HOOFDSTUK 4 SUMMARY

ABOUT THIS ATLAS

Backgrounds and aims

The first breeding bird atlas of The Netherlands, published in 1979 and for which fieldwork was conducted in 1973-77 (TEIXEIRA 1979), was a milestone in Dutch ornithology. It was not only the first time that the distribution of all breeding bird species was mapped at a national level, but it also stimulated a large number of volunteer birdwatchers to take part in follow-up projects like the year-round atlas in 1978-83 (*Atlas van de Nederlandse Vogels*; SOVON 1987) or become involved in long-term monitoring projects such as the *Broedvogel Monitoring Project* (BMP; common breeding bird census). These projects were among the first national ornithological surveys organised by *SOVON Vogelonderzoek Nederland* (Dutch Centre for Field Ornithology), initially established as a foundation in 1973 to stimulate volunteer field ornithology, but today co-ordinator for national ornithological monitoring projects.

Following the second generation of breeding bird atlases published in several neighbouring countries (e.g., United Kingdom and Ireland, France, Denmark, Switzerland, Finland), ideas for a second Dutch breeding bird atlas evolved by the end of the 1990s. A new atlas would assess many changes in the distribution of breeding birds at a national level, of which some had already been pointed at by the monitoring schemes and the recently published volumes of the Dutch *Avifauna* (VAN DEN BERG & BOSMAN 2001, BIJLSMA ET AL. 2001). The main aims of the atlas were therefore to assess the current distribution of breeding birds in The Netherlands, and to review changes in distribution between the first atlas in the 1970s and the new atlas in the 1990s. Moreover, data on current distributions at a national level were considered invaluable for evaluation of results obtained by monitoring schemes like the BMP. Additionally, it was assumed that a new atlas would encourage many new observers to become involved in volunteer survey work. Fieldwork was organised in such a way that less-experienced ornithologists were able to take part in the project. Unlike the first atlas, a quantitative survey (according to a slightly modified model from the British atlas) was added in order to allow a more detailed analysis of regional differences in abundance. As this part of the fieldwork was highly standardised, it provides a baseline data set for future atlas projects.

Organisation and fieldwork

Fieldwork for the new atlas was carried out during the breeding seasons of 1998, 1999 and 2000, with some additional fieldwork in 2001 to tackle remaining gaps in coverage (chapter 2, table 3, figure 5). Many birdwatchers were involved, organised at a regional level by local co-ordinators and supervised by a national co-ordinator and professional staff at SOVON. Fieldwork was adopted to the national grid of 5-km squares (referred to as atlas squares), which are subdivided into 25 1-km squares (STAATSBOSBEHEER 1987). Dutch national territory encompasses 1,674 of such atlas squares which were all surveyed (chapter 2, table 3, figure 5). Contributors to atlas fieldwork were requested to (a) compile a list of breeding bird species for each atlas square; (b) to spend two 1-hour visits in eight 1-km squares; and (c) to provide an estimate of the number of breeding pairs for a selection of species in an atlas square. The observers were provided with 1:25,000 maps of their atlas squares (indicating the 1-km squares as well) and several observation forms to record their data (chapter 2, figures 2-4). The species list was constructed to include a classification of breeding status, i.e. possible, probable or confirmed breeding (following international atlas codes, chapter 2, table 1). This part of the project provided basic knowledge on the national distribution of a species and enabled direct comparison with distribution data from 1973-77.

