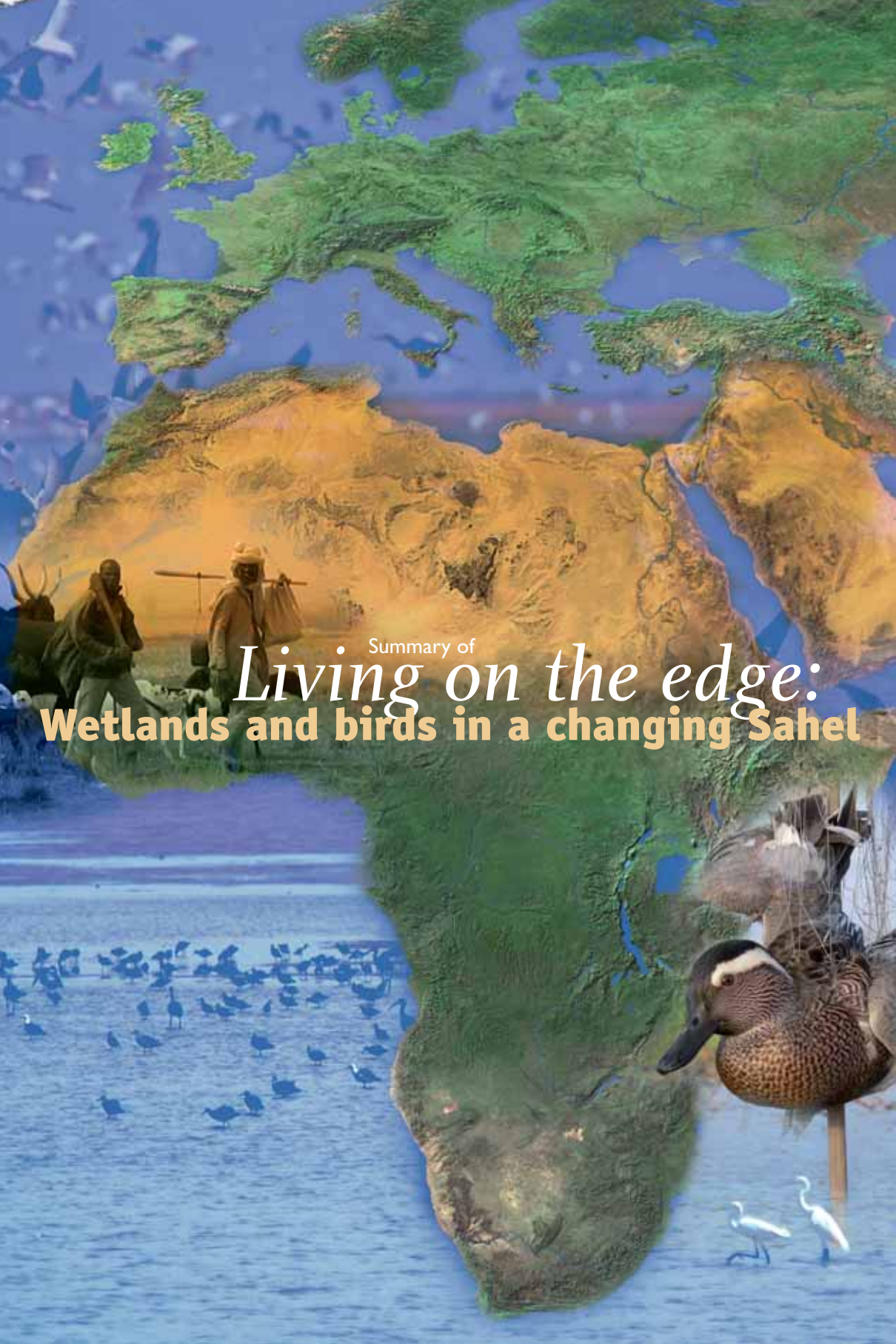

Summary of

Living on the edge:

Wetlands and birds in a changing Sahel

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Living on the edge: Wetlands and birds in a changing Sahel

About the importance of the Sahel as wintering area of European migratory bird species

ISBN 978-90-79341-03-0

This brochure is written on request of the Dutch Centre for Water Management of Rijkswaterstaat. It gives a summary of

Living on the edge: Wetlands and birds in a changing Sahel

Leo Zwarts, Rob G. Bijlsma, Jan van der Kamp, Eddy Wymenga (2009).
KNNV Publishing, Zeist. 564 pag. ISBN 978-90-5011-280-2. To order see www.knnvpublishing.nl.

The graphs and maps (Dick Visser), water colours (Jos Zwarts) and photos (Floris Deodatus, Nicolas Gaidet, Hans Hut, Ben Koks, Benny Klazenga, Jan van de Kam, Wim Mullié, Gray Tappan, Leo Zwarts) are all taken from the same book. The references are given in Living on the edge.

