albania. Most of the breeding colonies were small with fewer than 100 nests. However, around 50 % of all the breeders of the continental sub-species *P. c. sinensis* were recorded breeding in large colonies with more than 1,000 nests. The largest colony was found in Ukraine and had 18,000 nests.

The highest densities of breeders of the *sinensis* sub-species were found around the Baltic Sea (167,700 pairs) with most in Sweden (40,600 pairs), Denmark (27,250 pairs), Poland (26,600 pairs) and Germany (22,550 pairs). High densities were also found in several areas around the Black Sea, the Sea of Azov and the Caspian Sea (138,000-153,300 pairs). Major breeding areas outside these regions were The Netherlands (23,600 pairs), France (8,700 pairs), Greece (7,000 pairs) and Italy (3,900 pairs).

Since 2006, when a similar Pan-European count took place, breeding numbers of the continental sub-species have increased by 17,000 pairs along the eastern coast of the Baltic Sea and decreased by 15,000 pairs in the western part of the Baltic Sea. Along the North-East Atlantic coasts noticeable increases in breeding numbers were reported in Spain (by 1,300 pairs), inland areas in France (by 2,500 pairs) and the Norwegian coast of Skagerrak (by 1,100 pairs). In central Europe and the Mediterranean, noticeable increases were recorded in Greece (by 2,400 pairs), Italy (by 1,800 pairs), Serbia (by 1,100 pairs) and Switzerland (by 800 pairs). In this part of Europe, declines were recorded in Montenegro (by 850 pairs), Croatia (by 830 pairs) and Hungary (by 540 pairs). A marked decline of 11,000 pairs was recorded in the Danube Delta.

The breeding population of the more marine Atlantic sub-species *P. c. carbo* was estimated to total 42,500 pairs, with the highest number breeding in Norway (19,000 pairs). Breeding numbers of this sub-species had declined in Norway (by around 9,000 pairs over six years) and a similar trend was apparent along the coast of the United Kingdom (UK). Numbers had either increased or remained stable along the coast of Iceland, the Barents Sea (the Russian Federation) and Ireland, as well as in inland areas in the UK and France.



Aerial view of a Great Cormorant colony in the Volga Delta in the north-western part of the Caspian Sea. Photo: G. Rusanov .

Introduction

There is a continuous and considerable interest in Great Cormorants and their numbers in Europe. This is partly due to the fact that increasing populations of the continental sub-species *Phalacrocorax carbo sinensis* have been seen as a factor putting pressure on fisheries, aquaculture and angling activities. The interactions between the birds' activities and human interests have created various types of social and socioeconomic conflicts. On the basis of the concerns from the various social and economic sectors affected, the European Parliament requested in 2008 the European Commission to take action.

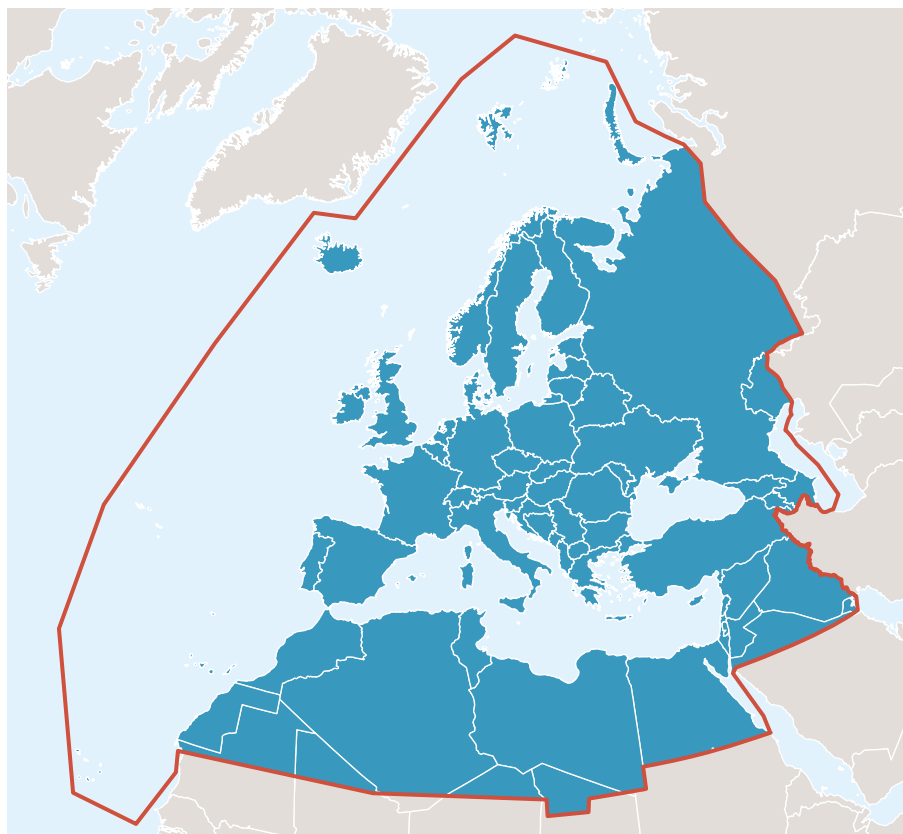
Following a consultation meeting with the Member States in 2009, the European Commission decided that one action should aim at increasing current knowledge about the status, trends and distribution of the Great Cormorant throughout Europe. This information was judged as being fundamental for some of the processes aimed at resolving management and conflict issues within the European Union. As a consequence, the Commission hired a contractor to collaborate with the IUCN/Wetlands International Cormorant Research Group and a large number of individual countries, in order to monitor the breeding and wintering population of cormorants in Europe.

The IUCN/Wetlands International Cormorant Research Group (hereafter referred to as the Cormorant Research Group) subsequently collaborated with the European Commission project 'CorMan' through its contractor, Aarhus University in Denmark and the NERC Centre for Ecology & Hydrology in the United Kingdom, in order to organize Pan-European counts of breeding colonies and of cormorants in their wintering areas. The name 'CorMan' is an acronym for the project 'Sustainable Management of Cormorant Populations', Service Contract No. 07-0307/2010/575579/SER/B3, see also <http://ec.europa.eu/environment/nature/cormorants/Background-and-Activities.htm>. The Cormorant Research Group and the EC contractors formed a specific counts project 'Cormorant counts in the Western Palearctic' to undertake this work.

The Western Palearctic covers all of Europe (including the Russian Federation west of the Ural Mountains), North Africa and the northern and western parts of the Middle-East (Fig. 1.1). Ideally the project aimed to obtain information about the size of all breeding colonies of Great Cormorants in the Western Palearctic in 2012. However, the primary focus was to obtain information from the breeding areas of the birds that occur in the EU Member States on the European continent.

Up to 2006 it was commonly believed that two sub-species of the Great Cormorant *Phalacrocorax carbo* bred in the Western Palearctic. However, Marion & Le Gentil (2006) found genetic evidence for the existence of a third sub-species (see 'Material and methods'). The two sub-species that are traditionally treated separately are the so-called 'Atlantic' sub-species *P. c. carbo* and the so-called 'continental' one *P. c. sinensis*. The Atlantic *carbo* sub-species is mainly found breeding on rocky cliffs and unvegetated islands on exposed marine coasts in Ireland, the UK, northwest France, Iceland, Norway and along the Barents Sea coast in the Russian Federation. The continental *sinensis* sub-species breed in trees and on the ground mainly along shallow coasts and at inland waters. The continental sub-species has a much wider distribution than the Atlantic sub-species. Within the Western Palearctic it breeds throughout most of continental Europe, from Finland in the

Figure 1.1. The parts of Europe, North Africa and the Middle-East included in the Western Palearctic. The border of the Western Palearctic follows that of Snow & Perrins (1998).



north to Spain in the south and west over most of continental Europe to the Caspian Sea in the east. The breeding distribution of *P. c. sinensis* extends further east of the Western Palearctic, across Asia to Japan.

Determining the population size and distribution of the continental subspecies was given highest priority because it is mainly the *sinensis* birds that cause conflicts with fisheries in continental Europe (van Eerden et al. 1995, Carss 2003).

Based on counts of nests in breeding colonies in 2012 and/or 2013, the present report provides the most recent information available about the size and distribution of the Great Cormorant population in the Western Palearctic.

All countries in the Western Palearctic participated in the organized counts and/or supplied the counts project with the best and most recent data available in case there were areas which could not be covered in 2012 or 2013. The majority of the countries have published their results both at national levels and as chapters in this report.

This first chapter of this report gives an overview of the major results from the monitoring of the breeding population. Recent trends in population development in the different parts of Europe are described and discussed in relation to a comparison with breeding numbers recorded during the Pan-European count of 2006. The overall results from that previous Pan-European count of breeding colonies were presented by the Cormorant Research Group in a leaflet (Wetlands International Cormorant Research Group 2008), as a paper in the proceedings from the 7th International Conference on Cormorants (Bregnballe et al. 2011) and in one of the Final Reports from the 'INTERCAFE' COST Action (van Eerden et al. 2012).

Material and methods

Areas of priority

Based on information on migration routes from different parts of the breeding range of the Great Cormorant, priority was given to all European countries located west of the Russian Federation and Turkey. As a result the area of priority also includes Belarus and Ukraine because these countries have breeders that migrate to various parts of Europe (Kostiushyn et al. 2011). Furthermore, priority was given to ensure counts of nests in breeding colonies in the Russian part of the Gulf of Finland and Kaliningrad as many of the Great Cormorants in these Russian regions are thought to migrate to EU Member States (A. Gaginskaya unpubl.). Coverage of the breeding colonies in Turkey, the Russian areas between the Sea of Azov and the Caspian Sea, west Kazakhstan, Georgia and Azerbaijan was given lower priority because few of these birds probably migrate to EU Member States (Gavrilov & Gavrilov 2005, Gavrilov & Gistsov 1978, A. Gavrilov, A. Abayev & S. Zaripova unpubl.).

With highest priority given to obtaining the most accurate information possible on the size and distribution of breeding populations of the continental *sinensis* sub-species, less effort was invested in ensuring full coverage of the coastal colonies of the *carbo* sub-species in Ireland and the UK.

Handling of sub-species

The question of sub-species is likely to be more complicated than the traditional separation between the nominate Atlantic race *P. c. carbo* and the continental race *P. c. sinensis*. Marion & Le Gentil (2006) found genetic evidence for the existence of a third sub-species which they named *P. c. norvegicus*. This sub-species was found mainly in Norway (north of Skagerrak) and in Brittany (France), but the sub-species also occurred in colonies near to the sea in Sweden, Denmark and The Netherlands. For simplicity, and because of the limited number of colonies for which information about *P. c. norvegicus* exist, we only distinguished between *carbo* and *sinensis* birds so, in effect, some *P. c. norvegicus* birds will be grouped with *carbo* ones and some (but fewer) will be grouped with *sinensis* ones.

We distinguish between *carbo* and *sinensis* in the present overview, partly because of their different conservation needs and the tendency of birds to occur in inland waters in continental Europe outside the breeding season. It was not difficult to distinguish between the two sub-species when the populations were small because the sub-species generally lived in different environments, particularly during the breeding season. However, as the populations of both sub-species expanded they started to breed in mixed colonies, particularly in inland colonies in England and in coastal and inland colonies in France (e.g. Marion 1995, Goostrey et al. 1998, Winney et al. 2001, Marion & Le Gentil 2006, Newson & Marchant 2007, Newson et al. 2004, Newson et al. 2007, Newson et al. 2013). With a few exceptions, the extent to which *carbo* and *sinensis* are breeding in mixed colonies in other countries is unknown.

The relative proportion of the two sub-species can vary extensively between colonies located relatively close to each other, and the *sinensis/carbo* proportions are also known to have changed over the years in individual colonies (e.g. Marion & Le Gentil 2006, S.E. Newson pers. comm.). This makes it very difficult to accurately determine the population sizes for the two sub-species. Colonies in Ireland, along the coast of the UK, in Iceland, in Norway (north of Skagerrak) and along the White Sea coast in Russia, were treated as

if only *carbo* (incl. *norvegicus*) were breeding. For inland colonies in the UK we assumed that 34 % of the breeders belonged to the sub-species *carbo* in 2012, based on the gular pouch angle criteria (Newson et al. 2013, S.E. Newson unpubl.). There have been no records of sub-species composition from genetic data in the French breeding colonies since 2002. To keep it simple, we assumed that the coastal colonies in France contained 80 % *carbo* (incl. *norvegicus*) and 20 % *sinensis*, and for the inland colonies in France we assumed that 20 % were *carbo* (incl. *norvegicus*) and 80 % were *sinensis*; these assumptions were based on published data (Marion & Le Gentil 2006) and unpublished data (L. Marion pers. unpubl.).