Eight out of the 25 1-km squares had to be visited twice during exactly one hour and were selected according to a standard procedure (chapter 2, figure 1), i.e., observers were not free to choose their own 1-km squares, but had to survey those assigned by SOVON. During the survey, 11,254 1-km squares were visited, once between 1 April-15 May and once between 16 May-30 June (with at least two weeks in-between). Visits had to be made in the first hours after sunrise. Generally, this period and this time of the day match the period of highest territorial behaviour of Dutch breeding birds (but see below). Observers could either simply record all breeding species present, or (preferably) provide counts of the number of breeding pairs/territories for a selection of species (listed in chapter 2, table 2). Moreover, the 1-hour visit included a point count of five minutes, carried out in the midpoint of the 1-km square and restricted to a 200-m circle around the observer. The surveys of 1-km squares aimed to assess the relative abundance of a species, expressed by the frequency of occurrence (e.g., if a species occurs in four of the eight 1-km squares, its frequency index is 4/8=0.5). The point count of five minutes was introduced to be able to detect differences in relative abundance in very widely distributed species like Common Blackbird, which would otherwise yield a frequency index of 1.0 in many atlas squares. A small-scale study in 21 1-km squares showed that the two 1-hour visits on average detected 69% of the species present (range 47-87%). However, a higher proportion of species was found in open and accessible habitats like grassland (74%) and arable land (80%), whereas the proportion of species found in mixed woodland was only 61%. Species which are notoriously difficult to map, like Lesser Spotted Woodpecker and Hawfinch, were easily missed during the two visits. The same applies to rare and elusive species (e.g., nocturnal species were hardly covered during the two visits). Also note that data for some resident species which show highest territorial activity early in the season (Mistle Thrush, Marsh Tit) or migrants that do not arrive before May (European Turtle Dove, Icterine Warbler, Marsh Warbler, Spotted Flycatcher, Eurasian Golden Oriole) should be treated with some caution.

Estimates of the number of breeding pairs/territories (bp) for each atlas square were made for the selection of species listed in chapter 2, table 2 and divided into six categories

ranging from 1-3 bp to >500 bp. Species list, breeding status and estimates for each atlas square were not only based on atlas fieldwork, but updated with records provided by a separate sheet for supplementary data. These were circulated widely among observers throughout the country, and aimed at encouraging the collection of data during excursions and holidays in other regions. Additional data were also derived from the national monitoring schemes. These include a common bird census (BMP, data from c. 1100 plots of 10-250 ha each, based on the territory mapping method), a national survey of all rare and colonial breeding birds (LSB, nearly complete or complete coverage for a selection of species) and a nest-record scheme (6000-8000 record sheets annually, mainly from raptors and nestbox breeding species like European Pied Flycatcher and Great Tit).

Data processing and checking

All data obtained from atlas fieldwork were collected on standard recording forms (chapter 2, figures 2-4). These were sent to the regional co-ordinators for an extensive check and (in case of questionable records) inquiry among the observers. Record sheets were then entered in a database (by double data-entry, to eliminate typing errors) and finally checked by regional specialists to detect unusual observations. In addition, a model based on a national database with habitat characteristics per atlas square (KWAK ET AL. 1988, DLO-STARINGCENTRUM 1997) was developed to detect outliers and atlas squares with insufficient coverage. This analysis, carried out with data received in 1998-2000, initially revealed 92 atlas squares with poor coverage (mainly an incomplete species list). After additional fieldwork had been organised in 2001, only 36 atlas squares remained for which coverage was considered as insufficient (chapter 2, figure 8).

Presentation and interpretation of the data

For each species account in chapter 5, a number of maps has been produced to show national and regional patterns in distribution. The *Breeding evidence map* presents the distribution in atlas squares, showing possible, probable and confirmed breeding in 218 species (rounded percentages are given in legend). In 56 species, probable and confirmed breeding records have been lumped since few observers paid enough attention to these categories in those, mostly passerine, species. Furthermore, note that the distribution shown in the maps is a summary of three years of fieldwork, but does not necessarily implicate annual breeding in all atlas squares. Especially for species subject to pronounced annual fluctuations, such as Common Quail and Little Ringed Plover, the maps only show the maximum possible distribution. The distribution maps include data derived from atlas fieldwork, as well as supplementary records and additional data from monitoring projects (see Organisation and fieldwork), and therefore also reflect some differences in observer effort.

The distribution map allows a direct comparison with that from the first breeding bird atlas. Therefore, a *Change map* has been included for 198 species. This map reflects the changes in distribution between 1973-77 and 1998-2000. Included in the map are only those atlas squares where the species disappeared or newly arrived as a probable or confirmed breeding bird. Only atlas squares with at least 250 ha national territory have been included. Variation in the duration of the atlas period (five and three years, respectively), as well as changing observer effort, should be kept in mind when interpreting these maps.

To assess regional differences in abundance, data for 70 species were processed to produce a *Relative abundance map*. For this purpose, data from the two 1-km square visits were analysed. Because quantitative data (number of breeding pairs/territories) were not available for 55% of the surveyed 1-km squares, only presence and absence of a species was entered in the analysis. These data were run through a geostatistical interpolation routine, called stratified ordinary kriging, using GSTAT and Gnuplot software (SEE ISAAKS & SHRIVASTAVA 1989 AND BURROUGH & MCDONNELL 1998 FOR DETAILS). For each 1-km square, a relative abundance index was calculated, taking into account the presence of a species in twelve surveyed neighbouring 1 km-squares, and using only 1-km squares with the same main habitat type (classified according to agricultural areas, woodland, urban areas, dry natural habitats and wetlands) (chapter 2, figure 7). Neighbouring 1-km squares with similar habitat were often found close to the analysed 1-km square, but in some species with scattered distributions and habitats, data from 1-km squares at a distance of up to 25 km were entered into the model to arrive at a reliable abundance index (this applied to only 2% of the 1-km squares, most 1-km squares were within a range of 4 km). The same procedure was also used to produce relative abundance maps for a few very common species, which were derived from data collected during the 5-minutes point counts (Mallard, Common Wood Pigeon, Winter Wren, Common Blackbird, Northern Chiffchaff, Willow Warbler, Great Tit, Carrion Crow, Common Starling and Common Chaffinch). Note that relative abundance maps mainly depict how common or widespread a species is in different parts of the country. Relative abundance is not necessarily directly related to true densities in terms of the number of breeding pairs or territories per hectare.

For 135 scarce breeding or colonial breeding birds, abundance is expressed by an *Estimates map*, showing the number of breeding pairs/territories for each atlas square with probable or confirmed breeding records (rounded percentages are given in legend). These data were derived from the population estimates given for each atlas square (see Organisation and fieldwork). For 16 colonial breeding bird species, data from the national monitoring scheme for colonial breeding birds were additionally directly plotted (to the nearest 100 m) on a *Colony map*. Here, dot size represents the maximum colony size in 1998-2000.

For 90 species, also data on population trends in the past decades are included. These data refer to the common bird census (BMP), but have been added with older data (prior to the start of BMP in 1984). Although these data, retrieved in the 1960s and 1970s, are often subject to more variation than the current BMP, they all refer to long-term standardised counts carried out according to the territory mapping method. Some 3811 plots were entered into the analysis, censused on average for more than six years. As the amount of data varies among species, trends do not always start in the same year. Moreover, when relevant, trends are shown according to habitat type. Indices were calculated

with log-linear Poisson regression, using TRIM version 3 (SEE PANNEKOEK & VAN STRIEN 2001). All output was checked by five experienced ornithologists and the authors of species accounts. Only those trends are shown which were commonly regarded as reliable.
The data from the atlas fieldwork also allowed estimates of the national breeding population. For rare and colonial breeding birds, these were rather easy and accurate as they could be directly calculated from the national monitoring scheme. For other scarce breeding birds (see chapter 2, table 2), an interpretation (by staff members of SOVON) of the estimates for each atlas square was used to arrive at a national population estimate. These calculations were carried out using the geometrical mean of the six categories of estimates (1-3; 4-10; 11-25; 26-100; 101-500; >500 bp, respectively). For common and abundant species, however, a different approach has been used. In a large number of 1-km atlas squares, BMP-plots had also been mapped during the atlas period. Hence, regression analysis was used to calculate a correction factor between absolute densities (BMP) and relative densities (atlas). The output was checked carefully by comparison of other recent and old estimates, and known changes in abundance. In particular, population estimates for common species occurring in urban areas or in agricultural landscape with scattered settlements proved to be erroneous (which can be explained by the small number of BMP plots in such areas) and have not been used in the species' texts. Other estimates proved more reliable, but it should be stressed that the results of this analysis merely point at the order of magnitude of the population size rather than revealing the true number of breeding pairs. For all species both the calculated number and an interpretation of this figure is presented.