Organisation of counts

The counts project '*Cormorant counts in the Western Palearctic*' was led by representatives from the Cormorant Research Group and the EC contractor through a 'Counts Steering Group'. The Counts Steering Group divided the Western Palearctic into four counting areas and 1-2 Area Coordinators were designated to each. Key people were contacted in countries throughout the Western Palearctic in order to recruit qualified people to coordinate the counts in each of their respective countries. Furthermore, a large number of organizations, institutions and other key people likely to have knowledge about the occurrence of breeding Great Cormorants in their countries were contacted. The contact with National Coordinators and other key people began in 2011 and continued until March 2014. Area Coordinators from the overall project were responsible for establishing and maintaining contact with the National Coordinators.

Guiding and facilities

The counts project provided support and guidance for all countries, informing them about the aim of the project, how to count breeding colonies and how to report count results so that all results obtained could be aggregated on a Pan-European level at the end of the project. The counts project also prepared relevant material and communicated this to the National Coordinators so they could distribute this further as they judged relevant. This material included (a) a guide describing the preferred methods for counting at Great Cormorant colonies, (b) an Excel and pdf form recommended to be completed for each colony counted, (c) an Excel form to insert the numerical conclusion at the national level as well as the basic information for each of the individual colonies counted, (d) a description of how the data from each country would be stored, published and made available to others through and after the end of the project.

A project home page and a web-based tool was also developed, offering facilities for the National Coordinators and individual counters for entering count results directly and for denoting the location of the counted sites using Google Maps (for details, see <http://www.cormocount.eu>). The website provided access to instructions for the counting of breeding colonies in English, Russian and Danish. The project home page was further used to communicate the progress of the counts project to the National Coordinators and individual counters, and to present summaries of results from completed counts.

It was recommended that all countries monitored their breeding population by first identifying all the sites known to have had breeding cormorants in recent years, and then ensure that each of these sites was visited during the breeding season in order to locate all active breeding colonies and count all nests occupied by breeders.

National Coordinators were asked to report their national results as soon as they were sure that all relevant count results had been collated and checked for possible mistakes.

Information provided to National Coordinators recommended that a colony was defined as a group or groups of nests that were located within 2,000 m of one another (Bregnballe et al. 2012). Groups of nests located within 2,000 m of one another should be referred to as 'sub-colonies'. A single nest was sufficient to be termed a 'colony' as long as it was not located within 2,000 m of other nests. This recommendation was followed by some but not all countries because National Coordinators were free to use other definitions of what constituted a colony if they had their own national protocol.

Instructions to counters

A practical guide was developed for people who would conduct counts of nests in breeding colonies (referred to as 'colony counters'). The guide was made available through the project home page and some of the National Coordinators distributed the guide to the colony counters. The guide recommended that observers counted apparently occupied nests, defined as nests in use and sufficiently completed to hold one or more eggs (Bregnballe et al. 2012).

It was further recommended that counts were made at the time of the breeding season when the maximum numbers of nests were likely to be occupied. However, for tree nesting colonies, colony counters were also advised to count the nests before extensive leaf-burst, as visibility decreases with expanding foliage. The ability of observers to count at the time when nest numbers peaked was in some cases constrained by other factors such as incomplete knowledge about exactly when in the season nest numbers might be expected to peak, partly because this may vary from year to year. In planning the time of a nest count, the colony counters also had to take into account that the number of nests tends to reach a maximum later in the season in newly-founded colonies than it does in older ones. Finally, some colony counters were forced to count at a suboptimal time because of other duties or poor weather conditions on the day when the count was planned.

The guide included instructions for counting at both ground nesting and tree nesting colonies. To minimise disturbance in the ground nesting colonies colony counters were advised to attempt to count nests from outside the colony. Entering colonies was avoided if it was possible to count the nests from one or more suitable vantage points. Where possible, the nest contents were recorded in order to obtain a general assessment of the stage of the breeding cycle when the count took place. When entering a colony was necessary to ensure precision of the nest count, colony counters were advised to carefully keep track of which nests were counted by making a map using features in the landscape possibly combined with the use of sticks or spray paint to mark the areas where nests had been counted. Some colony counters minimized the duration of disturbance by using a tape recorder to record information during the count and/or by having two or three people counting simultaneously.

It was recommended that where repeated counts were carried out (at different dates during the breeding season), the highest number of nests should be used to describe the size of the colony.

A few *sinensis* colonies and a large number of the *carbo* ones along open, rocky coasts were counted by taking photographs of the colony from the air (particularly in Iceland and Norway). Nests were counted either from a computer screen or from large prints of the photos.

As a minimum, colony counters were asked to report the number of apparently occupied nests, the name and location of the colony (coordinates in decimal degrees) and their own contact details. Colony counters were also given the opportunity to provide additional information about: (a) the locality (name of locality, geographical coordinates, protection), (b) the colony and its surrounding habitat (type of fishing water, minimum distance to fishing water, type of colony, species of nesting trees, % breeding on the ground, occurrence of predators), (c) the counting method (date of count and method), (d) clutch size, brood size and breeding success, (e) the occurrence of disturbance, and (f) the occurrence of management.

All colony counters were asked to report their results immediately after the count took place.

A female parent delivers a meal to one of its chicks, Vorsø, Denmark. Photo: Kim Biledgaard.



Precision of counts

In most of the countries the locations of the majority of the breeding sites were known in advance. This resulted in a high probability of obtaining up to date information about the size of all the countries' breeding colonies. Most colonies were counted once around the time of the season when nest numbers were at their maximum.

Despite the large and often conspicuous nests of this species, counts of apparently occupied nests are not necessarily straightforward. However, in many of the colonies the nests were fairly easily counted. For a minority of breeding colonies it was necessary to estimate the number of occupied nests in certain parts of the colony, e.g. due to insufficient visibility from the observation points. Some colony counters reported a minimum and a maximum number of nests in the colony they counted. A few National Coordinators used these lower and upper values and provided a range of nest numbers when reporting on total numbers in their country. Other Coordinators decided to use the mean number of nests when a minimum and a maximum

were given. As advised, the National Coordinators used the largest count for colonies where there was more than one count for a particular site and year.

The number of nests present at the time of the season when nest numbers reach their maximum will, in most cases, be lower than the total number of nests actually built in the colony. Thus nests may disappear before, and new nests may be built after, the peak in nest numbers (Harris & Forbes 1987).

Furthermore, the number of pairs that have attempted to breed will also usually be higher than the number of apparently occupied nests at the time of the season when nest numbers reach their maximum (Harris & Forbes 1987, Walsh et al. 1995). Thus nests built by pairs that give up early in the season are frequently taken over by new pairs, and some breeders may not initiate breeding until after the nests have been counted.

Handling of count results by National Coordinators

Each of the National Coordinators was responsible for keeping contact with the colony counters and ensured that they delivered the results from their counts. Some National Coordinators recommended that their colony counters reported their results directly into the CormoCount platform, having each colony counter as a registered user. Others entered their results in a predesigned form (editable pdf) or in the Excel form.

Having collated all the data, the National Coordinators checked all information for any obvious mistakes and identified and resolved possible uncertainties. After a final quality check the National Coordinator passed on the results to the relevant Area Coordinator. For the majority of colonies only the minimum information required (colony location and number of nests) was provided.

When reporting the national results, National Coordinators were asked to report the actual number of nests and colonies, to describe the coverage of the count at the national level, and to give a best estimate of the total number of colonies and nests in the country or region. In a few countries or regions total breeding numbers were difficult to estimate because some areas had not been covered in 2012 or in another recent year. In these cases 'best estimates' or 'best guesses' were made from knowledge about the presence of wetlands and potential breeding areas. Within the area of priority, this was done for Moldova, central and western Romania and for some small regions of Ukraine. Outside the area of priority best guesses were made for some regions in the Russian Federation, Georgia, Azerbaijan and Turkey.

National reports

From the onset of the counts project, the National Coordinators were encouraged to publish their results. Many of the Coordinators and their co-workers have done so (see references in individual chapters in this report). Furthermore, from the autumn of 2012 onwards all National Coordinators were invited to present major results from their national count in a collation of national reports (Bregnballe et al. 2013) and/or in the present report.

Handling of data for overview

For the present overview we use, for simplicity, the terms "number of nests" or "number of breeding pairs" as a reference to the number of "apparently occupied nests" which was the unit used by counters when reporting their results to the National Coordinator.

For a number of countries we also received results from counts of colonies conducted in 2013, but this overview chapter, only includes data from the 2012 counts, unless data only exist for other years.

Based on the information provided by the National Coordinators, who had also described their use of estimates to compensate for incomplete coverage, national overview tables were made giving the essential information on coverage, the number of colonies and the size of the national or regional breeding population.

The information on the geographical location of each breeding colony and the number of apparently occupied nests for each colony were organized in a database. From this we extracted the information needed to present total numbers breeding within 50 × 50 km squares for most of the Western Palearctic covered by the 2012 count.

To explore the frequency distribution of colony sizes and the distribution of the overall populations in relation to colony sizes, data on colony sizes were extracted for the *carbo* and *sinensis* sub-species. For colonies with *carbo* breeders, only data from Norway and Iceland were used. For *sinensis* colonies, breeding data were used from countries located west of the borders to Russia and Turkey (though colonies in the Russian areas along the Baltic Sea were included).

To provide an overview of recent population trends, the results from the 2012 count were compared with results of similar counts that took place in 2006. Comparisons were made for areas with equal coverage

Definitions of areas

The section of the Western Palearctic where Great Cormorants are breeding was divided into four major areas. Some regions in Russia and the western part of Kazakhstan which belong to the Western Palearctic and have breeding Great Cormorants were not included in this status for breeding numbers in the Western Palearctic.

The four areas were defined in relation to large and connected bodies of water: The North-East Atlantic Ocean, the Baltic Sea, the Mediterranean and the Black Sea. The border of each of the four areas is shown in Fig. 1.2 and the areas were defined as follows:

Area I. Includes the countries with coasts along the North-East Atlantic Ocean, except for Germany and Denmark.

Area II. Includes the countries along the Baltic Sea including the Russian part of the Gulf of Finland and Kaliningrad. Germany and Denmark were grouped under this area as the majority of the breeders in these countries are found close to the Baltic Sea and not close to the North Sea.

Area III. Includes countries in central Europe and the central and eastern Mediterranean.

Area IV. Includes Belarus, the countries that border the Black Sea, and several Russian regions between the Sea of Azov and the Caspian Sea, as well as Georgia, Azerbaijan and Armenia. The western part of Kazakhstan (at the