STATUS OF BREEDING BIRDS AND GENERAL CHANGES SINCE THE 1970S

Breeding birds in The Netherlands in 1998-2000

A total of 236 species was reported to breed in The Netherlands in 1998-2000, together representing a staggering 9,8-13,4 million breeding pairs (Appendix 1 for estimated numbers). These included a hybrid pair of Blyth's Reed Warbler and Marsh Warbler, and at least 29 species which can be considered as non-native. Non-native species have been introduced in the past decades or refer to escapes like Egyptian Goose, Mandarin Duck and Red-legged Partridge (species like Greater White-fronted Goose and Barnacle Goose are considered as 'native' as part of the population probably originates from wild birds). Confirmed breeding was observed in 217 species, although it is rather poorly documented in Red Kite, Dunlin, Brambling and Parrot Crossbill. Cattle Egret, Black-legged Kittiwake and Blyth's Reed Warbler (hybrid pair) were new breeding species to the Dutch list, whereas Red-spotted Bluethroat was a new breeding subspecies. In 19 species, breeding was likely but could not be confirmed (chapter 3, table 1). In the example of the Common Crane, suggestive records were made during the atlas period, but breeding was first confirmed one year later, in 2001. In other species such as Grey-headed Woodpecker, River Warbler, Red-breasted Flycatcher and Collared Flycatcher, indications for breeding were only weak, despite recorded territorial behaviour.
Among the most widely distributed species are the White Wagtail, Mallard, Stock Dove, Common Blackbird and Winter Wren (chapter 3, table 2). These species occur in more than 95% of the 1674 atlas squares and generally breed in a wide array of habitats. Notably Mallard and Winter Wren were thriving in 1998-2000 as their breeding was enhanced by a run of mild winters (Winter Wren) and generally wet weather conditions in spring (Mallard). Perhaps somewhat surprisingly, species like Common Starling and House Sparrow do not appear in the list of most distributed breeding birds, although many people still consider them as the most common species. About 25% of the species recorded do not occur in more than 1% of the atlas squares (chapter 3, figure 1).
The number of species per atlas square shows large regional differences (however, beware that this may partly reflect observer effort). In general, atlas squares holding many species are situated in the eastern part of the country (chapter 3, figure 2, table 3). A low number of species is often associated with large-scale open landscapes in provinces such as Groningen, Friesland and Flevoland. Similar patterns are found in former peat moors in Drenthe and Overijssel, which are now dominated by large-scale agriculture. The extensive forests of Veluwe and South-Limburg also lack many species since, for example, wetland species hardly occur here. The coastal dunes and several marsh areas in the western part of the country, however, hold more than average numbers of species. A maximum of 125 species was observed in one single atlas square near the Markiezaat, Southwest-Netherlands (chapter 3, table 3).
The distribution of threatened and vulnerable species (chapter 3, figure 3, table 4; based on the Red List of 56 species given by OSIECK & HUSTINGS 1994) shows a more patchy pattern. The Wadden Sea, the central part of Friesland, the marshes in Northwest-Overijssel, Oostvaardersplassen in Flevoland, the Zaanstreek in Noord-Holland, the river district and the Delta area have an outstanding importance for many threatened and vulnerable species. These include several colonial breeding birds like Eurasian Spoonbill, Sandwich Tern and Little Tern, species of dynamic (coastal) habitats like Pied Avocet, Common Ringed Plover and Kentish Plover, and typical marshland breeders like Great Bittern and Bearded Reedling as well as breeding birds of wet meadows like Garganey, Black-tailed Godwit and Common Snipe. Whilst the number of species is generally higher in the eastern part of the country, the western part definitely hold the largest numbers of Red List species. Exceptions are some (damp) heaths and peat moors in, e.g., West-Drenthe and Northwest-Limburg which hold a number of rare and endangered breeding birds.

Changes in breeding birds between 1973-77 and 1998-2000

Compared to the first breeding bird atlas of 1973-77, the number of species recorded as probable or confirmed breeding birds in 1998-2000 increased by 33 species (chapter 3, table 6). However, these mainly include escapes, which were far less abundant and generally ignored by observers during fieldwork for the first breeding bird atlas. Considering native breeding species, the difference therefore appears smaller. The average number of species recorded per atlas

square in 1998-2000 was 80 (75 in 1973-77, see chapter 3, figures 4 & 5). Few species disappeared or nearly disappeared between the first and second atlas survey, e.g., Ferruginous Duck, European Golden Plover, Stone-curlew, Eurasian Dotterel, Wood Sandpiper, Tengmalm's Owl, Eurasian Hoopoe, White-throated Dipper, Greenish Warbler, Cetti's Warbler, Great Grey Shrike and Ortolan Bunting (chapter 3, table 7). Most of these had already (almost) vanished by the 1970s or were only accidental breeding birds. However, Cetti's Warbler, Great Grey Shrike and Ortolan Bunting were still considered regular breeding birds in 1973-77, but have experienced dramatic declines ever since (see also chapter 3, table 12). The same also applies to species like Little Bittern, Black Grouse and Tawny Pipit, which are currently on the verge of extinction. Traditional habitat for Black Grouse, Great Grey Shrike and Tawny Pipit (as well as Eurasian Wryneck) has become very limited now (chapter 3, figures 21 & 22) as exuberant grass growth has covered most of the formerly sparsely vegetated heaths and sand-dunes.

When regarding distribution (proportion of atlas squares where the species was recorded), more or less the same conclusions can be drawn (chapter 3, tables 8 & 11). Black Grouse, Cetti's Warbler and Ortolan Bunting suffered a loss of more than 90% in distribution between 1973-77 and 1998-2000, coinciding with a 99% reduction in numbers. In addition, Crested Lark, Corn Bunting, Short-eared Owl, Ruff, Great Reed Warbler, Northern Wheatear, Black Tern and Common Snipe have experienced a range contraction of more than 60%. In most of these species, the estimated national population dropped with more than 75% between 1973-77 and 1998-2000 (chapter 3, table 12). Abundant species showing strong population declines as well are Eurasian Skylark (90%!), Eurasian Tree Sparrow, Bearded Reedling, European Turtle Dove, Grey Partridge and Common House Martin.

Among the new (confirmed) breeding birds in 1998-2000 are Red-necked Grebe, Little Egret, Great Egret, Barnacle Goose, Great Black-backed Gull, Eurasian Eagle Owl and Common Rosefinch (see chapter 3, table 7 for complete list), whereas substantial increases were reported in, e.g., White Stork (partly due to a re-introduction scheme), Black-winged Stilt, Mediterranean Gull, Eurasian Treecreeper, Eurasian Penduline Tit and Common Raven (re-introduction scheme). Some of these show an erratic pattern of occurrence (Eurasian Penduline Tit, Common Rosefinch, perhaps also Black-winged Stilt) and have experienced a decrease in recent years. Others are subject to an ongoing increase (Little Egret, Great Egret, Mediterranean Gull) or are still considered accidental breeding birds (Eurasian Eagle Owl). New species for which only probable breeding was recorded are Horned Grebe, Common Crane, Melodious Warbler and Two-barred Crossbill (following the influx in 1997/98).

By far the greatest range expansion in atlas squares was recorded for Greylag Goose (+1178%). This species showed an exponential population growth, especially in the 1990s. Other species which became more widespread are Lesser Black-backed Gull, (White-spotted) Bluethroat, Northern Goshawk, Gadwall, Hawfinch and Common Buzzard (see chapter 3, table 10 for a complete list). The national population of these species generally increased five to tenfold between 1973-77 and 1998-2000. Other species with thriving populations between 1973-77 and 1998-2000 were, e.g., Great Cormorant, Eurasian Spoonbill, European Goldfinch and Great Spotted Woodpecker (see chapter 3, table 13 for complete list).

From the changes in distribution and numbers mentioned above, one can conclude that within the relatively short period of 25 years between the first and the second breeding bird atlas, bird populations in The Netherlands were highly dynamic. Although some of the developments also reflect population changes at an European level (e.g. Great Cormorant, Greylag Goose, Mediterranean Gull), many changes are the result of an increased human pressure on landscape and natural environment in The Netherlands.