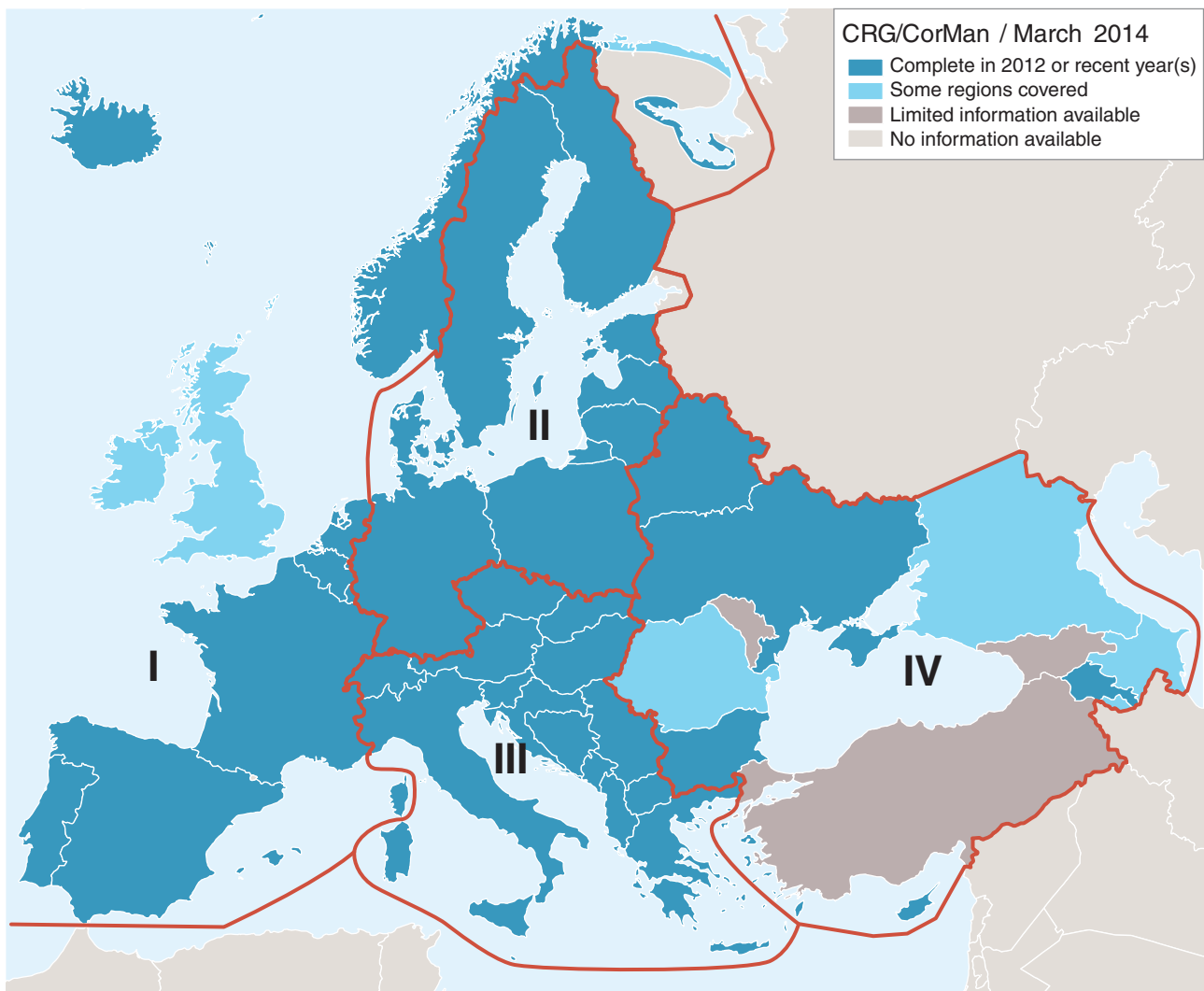


Figure 1.2. Overview of the countries where breeding colonies of Great Cormorants were counted as part of the current project and borders defining the four areas used to present the results of the counts. In the United Kingdom complete coverage of all inland colonies (*sinensis* and *carbo* sub-species) was obtained but not all coastal colonies with breeders of the *carbo* sub-species have been covered in recent years. Colonies along parts of the Irish coast were covered. In Romania complete coverage was obtained along the lower Danube and in the Danube Delta, but estimates from other regions were based on data from earlier years. Counts were carried out in the larger regions in Azerbaijan and the Russian Federation between the Sea of Azov and the Caspian Sea. For Moldova, Georgia and Turkey limited information was available relating to breeding numbers in 2012 or 2013. For further information on coverage, see Tables 1.2-1.5.

northern coast of the Caspian Sea) also belongs to the Western Palearctic but was not included in area IV. The same is true for a number of inland regions of Russia west of the Ural Mountains.

Coverage reached within the Western Palearctic

The primary focus was to obtain updated knowledge about breeding numbers of the sub-species *sinensis* within Areas I, II, III and the western part of Area IV which included Belarus, Ukraine, Moldova, Romania and Bulgaria (Fig. 1.2). Almost complete coverage was achieved for 2012. There are four circumstances which resulted in incomplete coverage inside the area of priority in 2012 as follows:

(1) *Colonies missed and not recorded/counted.* Whilst considerable effort was made to obtain complete coverage of all parts of each of the countries where cormorants could be expected to breed, it is highly likely that in some coun-

tries some colonies and breeding attempts were missed, as these colonies were not known or discovered in 2012. The National Coordinators strived to obtain clear knowledge about the completeness of the coverage of the breeding colony counts in their own countries. In general National Coordinators reported that all known colonies were counted and that any possible colonies not covered during the counts are likely to have been newly-established ones with small numbers of nests. However, some countries have regions which are rarely visited by ornithologists or other people who can be expected to report on the presence of breeding colonies of cormorants if discovered. This seems to have been the case for at least some parts of Albania, Romania, Belarus and Ukraine. Attempts have been made to correct for incomplete coverage in these countries.

(2) *Data from earlier years.* In some countries and regions, not all colonies could be counted in 2012. In these situations, data from the most recent count was used to estimate the current (i.e. 2012) national breeding population. This was the case in 2 out of 53 colonies in the UK, 8 out of 135 colonies in France, 20 out of 169 colonies in Sweden, 5 out of 54 colonies in Poland, 2 out of 46-50 colonies in Italy, 6 out of 11 colonies in the Stavropol region in Russia, 1 out of 13 colonies in Greece, 1 out of 20 colonies in Belarus and 1 out of 29 colonies in Romania.

(3) *Areas not covered.* In Romania counts of breeding colonies were carried out only on the lower River Danube and the Danube Delta. As a result, a best estimate of breeding numbers in the remainder part of the country was provided by the National Coordinator based on counts and information collected in earlier years (not necessarily in a year immediately prior to 2012). In Ukraine it was not possible to survey a small number of locations where breeding took place in previous years (locations in the Danube Delta, Dnieper Delta and northeast and northwest Ukraine). Therefore the National Coordinator provided an estimate of breeding numbers in these areas based on information from earlier years. In Moldova counts were carried out in three colonies, but for several parts of the country no information existed about the occurrence of breeding of Great Cormorants. Consequently, best guesses on breeding numbers were made for these uncovered areas.

4) *Counts in 2013.* In Bosnia-Herzegovina, FYRO Macedonia and Romania counts could not be conducted in 2012 and so were carried out in 2013 instead.

A secondary aim of the project was to obtain coverage in the eastern and southern part of area IV, i.e. in the part of Russia located between the Sea of Azov and the Caspian Sea as well as Georgia, Azerbaijan, Armenia and Turkey (see Fig. 1.2). In Georgia very limited information was retrieved through personal communication with local ornithologists (2 colonies) and for Azerbaijan a rough estimate of the total breeding population is presented based on counts from various years and parts of the country. For Armenia we obtained comprehensive information about the breeding populations. For Turkey information was obtained from a group of ornithologists (J.P. Tavares, O. Onmus, K. Erciyes and K. Boyla) who collated historical information and conducted counts of 20 breeding colonies during 2011-2013. However, a number of potential breeding areas here could not be covered.

The extent of coverage varied in the Russian regions located between the Sea of Azov in the west and the Caspian Sea in the east. Complete or almost

complete coverage in or around 2012 was obtained for the Krasnodar region and for the Volga delta (Astrakhan region). By combining counts from previous years, population estimates were made for the Rostov, Stavropol and Kalmykia regions as well as for the southern part of the Volgograd region. Suitable nesting habitats also exist within the Astrakhan (along the Volga River) and Dagestan regions, but it was not possible to obtain detailed information on breeding numbers in these regions (V. Belik pers. comm.). A full survey of the breeding colonies of Great Cormorants in the Don River Delta (Rostov region) is planned for 2014 (N. Lebedeva pers. comm.).

A third aim of the present project was to obtain counts of breeding colonies of the Atlantic sub-species *P. c. carbo* in Iceland, Norway, north-western Russia, the UK, Ireland and France. Complete coverage was obtained for Iceland, France and the inland colonies in the UK. In Norway the *carbo* breeding population was estimated based on counts carried out in individual colonies which took place in various years between 2007 and 2013 (Chapter 25). The majority of colonies (83 %, 132 out of 160) were counted between 2011 and 2013. The use of data from different years to reach an estimate of the total breeding population along the coast of Norway was not ideal because Great Cormorants may abandon a colony within a few years and move to another location if breeding conditions deteriorate in the original colony (e.g. Røv 1994). However, movements are usually to neighbouring or at least not very distant potential breeding sites, and the coverage of the colonies present within the individual regions in Norway was in most cases carried out in one year (S.-H. Lorentsen pers. comm.).

For the north-western coast of Russia, ornithologists made a best estimate of breeding numbers for the Barents Sea coast of the Kola Peninsula as well as for Kandalaksha Bay and Onega Bay in the White Sea, although coverage was not complete and for some sites data on breeding numbers were obtained prior to 2012. For the eastern part of the Barents Sea coast in the Russian Federation no information was obtained, and as a result a best guess of the breeding population was determined by one of the Area Coordinators based on studies of satellite photos.

For the UK and Ireland there has not been sufficient coverage to provide a precise updated overview of the total breeding numbers in the coastal colonies. However estimates were made from annual or almost annual counts of a number of coastal colonies (S.E. Newson, S. Newton and N. Tierney pers. comm.).

Information about the coverage within individual countries is provided in Tables 1.2-1.5 as well as in the national and regional chapters provided in this report.

We refer to the counts (and estimates) made in relation to the Pan-European survey in 2012 and/or 2013 as “the 2012 count”, even though the colonies in some countries were counted in 2013 or in a year immediately prior to 2012.

The term ‘breeding pairs’ is used for breeding numbers within larger areas – at national as well as at sub-national levels – whereas the term ‘nests’ is mainly used when referring to breeding colonies. However, numbers always refer to the counted or estimated number of ‘apparently occupied nests’.

Results

Overall numbers

The breeding population of Great Cormorants in the Western Palearctic had reached around 406,000-421,000 breeding pairs by 2012 according to the counts and estimates used in the present survey; this estimate excludes some regions in Russia and the western part of Kazakhstan. It was estimated that about 42,500 of the breeding pairs belonged to the Atlantic sub-species *carbo* and around 371,000 pairs to the continental sub-species *sinensis*.

Iceland, France and Norway – where complete coverage was reached through counts of all colonies – had 26,700 breeding pairs of *carbo* and it was estimated that a total of approximately 16,300 pairs of this Atlantic sub-species were breeding in Ireland, the UK and in the Russian Federation (along coasts of the Barents Sea and the White Sea).

The population size given for the continental sub-species *sinensis* is the average value of the estimate ranging between 363,300 and 378,600 breeding pairs (this estimate does not include all breeding areas within the Western Palearctic because no data on breeding numbers were collated for certain Russian inland regions located west of the Ural Mountains and for the western part of Kazakhstan which is also included in the Western Palearctic).

It is further estimated that around 294,000 pairs of the sub-species *sinensis* were breeding inside the area of the Western Palearctic that covers the countries located west of the western borders of Russia and Turkey (range 291,600-295,900 pairs; this sector of the Western Palearctic includes Kaliningrad and the Russian part of the Gulf of Finland). The 28 EU Member States had 214,500 of the breeding pairs of *sinensis* in Europe in 2012.

The Russian regions between the Sea of Azov and the Caspian Sea were estimated to have a breeding population of between 53,500 and 61,000 pairs.

The counted and estimated numbers breeding in the four areas shown in Fig. 1.2 are given in Table 1.1 for each the two sub-species of the Great Cormorant.

A male Great Cormorant bringing seaweed to its nest in the Danish Vorsø colony. Photo: Kim Biledgaard.



Table 1.1. The estimated and counted numbers of breeding pairs of Great Cormorants *P. c. carbo* (area I) and *P. c. sinensis* (Areas I-IV) breeding in 2012 in the Western Palearctic. The four Areas are defined in Fig. 1.1 alongside denoting the coverage during the 2012 count. National breeding numbers are presented in Tables 1.2-1.5. A small proportion of the number given under ‘Counted’ are based on estimates.

Sub-species	Area	Number of breeding pairs in 2012	
		Overall estimate	‘Counted’
<i>P. c. carbo</i> ¹			
	I. North-East Atlantic Ocean	42,500	34,004
<i>P. c. sinensis</i> ¹			
	I. North-East Atlantic Ocean	36,900	36,811
	II. Baltic Sea	167,700	167,689
	III. Central Europe and Central and Eastern Mediterranean	20,900	20,839
	IV. Black Sea, Sea of Azov and NW Caspian Sea	138,000-153,300	125,108

¹For France it is assumed that 80% of the breeders in the coastal colonies belonged to the *carbo* sub-species and 20 % to the *sinensis* sub-species whereas for the inland colonies the assumptions were 20 % *carbo* and 80% *sinensis* (Marion & Le Gentil 2006, L. Marion unpubl.). For the UK it is assumed that 66 % of those breeding in inland colonies belonged to the *sinensis* subspecies and that 34 % belonged to the *carbo* sub-species (cf. S.E. Newson unpubl.).

Overall distribution of *P. c. carbo*

The Atlantic sub-species *carbo* was recorded breeding in Russia, Norway, Iceland, Ireland, the UK and France. Most of the breeders were found along the coast of Norway (ca. 19,000 pairs). The UK was the second most important breeding area for this sub-species. Although there has not been any simultaneous and complete survey of the British coastal Great Cormorant colonies since around 2000, it was estimated that 8,545 pairs nested along the coast of the United Kingdom in 2005 (Newson unpubl.; see also Bregnballe et al. 2011). Analyses of trends suggested that there has been a decline in coastal breeding numbers in the UK after 2005 (JNCC and S.E. Newson unpubl.; trends based on annual counts of a variable number of the coastal colonies). The trends suggest that the coasts of the UK had around 6,500 breeding pairs in 2012 (S.E. Newson & T. Bregnballe unpubl.). Ireland was not fully covered in 2012, but based on annual surveys of 13 colonies that held 59 % of breeding numbers recorded during the ‘Seabird 2000’ survey, it was estimated that Ireland had around 4,400 breeding pairs in 2012 (S. Newton unpubl.). In France, *carbo* totalled about 3,000 breeding pairs in 2012, 55% of them on the coasts and 45% in inland colonies. Iceland had 4,772 breeding pairs. The total number of breeding pairs along the Barents Sea and White Sea coasts of the Russian Federation is unknown (E. Tolmacheva pers. comm.). However, some colonies have been counted in recent years, especially those located on islands in the White Sea. It is estimated that the Barents Sea and White Sea coasts had around 3,900 breeding pairs in 2012, but the estimate is uncertain due to incomplete coverage.