Especially farmland has suffered from the intensification of agricultural practice. Although some herbivorous species (Mute Swan, Greylag Goose, Egyptian Goose, see chapter 3, figure 9) have benefited from the high-productive grasslands, many traditional species breeding in pastures have suffered major losses. Whilst the area of pastures was reduced with 25% in the past decades (mainly pastures being converted into arable land and through urban expansion), drainage, earlier mowing dates, increased cattle-density and larger input of inorganic fertilizers have reduced nesting opportunities for species like Garganey, Ruff, Common Snipe, Black-tailed Godwit and Common Redshank. Special conservation measures, like nest-protection for Black-tailed Godwits, are only to some extent beneficial as many chicks still face serious food shortage before fledging. Large parts of the higher Pleistocene areas in the eastern part of the country have already been abandoned by these species, leaving only some relicts with suitable breeding conditions (chapter 3, figures 7 & 8). Garganey, Ruff and Common Snipe have experienced the strongest declines and only small pockets with high densities of these species occur in excellent wet grasslands in Friesland and Noord-Holland. Black-tailed Godwit and Common Redshank still occur in fairly good (but often declining) numbers in their strongholds such as Friesland, Northwest-Overijssel, Noord-Holland and Zuid-Holland. Common Redshank is also still common in coastal habitats in the Wadden Sea. In the eastern provinces, both species have also shown a severe range contraction and rarely occur in high densities. Other meadow birds like Eurasian Oystercatcher and Northern Lapwing have meanwhile partly switched to arable land, and therefore suffered less from the deteriorating breeding opportunities in pastures.

Other changes in the agricultural environment include the removal of hedges, increased use of field edges and other formerly extensive fields, and the conversion of many traditional crops into green maize. As a result, Ortolan Bunting and Corn Bunting were nearly wiped out of the country in the 1980s and 1990s, whereas Yellowhammer contracted its range in the western and central parts. Also species like Red-backed Shrike and Common Linnet experienced strong declines as their nesting (hedges) and feeding opportunities were reduced with increasing agricultural pressure (chapter 3, figure 10). Contrastingly, the amount of roadside plantations, young forestry plantations and parks has increased in lowland (agricultural) areas in the western

and northern parts of The Netherlands over the past 30 years. As a result, species like Great Spotted Woodpecker, Blackcap, Northern Chiffchaff, Short-toed Treecreeper, Eurasian Jay and Common Chaffinch were able to expand their range into lowland areas in Groningen, Friesland, Noord-Holland and Flevoland. Common Grasshopper Warbler, Lesser Whitethroat and Common Whitethroat benefited as well from the increase in young woodland and scrub in the lowlands, and nowadays occur in large parts of the northern and western provinces.

An increase in species associated with woodland also occurred in recently reclaimed areas (Lauwersmeer and eastern part of the Delta) where natural vegetation succession is reaching its final stage. By the time of the first breeding bird atlas, recent land reclamations like Zuidelijk Flevoland and Lauwersmeer were still dominated by species of dynamic habitats, such as Pied Avocet and Kentish Plover (chapter 3, figure 16). As the reclaimed areas became cultivated (Flevoland) or the dynamic, sparsely vegetated habitats disappeared through natural succession (Lauwersmeer), these species decreased in abundance, and were more and more replaced by scrub- and reed-breeding species like (White-spotted) Bluethroat, Common Grasshopper Warbler, Marsh Warbler and Common Reed Bunting, and recently also woodland species (chapter 3, figures 11, 19 & 20). Similar developments were observed in large-scale industrial areas (e.g., harbours of Amsterdam), which were still wasteland in the 1970s, but have been cultivated meanwhile. In fact, apart from the coastal areas, species like Pied Avocet and Little Ringed Plover nowadays depend heavily on 'human dynamics', caused by sand and gravel exploitation, dredging and sand deposits for large urban areas or industrial purpose (several sites around Lake IJsselmeer). Often such sites provide excellent breeding opportunities, but become overgrown with vegetation within a few years.

In the Delta area, Southwest-Netherlands, even more pronounced changes occurred as the large estuaries (except for the Scheldt estuary) were all closed by barriers and lost most of their original (tidal) dynamics. Subsequent embankments were closely followed by temporarily thriving populations of Pied Avocet, Common Ringed Plover and Kentish Plover. As the last embankments were carried out at the end of the 1980s, these species have become more and more dependent upon special conservation measures. These have also enhanced breeding opportunities for species like Mediterranean Gull and Barnacle Goose, which mainly breed on islands in the former estuaries. Especially Kentish Plover and Little Tern are also subject to an increased human pressure (mainly recreational activities) in their remaining, traditional coastal habitats.

The cultivation of embankments also had a large impact on reed-breeding species. In the mid 1970s, large parts of Zuidelijk Flevoland (reclaimed in 1968) were covered with *Phragmites* and held large populations of Bearded Reedling and other species (chapter 3, figure 17). Cultivation, conversion into arable land and urbanization caused a rapid decline of reed-breeding species, which nowadays are nearly confined to the remaining marshes like Harderbroek, Lepelaarplassen and especially Oostvaardersplassen. In other parts of the country, species like Great Bittern, Little Bittern, Purple Heron, Savi's Warbler and Great Reed Warbler have also been subject to major declines. On the higher grounds in the eastern part of The Netherlands, most of these species even disappeared. Many marshes and wet reed beds in the lowlands have suffered from eutrophication and a loss of water table dynamics, and have become more and more isolated. Moreover, some of these are heavily exploited and reeds are harvested annually. As mentioned before, only in the recently embanked areas, like Lauwersmeer and the Delta area, some species have (often temporarily) benefited from natural vegetation succession and have shown upward trends. Strongholds of reed- and marsh-breeding birds are currently Northwest-Overijssel, the central part of Friesland, Lauwersmeer, the northern part of the Border Lakes between Flevoland and Overijssel/Gelderland and Oostvaardersplassen (chapter 3, figure 18).

Natural succession has also played a major role in the change in woodland bird communities, especially in the central and eastern Netherlands, where most plantations originated in the first half of the 20th century. Partly enhanced by changing forestry practice (less intensive exploitation, selective cutting of introduced tree species, higher tolerance of dead timber, conservation of old trees), species like Tawny Owl, Lesser Spotted Woodpecker, Marsh Tit, Eurasian Nuthatch and Hawfinch have benefited from the matured forests, and were able to expand their breeding range in formerly still unsuitable woodland (chapter 3, figures 12 & 13). Hawfinch was also able to exploit forestry plantations which were planted in the reclaimed areas in Flevoland in the 1970s. Moreover, some birds of prey have experienced enhanced breeding opportunities, coinciding with a recovery after the ban on persistent pesticides around 1970. Most notably, Northern Goshawk, Eurasian Sparrowhawk and Common Buzzard have shown a strong range expansion, and may now be found in large parts of the country (chapter 3, figure 14). Increased predation by Northern Goshawk had an impact on numbers of species like Eurasian Sparrowhawk, Long-eared Owl, Tawny Owl, Common Magpie and Carrion Crow.

Increased predation, this time by the red fox *Vulpes vulpes*, also initiated a remarkable movement of gull colonies from the coastal dunes into nearby urban areas (chapter 3, figure 15). Virtually all colonies accessible to foxes were destroyed and gulls have now become a common breeder on roofs of buildings in coastal urban areas like Leiden and Haarlem. However, initial population increases at the Wadden Sea islands, where foxes do not occur, have also levelled off now, pointing at limiting food stocks. In the interior parts of The Netherlands, most colonies of Black-headed Gulls have disappeared as a result of deteriorated feeding conditions, causing poor reproductive output. This species has especially suffered from drainage of pastures. Predation by red foxes (as well as corvids) also affects breeding of meadow birds at a local scale, although knowledge to what extent populations really suffer is rather limited and controversial. In these species, changing agricultural practice is considered to be the major trigger causing population declines (see above), making them particularly susceptible to predation.

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