Overall distribution of *P. c. sinensis*

The largest numbers of breeding Great Cormorants of the continental sub-species were found in the countries bordering the Baltic Sea (167,700 breeding pairs) and the Black Sea, the Sea of Azov and the Caspian Sea (>138,000 breeding pairs, Table 1.1). Breeding numbers were lower in the countries along the North-East Atlantic Ocean (36,900 pairs; Germany and Denmark

not included in this area). The area of central Europe and the central and eastern Mediterranean held a breeding population of 20,900 breeding pairs.

Great Cormorants were found breeding in all the countries included in Areas I-IV (Fig. 1.2) except for Luxembourg, Monaco, Portugal, Slovenia, Kosovo and Albania.

The numbers of breeding pairs of Great Cormorants in each of the countries in 2012 are given in Tables 1.2-1.5.

The overall distribution of the breeding population of Great Cormorants is shown in Fig. 1.3. Breeding numbers are shown as the total numbers within 50 x 50 km grid cells. It is evident that the largest concentrations were found:

- Near shallows, lagoons and large river deltas along the Baltic Sea coasts.
- Around lake IJsselmeer in The Netherlands.
- In the large deltas of the rivers Danube (Romania and Ukraine), Dnepr (Ukraine) and Volga (Russia)
- Along the Black Sea and Sea of Azov coasts of Ukraine and Russia
- The Volga Delta in the north-western part of the Caspian Sea.

Besides these areas, moderately high numbers of breeding Great Cormorants of the *sinensis* sub-species were found near coasts, estuaries, lagoons, as well as near to large rivers and large lakes in inland areas in Sweden, Belarus, Poland, Germany, The Netherlands, France, Spain, northern Italy, Hungary, Croatia, Serbia, Montenegro, FYRO Macedonia, northern Greece, Romania and Ukraine (Fig. 1.3, Tables 1.2-1.5).

The areas within the Western Palearctic that are not included in the present survey, but have breeding populations of Great Cormorants of the continental sub-species are a number of inland regions in the Russian Federation located west of the Ural Mountains and the western most part of Kazakhstan (only the western part of Kazakhstan is located inside the Western Palearctic according to Snow & Perrins 1998). Updated information on breeding numbers in these areas could not be gathered for this project. However, information about occurrence of breeding of Great Cormorants in earlier years in these regions is given in Belik (2008), Gavrillov & Gavrillov (2005), Kuzmenko & Fedotov (2005), Numerov (2013) and Shevchenko et al. (1993). These references document that Great Cormorants breed periodically on lakes in the steppes between the Volga and Ural Rivers in the Western Kazakhstan (Shevchenko et al. 1993). These lakes periodically dry up, but are filled with water again after winters with plentiful snow. The most recent published record of breeding in this area refers to 1996 (Belik 2008). Great Cormorants also occur numerously in summer on the wide Voronezh reservoir, but colonies have not been found yet (Numerov 2013). In 2004 a colony with 15-20 nests was (for the first time) found in the western part of the Bryansk Region, near the border to Belarus (Kuzmenko & Fedotov 2005).

The following countries, located outside Europe but inside the Western Palearctic, currently do not have breeding populations of the continental sub-species of Great Cormorants: Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Israel, Lebanon, Syria and Iraq (S. Jbour, L. Marion, G.A. Nabegh, T. Qaneer, M.A. Salim & M. Smart pers. comm.). Breeding does, however, occur in Iran (just east of the Western Palearctic) – at least three colonies were reported around 2003 (Barati & Balmaki 2005).

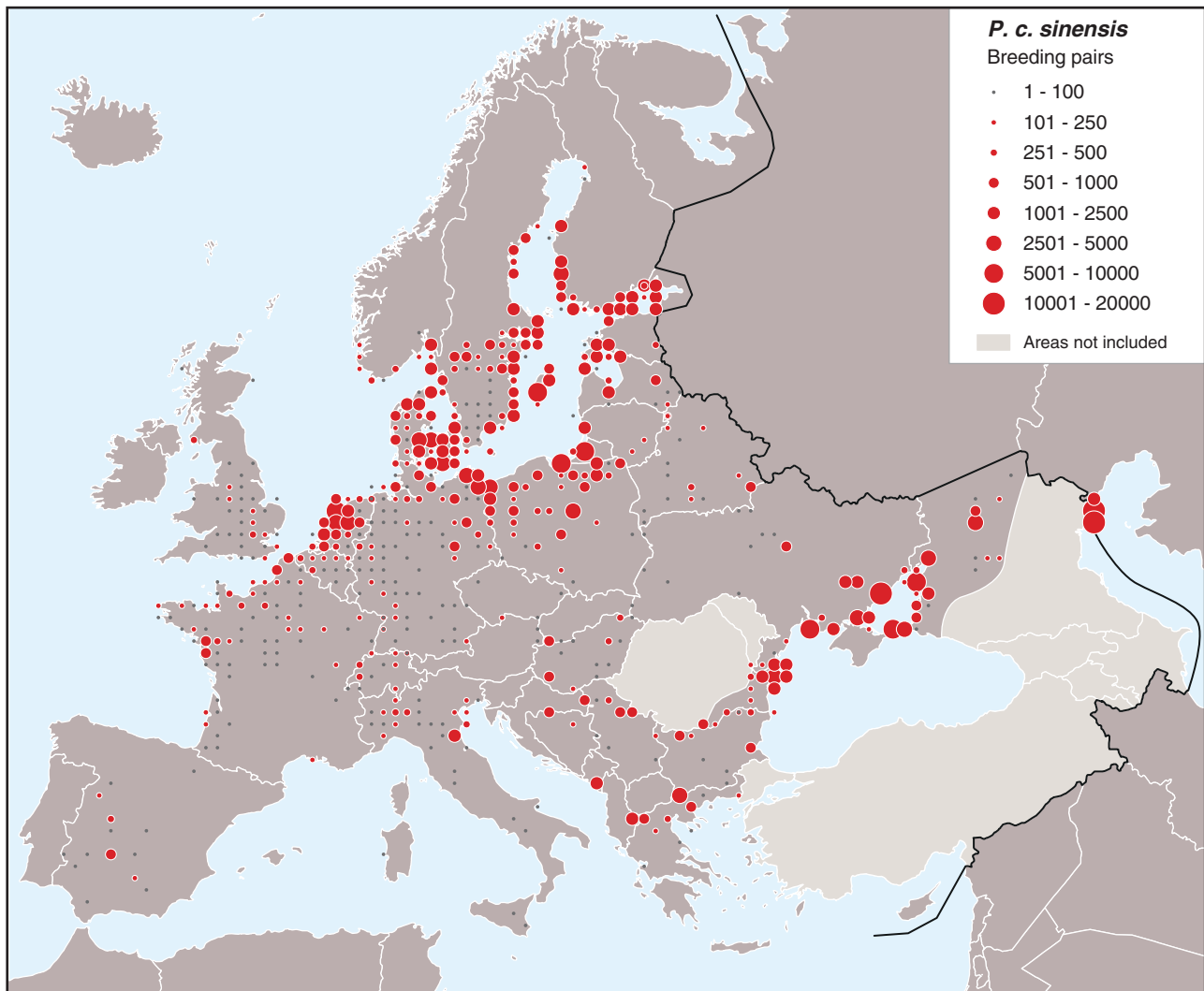


Figure 1.3. Distribution of the breeding population of Great Cormorants in the Western Palearctic in 2012 presented in 50 x 50 km grid cells. The blue line denotes the border of the area covered by the overall survey of the breeding population. The map only includes breeding colonies where all or some of the breeders belonged to the *sinensis* sub-species. Breeders in the following areas where only the *carbo* sub-species is breeding (or at least very few of the breeders are likely to be *sinensis* birds) are not included: Ireland, the coast of the UK, Iceland, Norway (north of Skargerrak) and the Barents Sea coast of the Russian Federation. The map does not show the distribution of breeders in Turkey, Armenia, Azerbaijan, Georgia, parts of Russia, Moldova and the central and western part of Romania because of incomplete coverage in some of the regions in these countries.

Distribution in relation to colony size

P. c. carbo. Among the breeding colonies in Norway and Iceland most colonies (61 %) were small with 1-100 nests (Fig. 1.4A), but the majority of the birds (73 %) bred in colonies with 101-1000 nests (Fig. 1.4B). The three colonies with 1001-1300 nests (all located in Norway) had 12 % of all the *carbo* breeders present in Norway and Iceland. Røy (1994) has found evidence to suggest that the area of shallow water and the spatial distribution of adjacent colonies (but not their sizes) regulated the sizes of the Norwegian colonies.

The colonies in the White Sea in Russia (not included in Fig. 1.4) were generally small with <100 nests, but a single colony had 420 nests (this colony consisted of 3 sub-colonies located <2,000 m apart).

P. c. sinensis. Breeding colonies with 1-100 nests made up 57 % of all the breeding colonies recorded in Europe west of the border to Russia and Turkey (Fig. 1.5A). However, these colonies contained only 0.5 % of the total breeding population (Fig. 1.5B). The largest colonies with >1,000 nests made up 5 % of all existing colonies (Fig. 1.5A) but had 50 % of all the breeders (Fig. 1.5B).

It is evident that breeding *sinensis* birds generally nested in larger colonies than did breeding *carbo* birds (compare Figures 1.4B and 1.5B).

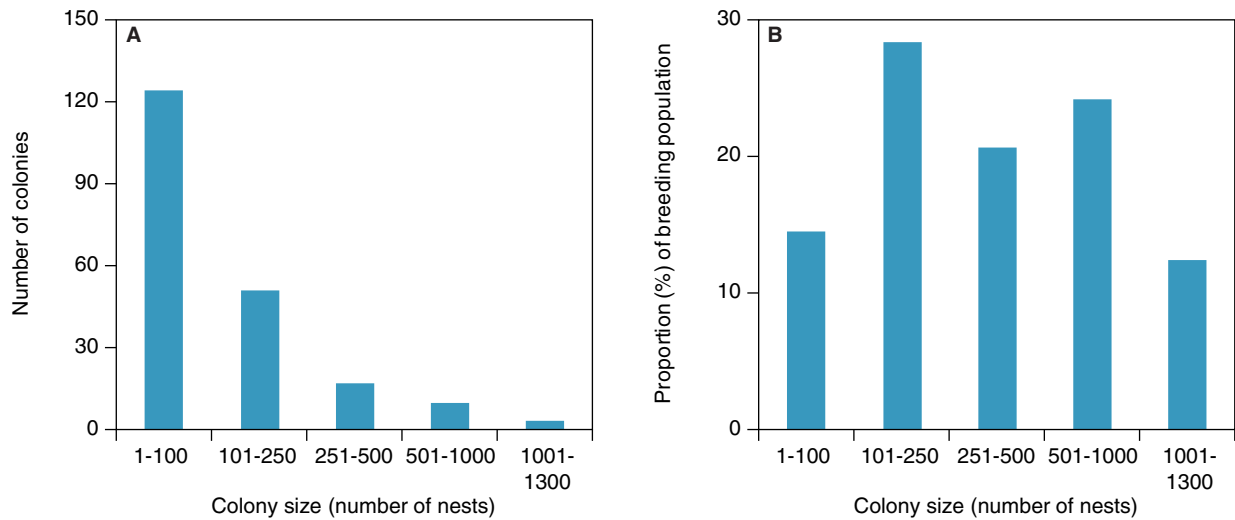


Figure 1.4. The Great Cormorant colonies of the *P. c. carbo* sub-species in Iceland (n=49) and Norway (n=153) in 2012 in terms of (A) size distribution and (B) distribution of the breeding population in relation to colony size.

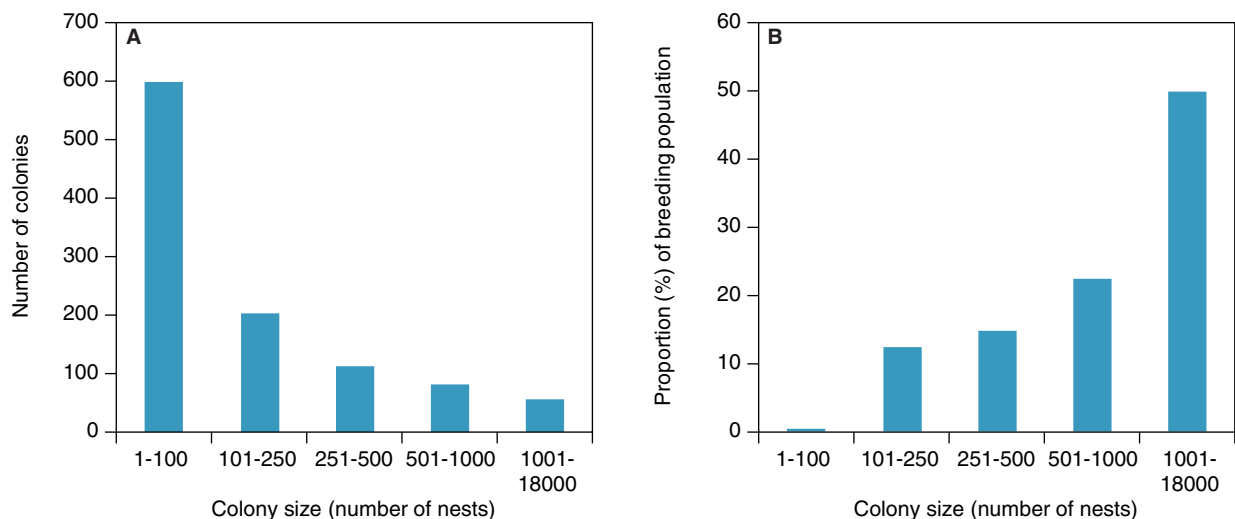


Figure 1.5. The Great Cormorant colonies of the *P. c. sinensis* sub-species in parts of the Western Palearctic in 2012 in terms of (A) size distribution and (B) distribution of the breeding population in relation to colony size. The 1,059 breeding colonies included were located in countries west of the border to Russia and Turkey, although Kaliningrad and the Russian part of the Gulf of Finland are included. Some of the colonies had breeders of both sub-species.

Distribution of *P. c. sinensis* within areas

Area I - North-East Atlantic. This area includes the countries along the North-East Atlantic Ocean, but not Germany and Denmark. The area had 784 breeding colonies in which all or some of the breeders were *sinensis*. A fairly high proportion (39 %) of the breeders nested in colonies with 1-250 nests (Fig. 1.6A).

The highest numbers of breeders (23,600 pairs) were found in The Netherlands (Table 1.2) which had 64 % of all the breeders in Area I. This country also had the six largest colonies, of which five were situated at Lake IJsselmeer. These six colonies had 27 % of all the breeders in Area I (Fig. 1.6A).

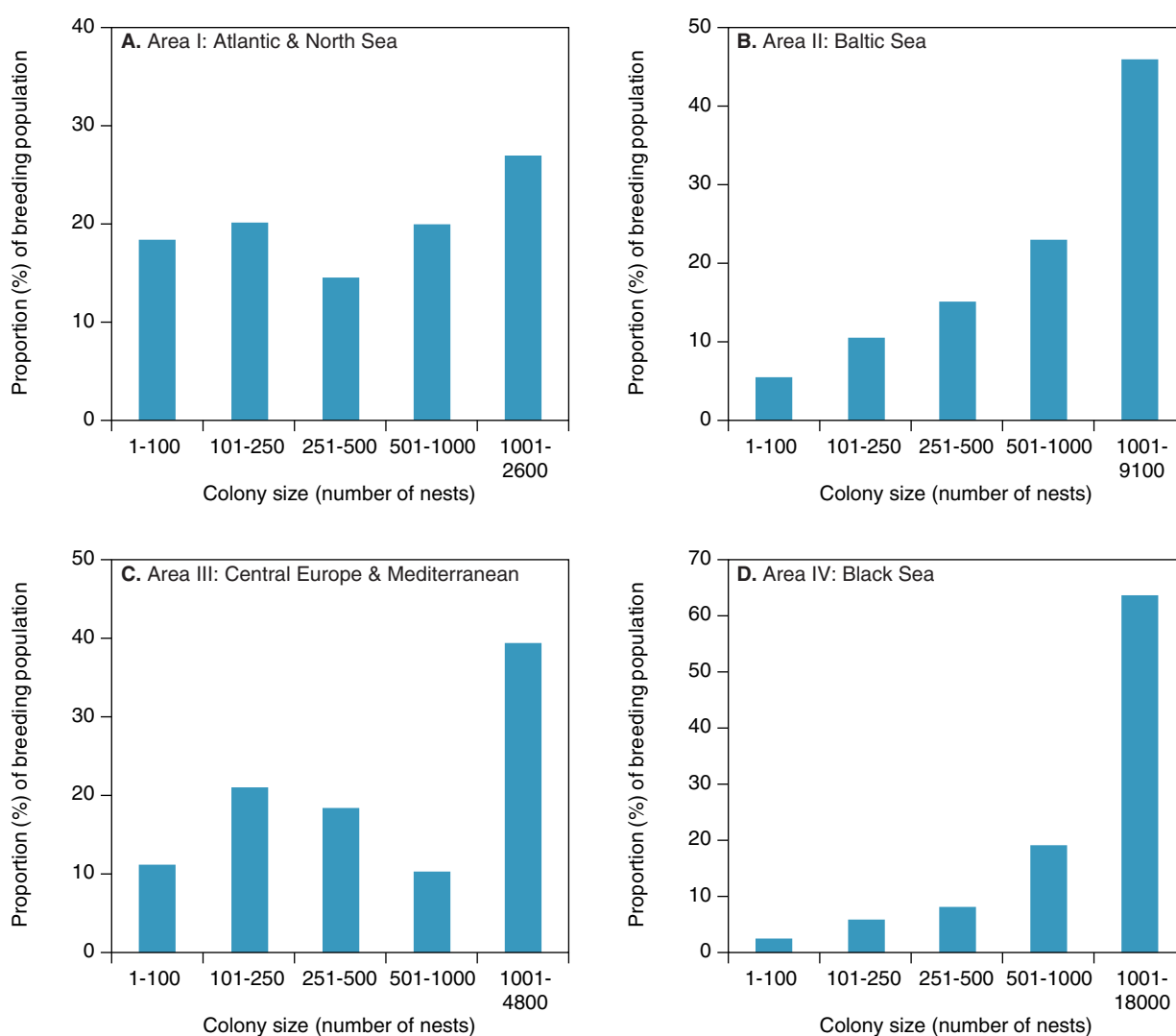


Figure 1.6. Distribution of the 2012 breeding population of Great Cormorants in relation to colony size in each of the areas I-IV. For Area IV data are only included for colonies located west of the border to Russia and Turkey. Only data from colonies where all or some of the breeders were *sinensis* birds are included. The proportions are calculated from the following number of breeding pairs: 40,709 pairs in Area I, 166,714 in Area II, 20,594 in Area III and 60,894 in Area IV. Be aware that the y-axes are not drawn to the same scale and that the highest interval of colony sizes differs between Areas.

Table 1.2. The number of breeding pairs (assumed occupied nests) in the countries along the North-East Atlantic Ocean (Area I), given per country or region within a country. The numbers given relate to counts carried out in 2012 unless otherwise stated. ‘Estimated total’ is the estimated total number of nests in the country or region. ‘Counted’ refers to the total number of nests counted. In countries or regions where the coverage was believed to be complete, the ‘Estimated total’ and the ‘Counted’ figures are equal. In countries or regions where the coverage was incomplete, an estimate of the national or regional population was provided by the National Coordinator. In Norway and France, ‘*P. c. carbo*’ refers to the *P. c. carbo* and *P. c. norvegicus* subspecies combined. The estimated totals given in parentheses are best guesses based on incomplete coverage.

Country	Number of nests			Remarks and sources	
	Region	Estimated total	No. of colonies		
Iceland	<i>P. c. carbo</i>	4,772	4,772	49	Chapter 18 (Gardarsson & Jónsson 2014)
Russia	<i>P. c. carbo</i>				
	Area A at Barents Sea coast of the Kola Peninsula	550	523	3	Area A covers ‘Seven Islands’, ‘Gavrilovsky Archipelagoes’ and ‘Maly Ainov Island’. Using counts during 2010-2013. Largest colony on Maly Ainov with 420 nests in 2010. R.V. Plotnikov, I.P. Tatarinkova, N.Ju. Ivanenko & T.D. Paneva (unpubl.)
	Uncovered areas of Barents Sea coast, Kola Peninsula	1,400			Estimate by M.V. Melnikov & T.D. Paneva (based on unpubl. data)
	Kandalaksha Bay, White Sea	100	60	3	Chapter 30 (Bianki et al. 2014)
	Onega Bay, White Sea	50		4	Chapter 32 (Tertitski et al. 2014). Using counts during 2008-2013
	White Sea to Novaya Zemlya	(1,800)			Estimated total is a best guess by T. Bregnballe
Norway					
	North of Skagerrak <i>P. c. carbo</i>	19,000		153	Chapter 25 (Lorentsen 2014a). Using counts during 2007-2013
	Skagerrak <i>P. c. sinensis</i>	2,500	2,434	14	Chapter 24 (Lorentsen 2014b).
United Kingdom					
	Coastal colonies <i>P. c. carbo</i>	(6,500)		(65)	Estimated total is a best guess by T. Bregnballe based on data from S.E. Newson (unpubl.)
	Inland colonies <i>P. c. carbo</i> & <i>P. c. sinensis</i>	2,809	2,809	53	Chapter 11 (Newson et al. 2014). England: 2,362 nests in 48 inland colonies; Wales: 58 nests in 1 inland colony; Scotland: 389 nests in 4 inland colonies (2 counted in 2000). Northern Ireland: no inland breeders
Ireland	<i>P. c. carbo</i>	4,366		>13	Estimated from trends of 13 colonies (representing 59% of the Seabird 2000 population estimate) monitored 2000-2012. S. Newton (pers. comm.). All colonies are coastal
The Netherlands	<i>P. c. sinensis</i>	23,556	23,556	78	Chapter 23 (van Rijn 2014)
Belgium	<i>P. c. sinensis</i>	1,584		28	Chapter 5 (Devos & Paquet 2014)

Monaco	0	0	0	L. Marion (pers. comm.)
Luxembourg	0	0	0	P. Lorge (pers. comm.)
France <i>P. c. carbo</i> & <i>P. c. sinensis</i>				
Total	8,673	8,624-8,722	135	Chapter 14 (Marion 2014). Using counts from 2009 or 2011 for 9 colonies
Inland colonies	6,629	6,581-6,676	108	
Coastal colonies	2,044	2,042-2,046	27	
Spain <i>P. c. sinensis</i>	1605	1,527-1,595	21	Chapter 36 (Molina 2014)
Portugal	0	0	0	V. Encarnacao (pers. comm.)

The UK had 2,809 breeding pairs in inland colonies of which 1,854 were estimated to be *sinensis*. The largest inland colony in the UK with *sinensis* breeders was located in England and had 226 nests.

The three other countries in Area I with breeding Great Cormorants were Spain (1,605 pairs), Belgium (1,584 pairs) and Norway (2,500; only the most southern part of Norway had *sinensis* breeders). Maximum colony sizes in these countries were: 823 nests for southern Norway, 614 for Spain and 213 nests for Belgium.

Area II - Baltic Sea. The Baltic Sea countries had 505 breeding colonies altogether and each of the countries around the Baltic Sea had between one and seven colonies with >1,000 nests (including each of the two Russian regions). The highest breeding numbers were along the coasts of Sweden, Finland, Estonia, Kaliningrad, Poland, North Germany and Denmark (Fig. 1.3, Table 1.3).

Cliff breeding Great Cormorants on the west coast of Sardinia, Italy 2011. Based on a genetic study of Great Cormorants in Europe, Marion & Le Gentil (2006) suggested that this Sardinian colony could be a relict because the breeders belonged to the *carbo* sub-species which normally breeds on cliffs (see also Chapter 19). Photo: Egidio Trainito.



Overall, the majority of breeders (84 %) were in colonies with >250 nests, and the 37 largest colonies with 1,001-9,100 nests held 46 % of Area II's breeders (Fig. 1.6B). The largest colony (9,075 nests) was located in the estuary of the Deyma River in Kaliningrad and the second largest (6,450 nests) was Kąty Rybackie, located on the Baltic Sea coast of Poland (nest numbers in this Polish colony had declined from 11,600 nests in 2006).

Area III - Central Europe and the Central and Eastern Mediterranean. This area had 131-135 breeding colonies in 2012 and 40 % of the breeders were found in four colonies with >1,000 nests (Fig. 1.6C). The largest colony had 4,730 nests and was located at Kerkini Lake in northern Greece. The three other large colonies had 1,000-1,200 nests and were found in FYRO Macedonia, Montenegro and Italy.

At the national level, Greece had the highest number of breeding pairs (ca. 7,000 pairs), followed by Italy (ca. 3,900 pairs) and Hungary (ca. 2,700 pairs). Five other countries – Switzerland, Croatia, Serbia, Montenegro and FYRO Macedonia – had 1,000-2,100 breeding pairs each (Table 1.4).

Table 1.3. The number of breeding pairs (assumed occupied nests) in the Baltic Sea (Area II), given per country or region within a country. The numbers given relate to counts carried out in 2012 unless otherwise stated. Great Cormorants breeding in this area belong to the *sinensis* sub-species. However, it cannot be excluded that also some birds of the *carbo* sub-species breeds in colonies of *sinensis* in for example Denmark. See also Table 1.2 for further explanations.

Country / region	Number of nests		No. of colonies	Remarks and sources
	Estimated total	Counted		
Sweden	40,598	40,598	169	Chapter 37 (Engström & Wirdheim 2014). Using counts for 20 colonies prior to 2012
Finland	17,258	17,258	41	Chapter 13 (Rusanen 2014)
Russia - Gulf of Finland	4,605	4,605	7	Chapter 28 (Gaginskaya et al. 2014)
Estonia	13,000	12,880	18	Chapter 12 (Rattiste 2014)
Latvia	3,106	2,634	9	Chapter 20 (Millers 2014)
Lithuania	3,200	3,004	6	Chapter 21 (Dagys & Zarankaitė 2014). A small number of colonies (Nemunas river delta) were not surveyed due to limited access
Russia - Kaliningrad	9,535	9,535	2	Chapter 29 (Grishanov et al. 2014)
Poland	26,600	25,473	54	Chapter 26 (Bzoma et al. 2014). Using counts from 2010 for 5 colonies
Germany	22,550	22,550	150	Chapter 15 (Kieckbusch 2014)
Denmark	27,237	23,237	64	Chapter 10 (Bregnballe et al. 2014)

Area IV - Belarus and Black Sea-Caspian Sea. This area includes Belarus, the countries that border the Black Sea, several Russian regions between the Sea of Azov and the Caspian Sea as well as the countries Azerbaijan, Armenia and Georgia.

The total number of breeding colonies in area IV is not known, but exceeded 270 colonies. The area around the Black Sea, the Sea of Azov and the Volga Delta had the largest colonies. One colony, located on the Obithochnaya Spit on the Ukrainian coast of the Sea of Azov, had 18,000 nests (surveyed using aerial photography). This colony seems to be the largest breeding colony ever recorded in the Western Palearctic.

Table 1.4. The number of breeding pairs (assumed occupied nests) in Central Europe and the central and eastern Mediterranean (Area III), given per country or region within a country. The numbers given relate to counts carried out in 2012 unless otherwise stated. Great Cormorants breeding in this area belong to the *sinensis* sub-species. See also Table 1.2 for further explanations.

Country	Number of nests		No. of colonies	Remarks and sources
	Estimated total	Counted		
Switzerland	1,037	1,037	13	Chapter 38 (Keller & Müller 2014)
Italy	3,914	3,865-4,016	46-50	Chapter 19 (Volponi & CoroMoNet.it 2014). Counts from 2011 used for 2 colonies
Austria	65	65	3	Chapter 3 (Parz-Gollner et al. 2014)
Czech Republic	297	297	7	Chapter 9 (Musil & Musilova 2014)
Slovakia	99	99	2	Chapter 35 (Ridzoň et al. 2014)
Slovenia	0	0	0	L. Božič (pers. comm.)
Croatia	1,331	1,331	2	Chapter 8 (Mikuska et al. 2014)
Hungary	2,661	2,641-2,681	22	Chapter 17 (Szinai 2014)
Bosnia-Herzegovina	171	171	1	Chapter 6 (Sjeničić & Kotrešan 2014). Using counts from 2013
Serbia	1,900-2,100	1,873-1,987	20	Chapter 34 (Šćiban et al. 2014)
Kosovo*	0		0	
Montenegro	1,156	1,156	1	Chapter 22 (Vizi 2014)
Albania	0	0	0	Chapter 2 (Jorgo & Jorgo 2014)
FYRO Macedonia	1,130	1,130	1	Breeding in 1 colony at Golem Grad Island, Prespa Lake in 2013. O. Avramoski (pers. comm.). Colony had 2,500-3,000 occupied nests during 2008-2010 (Veleviski et al. 2010)
Greece	6,978	6,963	13	Chapter 16 (Kazantzidis 2014). Counts from 2010 used for 1 colony

*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

In Bulgaria, Romania, Belarus and Ukraine (i.e. in the west and north end of the Black Sea) 64 % of the breeders were found in colonies with >1,000 nests (Fig. 1.6D). The number of small and medium sized colonies in this part of Area IV was low compared with Areas I-III: 17 % of the breeders were found in colonies with 1-500 nests in area IV versus 31-53 % in Areas I-III.

The most important breeding areas in Area IV were the Danube Delta, the Ukrainian coast of the Black Sea, the coasts of the Sea of Azov and the Volga Delta in the northwest end of the Caspian Sea (Table 1.5). The Danube Delta had approximately 10,600 breeding pairs of which 8,800 pairs were located on the Romanian side and 1,800 pairs on the Ukrainian side. The area along the Ukrainian coast of the Black Sea and the Ukrainian and Russian coasts of the Sea of Azov held 64-66,000 breeding pairs. Of these 38,600 were found in Ukraine and 21-23,000 on the Russian side of the Sea of Azov (V. Belik. pers. comm.). The Volga Delta had at least 28,000 breeding pairs on the Russian side.

The following describes current knowledge about breeding numbers and distribution in the parts of area IV where some (but not all) breeding colonies were counted in the present study.

Moldova. Very little is known about the breeding population of Great Cormorants in Moldova. However, 8 colonies have been located during recent surveys of wetlands and nests were counted in three of these in 2012-2013 (80, 90 and 179 nests; E. Baltag, V. Ajder & P. Constantin pers. comm.). Combining this with knowledge about the presence of wetlands, the current best guess is that Moldova had between 700 and 1,500 breeding pairs around 2012 (V. Ajder, T. Bregnballe, B.J. Kiss & V. Kostiuszyn unpubl.).

Turkey. The following description is based on a report under preparation by J.P. Tavares, O. Onmus, K. Erciyes and K. Boyla. Nests were counted or estimated in 20 breeding colonies in one or more breeding seasons between 2011 and 2013 and this ensured an almost complete coverage of the breeding colonies in the Aegean region, along the Mediterranean coast, in central Anatolia and along the eastern Black Sea. Total number of nests counted ranged from 5,003 to 6,753. Based on these counts, and historical data and literature references, a preliminary estimate is that Turkey currently has around 6,500-8,500 breeding pairs (J.P. Tavares & T. Bregnballe unpubl.).

The majority of breeding colonies are concentrated in a few sites in west and northwest Turkey and along the Black Sea coast. The two colonies in Manyas Lake (Marmara region, north-west Turkey), had a total of 3,000-4,000 pairs and are the largest breeding colonies in the country. Breeding numbers have been increasing in several parts of Turkey but the species has declined or disappeared as a breeding bird in several sites in central Anatolia and in the eastern regions of Turkey. There has been a significant drainage and/or degradation of many inner Anatolian wetlands in the last few decades, and this has apparently reduced their value for the Great Cormorant.

Armenia. Great Cormorants were recorded breeding in Lake Sevan up until the 1950s when water levels dropped due to drainage (M. Ghasabyan pers. comm.). The species returned to the lake as a breeder in 2011: 2 nests in 2011, 10 nests in 2012 and 18 nests in one colony in 2013 (M. Ghasabyan pers. comm.).

Table 1.5. The number of breeding pairs (assumed occupied nests) in Belarus, around the Black Sea and between the Black Sea and the Caspian Sea (Area IV), given per country or region within a country. The numbers given relate to counts carried out in 2012 unless otherwise stated. Great Cormorants breeding in this area belong to the *sinensis* sub-species. See also Table 1.2 for further explanations. The estimated totals given in parentheses are only best guesses based on incomplete coverage.

Country	Number of nests		No. of colonies	Remarks and sources
	Estimated total	Counted		
Belarus	3,250	1,849-2,914	20	Chapter 4 (Samusenko 2014). Using counts from local residents for 4 colonies and counts from 2011 for 1 colony
Ukraine				
Total	46,500	44,597	36	Chapter 39 (Kostiushyn et al. 2014)
Inland	4,197		16	
Black & Azov Sea coasts	38,642		17	
Danube Delta	1,758		3	
Uncovered areas and regions	1,900			
Moldova	700-1,500	349	≥8	8 colonies known and 3 counted in 2012-2013 (80, 90 and 179 nests). The estimated total is a best guess by V. Ajder, T. Bregnballe, B.J. Kiss & V. Kostiushyn
Romania				
Total	13-15,000	11,306	29	Chapter 27 (Kiss et al. 2014). Using counts from 2013. Additional information provided through Bulgarian national census for 1 colony (I. Nikolov pers. comm.)
Danube delta	8,804	8,804	19	
River Danube (excl. delta)	>2,502	2,502	>10	
Uncovered areas and regions	1,700-3,700			
Bulgaria	2,775	2,658-2,677	15-20	Chapter 7 (Nikolov et al. 2014)
Russia - from Sea of Azov to Caspian Sea				
Total	60-68,000		70-80	Regional estimate by V. Belik, T. Bregnballe & J. Lynch (unpubl. 2014)
Rostov	≥6,790	6,790	5	Using counts from 2006, 2010, 2011 & 2012. Largest colonies on the Tsimlyansky Reservoir (3,500 nests) and in the Don River Delta (2,477 nests) V. Belik (pers. comm.).
Volgograd (southern part)	≥972	972	4	Counts from 2009, 2012 & 2013. Largest colony on the Tsimlyansky reservoir (500-1,000 nests). V. Belik (pers. comm.)
Krasnodar	18-20,000	16,928	17-19	Chapter 31 (Lokhman et al. 2014)
Stavropol	≥866	866	11	Using counts from 2011 and 2013. Largest colony in Chograi Reservoir, East Manych River (150 nests). L. Malovichko (pers. comm.)
Kalmykia	2,500-3,000	1,350-1,850	>7	V. Muzaev (pers. comm.)
Volga Delta, Astrakhan	≥28,123	28,123	11	Chapter 33 (Rusanov et al. 2012)
Uncovered areas and regions	(3,000-8,000)			Estimate by V. Belik, T. Bregnballe & J. Lynch (unpubl.)
Azerbaijan	1,000-2,000		>15	Sultanov (2011)

Georgia	(4,000-6,000)	120	>2	Using counts for 2 colonies in 2012 (Z. Javakhishvili pers. comm.). For 2006 B. Japoshvili estimated c. 7,000 pairs. Guess for total numbers in 2012 by T. Bregnballe
Armenia	10		1	Breeding in Armenia up until the 1950s. Returned as a breeder (3 nests) in 2011 at Lake Sevan where numbers increased to 10 nests in 2012 and 18 nests in 2013 (Mamikon Ghasabyan pers. comm.)
Turkey	(6,500-8,500)	3,500	>20	20 colonies with ca. 3,500 nests recorded in 2011-2013 (J.P. Tavares pers. comm.). Guess for total numbers in 2012 by J.P. Tavares & T. Bregnballe (unpubl.)

Azerbaijan. The following description of the situation in Azerbaijan is based on material collated by E. Sultanov (pers. comm.). Surveys in the years up to, and including, 2011 have provided information about 15 breeding colonies. Findings suggest that the country's breeding population varies between years, ranging from 1,000 to 2,000 pairs, depending on water levels (no general up- or downward trend has been recorded). Almost 95 % of the breeders were recorded on islets along the coast of, or on oil platforms in, the Caspian Sea. Smaller colonies were recorded inland along large rivers, at water reservoirs and lakes, such as the large Mingechaur Lake. The species is not protected in Azerbaijan and is regularly exposed to persecution, including in the breeding areas outside nature reserves.

Georgia. Information has been obtained for two small breeding colonies in Georgia. An earlier estimate suggested that Georgia had around 7,000 breeding pairs in 2006, but this was a very uncertain estimate (B. Japoshvili pers. comm., Bregnballe et al. 2011). The current best-guess for total breeding numbers in 2012 is 4,000-6,000 breeding pairs (T. Bregnballe unpubl.)

Russia between Sea of Azov and Caspian Sea. It is estimated that the Russian regions between the Sea of Azov, the Black Sea and the Caspian Sea held about 70-80 colonies around 2012, and that numbers amounted to at least 60,000 breeding pairs and possibly up to 68,000 pairs (Table 1.5, V. Belik, T. Bregnballe & J. Lynch unpubl.). The area includes the regions of Krasnodar, Rostov, Volgograd (south), Stavropol, Kalmykia, Astrakhan, Dagestan and a number of smaller regions.

The Krasnodar Region on the east side of the Sea of Azov had 17-19 breeding colonies with 18-20,000 breeding pairs. Over half (54 %) of the breeding population was located in the Yeisk estuary which also had the largest colony in the Krasnodar region with 6,700 nests.

The Don River Delta (Rostov region) at the north-eastern coast of the Sea of Azov had 2,477 pairs in 2 colonies (V. Belik. pers. comm.).

The inland areas between the Sea of Azov and the Caspian Sea had a number of small and (a few larger) breeding colonies on major rivers, lakes and reservoirs. The largest numbers of inland breeders were found on the Tsimlyansky reservoir, located on both sides of the border between the Rostov and Volgograd regions; 4,265 pairs in three colonies. The Manych Lake system, on the border of the Rostov and Stavropol regions, contained 465 pairs

in six colonies. Two small colonies with a total of 290 pairs were located on the East Manych River in the Stavropol region.

The Volga Delta at the north-western coast of the Caspian Sea (in the Russian region of Astrakhan) had 11 breeding colonies with a total of approximately 28,000 breeding pairs in 2012.

It is estimated that the un-surveyed areas and regions in Russia between the Sea of Azov and the Caspian Sea had a breeding population of 3,000-8,000 pairs.

Changes in breeding numbers of *P. c. carbo* from 2006 to 2012

The overall breeding population of the Atlantic sub-species in the Western Palearctic has apparently declined from 2006 to 2012. In the areas covered by counts in both 2006 and 2012 numbers dropped by ca. 8,800 pairs, corresponding to a decline of 23 % (Table 1.6). The increase from 2006 to 2012 recorded in Iceland, along the Barents Sea coast of the Kola Peninsula, in the UK and in France amounted to approximately 2,360 pairs. Overall, however, this increase was smaller than the decline of approximately 11,000 pairs in Norway.

Breeding numbers in Iceland increased by ca. 640 pairs. In inland colonies in the UK numbers increased by ca. 340 pairs and in inland colonies in France by ca. 580 pairs (the exact increase in numbers in the UK and France is uncertain because of the mixed breeding of *carbo* and *sinensis*; see also Material and methods regarding sub-species composition).

Analyses of trends in the UK, based on annual counts of a variable proportion of the coastal colonies, indicate that the coastal section of the breeding population declined between 2006 and 2012 (maybe by as much as 30 % which would correspond to a decline of almost 2,600 pairs; NERC and S.E. Newson unpubl.). Monitoring of coastal colonies in Ireland (representing 59 % of the 'Seabird 2000' project population estimate) showed a 4% decline from 2000 to 2012 (S. Newton pers. comm.). The data available suggested that the breeding population along the coast of the Barents Sea and the White Sea in the Russian Federation increased between 2006 and 2012, but the coverage is incomplete.

Changes in breeding numbers of *P. c. sinensis* from 2006 to 2012

The overall breeding population of the *sinensis* sub-species in the Western Palearctic has changed only little from 2006 to 2012. In the areas covered by counts in both 2006 and 2012 numbers declined from 328,400 to 309,400 breeding pairs corresponding to a decline of -6 %. Considering the increases have taken place in some of the areas for which data are too incomplete to make comparisons between 2006 and 2012 (Turkey and some of the regions between the Sea of Azov and the Caspian Sea), it is judged that overall breeding numbers are likely to have changed by only a few percent between 2006 and 2012.

In the area of Europe located west of Russia, Belarus, Ukraine and Turkey, and for which we have data from both 2006 and 2012, numbers increased by 3,300 pairs (+1.4 %; from 232,500 pairs in 2006 to 235,800 pairs in 2012; Kaliningrad and the Russian part of the Gulf of Finland included).

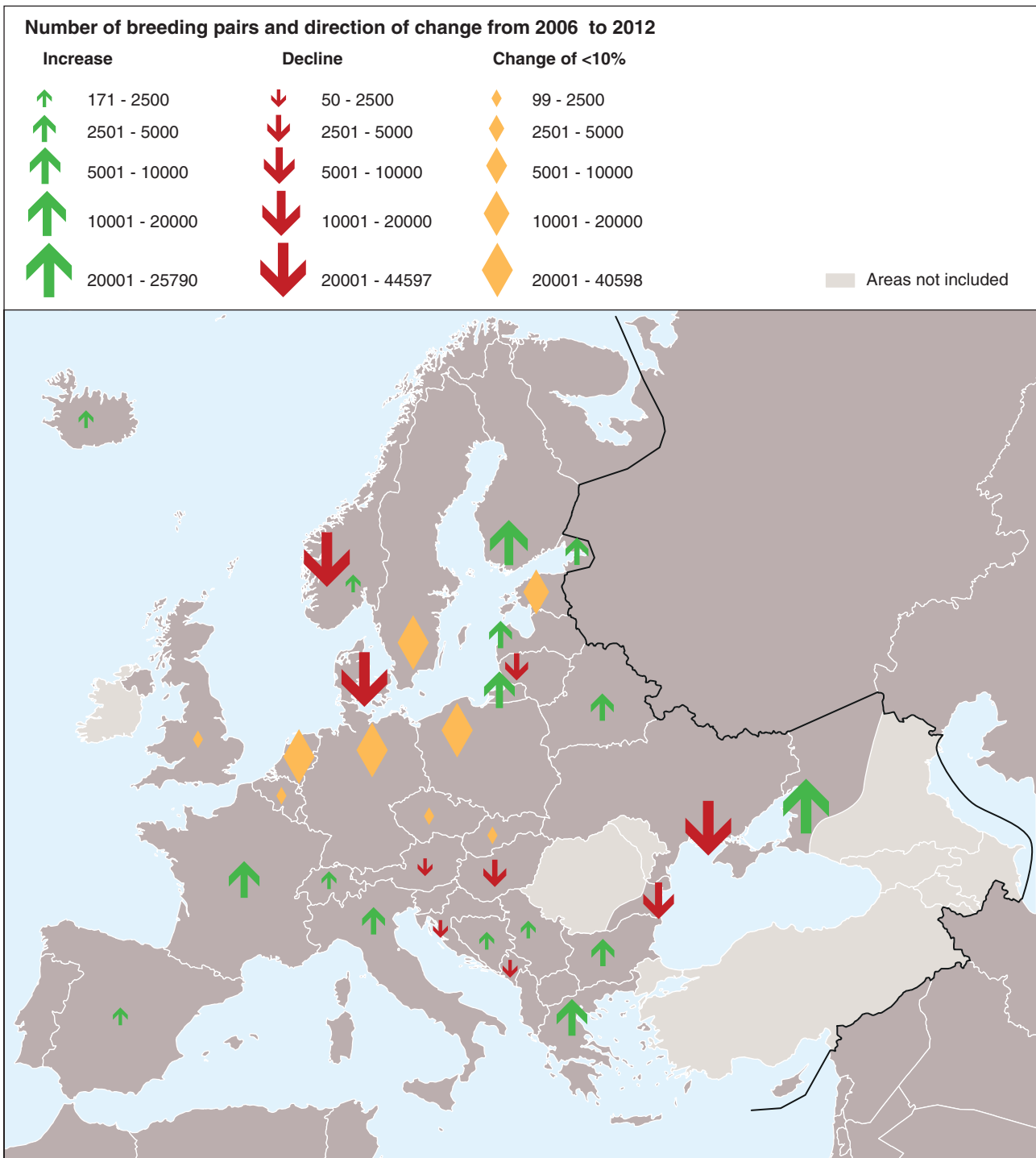


Figure 1.7. Changes in breeding numbers in 29 countries and 3 regions in Russia from 2006 to 2012. The black line denotes the border of the area covered by the overall survey of the breeding population. The large arrow in Norway shows the change in breeding numbers of birds belonging to the *carbo* sub-species whereas the smaller arrow in southeast Norway refers to the breeding population of the *sinensis* sub-species. Breeding numbers are indicated by arrows if numbers increased or decreased by more than 10% from 2006 to 2012. Changes by less than 10 % are indicated by diamonds. The size of the arrows and diamonds refer to the number of breeding pairs in 2012. Some countries and regions of Romania and Russia are not included due to incomplete coverage in 2006 and/or in 2012.

This overall 'stability' in breeding numbers in the Western Palearctic covers large differences in trends among countries. The country by country trends are shown in Fig. 1.7 and are described below together with descriptions of the overall trends within each of the four areas.

Area I - The North-East Atlantic. In this area, *sinensis* breeding numbers increased by ca. 4,800 pairs corresponding to a 15 % increase from 2006 to 2012. This was primarily due to increases in Norway (the Skagerrak region), France (inland colonies only) and Spain. The increases amounted to 1,162 pairs (+87 %) in southern Norway, 2,046 pairs (+56 %) in France (for assumptions regarding sub-species composition see Material and methods) and 1,300 pairs (+453 %) in Spain. The estimated increase of *sinensis* in inland colonies in the UK amounted to 281 pairs (+18 %; for assumptions regarding sub-species composition see Material and methods). Breeding numbers in The Netherlands increased by only 80 nests (+0.3 %) from 2006 to 2012.

Area II - Baltic Sea. The overall breeding numbers in the Baltic Sea increased by ca. 2,000 pairs from 2006 to 2012, but because of the large number of breeders in 2006 this corresponds to an increase of only 1 %. Despite this minor change in overall breeding numbers, there were noticeable differences in individual Baltic countries in the development in numbers from 2006 to 2012.

Moderate to marked declines were evident in the western Baltic countries: a decline of 10,800 pairs (-28 %) in Denmark, of 3,400 pairs (-8 %) in Sweden and of 800 pairs (-3 %) in Germany.

Except for a decline of 490 pairs (-13 %) in Lithuania, marked increases were reported in the eastern parts of the Baltic Sea: An increase of 11,500 pairs (+199 %) in Finland, 2,600 pairs (+520 %) in Latvia, 790 pairs (+21 %) in the Russian part of the Gulf of Finland, 700 pairs (+6 %) in Estonia, 1,000 pairs (+12 %) in Kaliningrad and 870 pairs (+3 %) in Poland.

Area III - Central Europe and the Mediterranean. The overall number of breeding pairs in central Europe and the central and eastern Mediterranean increased by 3,900 pairs (+25 %) from 2006 to 2012 (FYRO Macedonia not included). The largest increases were recorded in Greece (2,400 pairs, +53 %), Italy (1,770 pairs, +83 %), Serbia (1,060 pairs, +113 %) and Switzerland (820 pairs, +385 %). Conversely, the largest declines were recorded in Montenegro (840 pairs, -42 %), Croatia (825 pairs, -38 %) and Hungary (540 pairs, -17 %).

Area IV - Belarus and Black Sea-Caspian Sea. A comparison could be made for the western and northern areas of the Black Sea where at least 56 % of the breeders were found in 2012. A decline of -26 % was recorded in this area (Table 1.6). V. Kostiusyn (pers. comm.) raised doubts about the precision of some of the counts of breeding colonies in 2006 and suggested that the decline in breeding numbers might have been overestimated.

Breeding numbers in the Danube Delta had declined from 21,700 pairs in 2006 to 10,560 pairs in 2012 (-51 %). The largest decline was recorded on the Romanian side of the delta (a decline of 7,650 pairs), but it was also noticeable on the Ukrainian side (a decline of 3,500 pairs).

Table 1.6. The numbers of Great Cormorants of the two sub-species *carbo* and *sinensis* recorded breeding in 2006 and 2012 in four Areas in the Western Palearctic. Only data is presented where comparable information was available for both 2006 and 2012 (see notes for countries and regions excluded/included). Areas are defined in Fig. 1.2 alongside coverage of the 2012 count.

Sub-species		Number of breeding pairs	
Area	Name of Area	2006	2012
<i>P. c. carbo</i>			
	I. Atlantic Sea and North Sea ^{1,2}	38,470	29,638
<i>P. c. sinensis</i>			
	I. Atlantic Sea and North Sea ²	31,991	36,811
	II. Baltic Sea ³	165,650	167,689
	III. Central Europe and Central and Eastern Mediterranean ⁴	15,792	19,709
	IV. Black Sea and Sea of Azov ⁵	114,557	85,216

¹The comparison does not include breeding numbers for Ireland, coastal areas of the UK, Kandalaksha Bay in the White Sea and the coastal areas from the White Sea to Novaya Zemlya. The comparison represents 69.0 % of the *carbo* and 100 % of the *sinensis* counted in Area I in 2012.

²For France it is assumed that the coastal colonies in both 2006 and 2012 had 80 % *carbo* and 20 % *sinensis* whereas vice versa for the inland colonies. For United Kingdom it is assumed that 72 % of those breeding in inland colonies in 2006 belonged to the *sinensis* sub-species whereas the proportion was assumed to be 66 % in 2012 (cf. S.E. Newson unpubl.).

³The comparison represents 100 % of breeders counted in this area in 2012.

⁴The comparison does not include breeding numbers for Albania and FYRO Macedonia. The comparison represents 94.6 % of all breeders counted in this area in 2012.

⁵The comparison includes breeding numbers for Belarus, Ukraine, Romania (Danube Delta and lower Danube), Bulgaria, the Rostov and Krasnodar regions in Russia. This comparison represents at least 56 % of the estimated total numbers of breeders in this region in 2012.

Increases were reported in both Belarus (by 1,100 pairs, +52 %) and Bulgaria (790 pairs, +40 %). Breeding numbers have also increased in most of the Russian areas between the Sea of Azov and the Caspian Sea. It has been estimated that this area had 35-55,000 breeding pairs in 2000-2003 (V. Belik pers. comm.) compared to 60-68,000 pairs in 2012 (Table 1.5). Overall numbers in Turkey have also increased over the last 20 years or more (J.P. Tavares unpubl.).

Discussion

Coverage

Although the *P. c. carbo* sub-species is the nominate race of the Great Cormorant, it is not the most widespread sub-species of the species in Europe nor the one most frequently/widely involved in conflicts with fishery (and other) interests (van Eerden et al 1995, Carss 2003). As such, counting this sub-species and recording its geographical distribution were not the main priority for the present study (see also Material and methods). The coverage achieved by the counts presented here for Atlantic *carbo* birds was not sufficiently complete to allow a precise estimate of the total number of this sub-species breeding in the Western Palearctic. This is primarily because of the incomplete coverage of the coastal breeding colonies in Ireland, the UK and the Barents Sea in the Russian Federation. Furthermore the exact numbers of breeding *carbo* are not known for colonies where both *carbo* and *sinensis* birds are breeding.

For *sinensis* birds, despite missing information from some of the countries and regions located outside the priority counting area, the present survey provides a very accurate overview of the overall size and distribution of the breeding population in the Western Palearctic.

In almost all countries the vast majority of *sinensis* colonies were covered in either 2012 and/or 2013, with only a small number of colonies being counted in a previous year(s). For three of the countries (Romania, Bosnia-Herzegovina & FYRO Macedonia) in the area of priority, counts of colonies had to be postponed to 2013. Overall we judge that the use of information from counts carried out in earlier years is likely to have had only a very small effect on the precision of the so-called status of Great Cormorants in 2012 referred to in the present study.

Overall distribution of the breeding population

P. c. carbo. Counts have documented that Norway is the most important breeding area for this sub-species, despite marked declines in several parts of country. The other areas which have been important for many decades, and continue to be so, are the coasts of the UK, Ireland and Iceland. The sub-species is increasingly dispersing to inland areas in France and breeds alongside *sinensis*. For example, some of the inland colonies in France with *carbo* breeders are located more than 180 km from the coast (L. Marion unpubl.).

P. c. sinensis. The continental sub-species has continued its dispersal in Europe. In 2012 there were only six countries in Europe that did not have a breeding population of Great Cormorants. The geographical expansion has been most evident in the eastern part of the Baltic Sea and in central and southern Europe.

A very large proportion of the European *sinensis* population has been recorded breeding in large and very large colonies holding more than 1,000 nests up until the early 1990s (e.g. Zijlstra & van Eerden 1991). The proportion of the population that breeds in these very large colonies has gradually decreased as new areas have been colonised (van Eerden & Gregersen 1995, Bregnballe 2009). In general, birds breeding in new colonies, many of which are located in inland areas, have apparently not had a similarly high amount of fish available close to their colony, as was the case for birds that nested in colonies along coasts and on islets in the Baltic Sea and in The Netherlands (see van Eerden et al. 2012). The establishment of new breeding colonies has also in some regions been followed by a gradual move of breeders from the very large colonies to colonies of more moderate size (van Eerden & Gregersen 1995, van Eerden & van Rijn 2003, van Rijn & van Eerden 2007, Hénaux et al. 2007, Bregnballe 2009). This has led to a more even geographical distribution of the breeding population and to an increase in the proportion of birds breeding in medium sized colonies (van Eerden & Gregersen 1995, van Eerden & Rijn 2003, Bregnballe & Gregersen 1997, Bregnballe 2009).

Despite the gradual redistribution of the breeding population from very large colonies to more medium sized ones, 50 % of the breeders are still found in breeding colonies with more than 1,000 nests. The tendency for breeders to concentrate in very large colonies is most evident in the Baltic Sea and in the Black Sea (Fig. 1.6).

Population development of *P. c. carbo*

The population of the *carbo* birds increased slowly during the 1970s and 1980s, only a few percent per annum, and the increase did not continue in all breeding areas during the 1990s (e.g. Debout et al. 1995, Røv et al. 2003). The European breeding population of *carbo* was estimated at 41,000 pairs around the second half of the 1980s until 1992 (however, the numbers for Iceland refers to counts conducted in 1975; Debout et al. 1995).

The Western Palearctic breeding population of *P. c. carbo* can be estimated to have had around 53,600 pairs in 2006 and 42,500 pairs in 2012. For 2006 we used the estimate by Bregnballe et al. (2011) after having adjusted the proportion of *carbo* birds in the mixed colonies (according to revised estimates by S. Newson and L. Marion, unpubl.). These estimates of total numbers are somewhat uncertain because of the incomplete coverage of coastal colonies in UK, Ireland and along the Kola Peninsula in Russia. Confining the comparison to only those breeding areas for which there was a high level of coverage in both 2006 and 2012 gave a change in breeding numbers from 38,470 pairs in 2006 to 29,638 pairs in 2012.

Overall, the available data suggest that the total breeding population of the Atlantic sub-species was relatively stable in the Western Palearctic and that it increased in some periods between 1980 and 2005 after which overall numbers have declined.



A Great Cormorant nest with two newly hatched chicks, Holløse Bredning, Denmark, 2006. Photo: Steffen Ortmann.

The earlier observed increase and current overall decline masks large geographical variations in population trends. In Iceland numbers first declined from 3,500 in 1975 to 2,350 in 1995 (Gardarsson 2008), then increased to approximately 4,100 nests in 2001 and 5,250 nests in 2010 (Gardarsson 2008). In Norway numbers increased from 21,000 pairs in 1983-1986 (Røv & Strann 1987) to 27,000 nests in 1995 (Røv 1997), then declined to 25,000 nests in 2000 (Røv et al. 2003). By 2005 the Norwegian breeding population was estimated at 30,000 pairs (Barrett et al. 2006), but many colonies in Norway decreased thereafter (some began doing so from 2002) and by 2012 breeding numbers had dropped to 19,000 pairs. The reasons for the general decline in Norway are not known, but it is presumed that declining food availability is one of the factors that have affected the development of the breeding population (S.-H. Lorentsen pers. comm.).

Breeding numbers in coastal colonies in the UK were apparently relatively stable during 1986-2005, with annual estimates ranging from ca. 8,000 to 9,500 breeding pairs (S.E. Newson unpubl.). The calculated trends suggest that this period was followed (2006-2012) by a period of decline in breeding numbers (S.E. Newson unpubl. data).

Along the coast of France, nest numbers were estimated at ca. 1,600 in 1988 (Debout et al. 1995), at 2,122 in 2003, and coastal breeding numbers have been stable since then (Marion 2008).

The increasing tendency for the *carbo* and *sinensis* sub-species to breed in the same colonies makes it increasingly difficult to reveal how numbers of the two sub-species are developing in France and in inland areas in the UK (see also Carss & Ekins 2002).

Population development of *P. c. sinensis*

The European breeding population of the continental sub-species of the Great Cormorant *P. c. sinensis* was small during long periods between the mid-1800s and the early 1970s (e.g. Hansen 1984, Lindell et al. 1995, Bregnballe 1996). By the early 1960s, total breeding numbers in the main breeding areas were estimated at 3,500-4,300 pairs (the main breeding areas were at that time The Netherlands, Germany, Denmark, Sweden and Poland; Bregnballe 1996).

Partly due to a gradual increase in the protection of the species, numbers began to increase during the 1970s-1980s. In the five countries mentioned above, population growth rates were on average 11 % per year during the 1970s and 18 % per year during the 1980s, and by 1995 breeding numbers had reached 95,000 pairs in these countries (van Eerden & Gregersen 1995, Bregnballe 1996). This rapid population growth was apparently the result of both increased survival and improved breeding success due to the combined effects of protection of breeding colonies, protection against shooting, a decrease in the use of pesticides, and high abundance of small fish in a large number of European waterbodies (van Eerden et al. 1995).

Breeding numbers stabilized in some of the core breeding areas in the early 1990s (Bregnballe et al. 2003), and declines have been recorded in recent years in several of the breeding areas that formerly housed many thousands of Great Cormorants (e.g. in main breeding areas in the west Baltic Sea; Herrmann et al. 2011). On the other hand, as the *sinensis* breeding population began to stabilize in the core breeding areas, it continued to extend its range into central and southern Europe and along the east Baltic Sea coast

the 1990s and the 2000s (Marion 1997, Marion & Suter 1997, Palomino & Molina 2009, Bregnballe et al. 2011, Hermann et al. 2011), thereby returning to breeding areas from where it had been extinct for a century or more (e.g. Hansen 1984, Lindell et al. 1995).

Increases in breeding numbers were also recorded in many breeding areas along the northern coast of the Black Sea and the Sea of Azov during the first 20-25 years after the early 1980s.

For the years 2000-2002, BirdLife International (2004) estimated total breeding numbers of *sinensis* to be 169,000 pairs in the countries that largely correspond to Area I, II, III and Romania and Bulgaria in Area IV of the present study. Using the same countries as BirdLife International, the comparable figure for the 2006 status was 219,400 pairs (Bregnballe et al. 2011) and for 2012 the comparable number was 225,800 pairs (excluding England inland, FYRO Macedonia and Baltic regions in Russia, but including *sinensis* in South Norway). Overall, this represents an increase of ca. 50,000 breeding pairs (30 %) between the years 2000-2002 and 2006 and an increase of ca. 6,000 breeding pairs (3 %) from 2006 to 2012.

Population development of *P. c. sinensis* after 2006

Several major changes have taken place in breeding numbers of the continental sub-species in the Western Palearctic from 2006 to 2012. They can be summarized as follows:

Increases in the eastern Baltic Sea. The breeding population along the eastern and south-eastern coast of the Baltic Sea increased by 17,000 breeding pairs from 2006 to 2012. This growth presumably reflected that this part of the Baltic Sea offered suitable breeding sites near to previously unexploited feeding areas where the densities of fish were sufficiently high to support the food demands of several very large colonies. Although there were new colonisations annually in this region, the growth levelled off in Finland and Estonia in the years up to 2012. Nevertheless, these countries were still the most important breeding areas in the eastern part of the Baltic Sea by 2012.

Decreases in the western Baltic Sea. Another major change in the Baltic Sea is the decrease of 15,000 breeding pairs in the western part of the region (Denmark, Sweden and Germany). This part of the Baltic Sea constituted a core breeding area for Great Cormorants in Europe for more than 20 years up to 2006. The food resource has presumably deteriorated around some of the former large colonies and, despite gradual changes in distribution, resulted in a more even distribution among breeding sites, whilst overall numbers have declined. Factors other than declining food availability in some of the important breeding areas are presumed to have contributed to the decline. These other factors, likely to have been of importance, include lower fledging success due to management actions in breeding colonies, increased mortality among first year birds and maybe older birds due to extensive shooting in the wintering areas in France, and a series of severe winters (Bregnballe 2009).

The North-East Atlantic. The most noticeable change recorded in the countries along the North-East Atlantic coasts was the increase of 4,500 pairs in Spain, France (inland areas) and Norway (Skagerrak). All of these countries have extensive areas of wetlands and many of these were only beginning to be colonised or had no breeding colonies in 2006. Based on the wetlands still unoccupied by breeding Great Cormorants, there is still potential for further

growth in breeding numbers in Spain, France and Norway. However, the rate of expansion in France and Norway is apparently to some extent hampered by human actions in breeding colonies, whereas this does not seem to have been the case in Spain.

Central Europe and Mediterranean. Many areas in central Europe and in the central and eastern Mediterranean did not have breeding colonies of Great Cormorants over many decades or for more than a century. Some of these areas were re-colonised during or after the 1990s and overall numbers increased by 3,900 pairs between 2006 and 2012. The largest increases were recorded in Greece, Serbia, Italy and Switzerland. The re-colonisation in some of the countries in this area may be hampered by human actions in breeding colonies aimed at avoiding establishment of new colonies.

Black Sea and Sea of Azov. For the Black Sea countries, our knowledge of trends since 2006 is incomplete. Counts were comparable for the Danube Delta, which in 2006 had 21,700 breeding pairs but by 2012 nest numbers had dropped by 50 %. Marked declines have also been recorded in some of the Black Sea colonies in Ukraine, but the exact extent of declines is currently uncertain (V. Kostiusyn pers. comm.). The coverage of the Krasnodar and Rostov regions on the Russian side of the Sea of Azov was good in both 2006 and 2012, and numbers here increased from 22,000 pairs in 2006 to 25,800 pairs in 2012 (an increase by 18 %). From the information available for the other regions between the Sea of Azov and the Caspian Sea it is somewhat unclear to what extent breeding numbers have increased since 2006.

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