There is also a French and Dutch edition of this brochure; *"Résumé français de Living on the edge: wetlands and birds in a changing Sahel* (ISBN 978-90-7934-104-7) and *"Nederlandse samenvatting van Living on the edge: wetlands and birds in a changing Sahel"* (ISBN 978-90-5011-280-3).

Layout and printing: Brandsma Offset Ferwerd.

Contents

Billions of birds from Eurasia spend the northern winter in Africa

In the summer of 1969, sharp-witted birders in various parts of Europe were struck by the scarcity of Common Whitethroats on the breeding grounds. Remember: this was the era that standardised monitoring of breeding birds was still in its infancy (in Britain, and nowhere else). To be noticed on such a scale, the decline must therefore have been enormous, as it turned out to be. Some birders were quick to suggest that perhaps something ominous might have happened in the African wintering areas. It took several more years before the drought south of the Sahara made headlines in the newspapers: scorched vegetation, livestock starving to death and millions of emaciated people. That hundreds of millions of European migratory birds were dying in Africa as well is not surprising in hindsight, but at the time this was a hotly debated issue.

1968 was the start of *The Great Drought*, a period of 25 years with consistently below-average rainfall in the Sahel and adjacent vegetation zones. It was a humanitarian tragedy, on top of an ecological disaster. The Sahara advanced to the south and experts were convinced that the desertification was irreversible. Forty years later, this viewpoint appears to have been too pessimistic. Satellite images show that since 1992 the Sahel has become greener again in the wake of an increase in rainfall, bouncing back from drought-related devastation. Nonetheless, the current situation is still unfavourable compared with that of half a century ago. What has been the impact on bird populations?

Since the start of standardised monitoring from the late 1960s onwards, population trends of many bird populations in Europe have become available, spanning 20 years or more. Matching trends of long-distance migrants with conditions in the African wintering areas is now within our grasp, especially relevant because so many long-distance are in rampant decline. If ups and downs of 'our' migrants are mainly triggered by events occurring in the African wintering areas, (better) protection in the breeding areas will not improve the fortunes of this group of birds. A legitimate question therefore is: to what degree is European birdlife determined by the circumstances in sub-Saharan Africa? That is the leading question in the book *Living on the edge: Wetlands and birds in a changing Sahel*.

MIGRATORY BIRDS CONNECT CONTINENTS

The twice annual journey of migratory birds between breeding and wintering grounds is quite a feat. The exhausted Wheatears we saw on the beach in Mauritania are a case in point: they had just crossed the Atlantic Ocean in a single leap from East Canada or Greenland to West Africa, a distance of 5000 km. Garganey and Ruff, breeding in the outer east of Siberia, cover an even longer distance of 15,000 km to reach their African wintering areas. They do it in several steps, but it remains as impressive.

Europe accommodates more than 500 breeding bird species, by estimate some 2000 millions of pairs. This equals 8000 millions of post-breeding birds, of which a quarter winter south of the Sahara. For the southern European birds the fraction of trans-Saharan migrants is smaller than for the birds in northern Europe where it amounts up to 40%. Africa is of vital importance for the long-distance migrants breeding between East Canada and East Asia, ranging in habitat from the Arctic tundra to the Mediterranean scrubland.

EUROPE'S LONG-DISTANCE MIGRANTS ARE IN DECLINE

Migratory bird species are in trouble, big trouble. The population estimates of European birds in 1970, 1990 and 2000, as compiled by *BirdLife International*, clearly show the point: most species wintering south of the Sahara are in decline. Of the 127 species crossing the Sahara, 16 show an increase (13%), 36 are stable (28%), but 75 (59%) are in decline. This compares unfavourably with short-distance migrants (33% in decline) and residents (28% in decline).

These downward trends were particularly evident in birds wintering in the savanna (large decline in Egyptian Vulture, Pallid Harrier, Steppe Eagle, Stone-Curlew) and wooded savanna (large decline in Black Kite, European Roller, Common Redstart), but equally so in waterbirds (large decline in Glossy Ibis, Ruff, Black-tailed Godwit). A large decline stands for a decrease of more than 30% in the period concerned. Conversely, bird species wintering in the African forests (like European Honey-buzzard, European Golden Oriole and Pied, Spotted and Collared Flycatcher) seem to have been less affected; although in decline, the downward slope is less steep than in the species wintering in the Sahel. Many factors play their role, but it seems beyond dispute that the Sahel is a key factor indeed. Before embarking on a verification of the causes behind the declines of long-distance migrants, we first have to distinguish where in Africa they spend the winter. After all, not all of Africa was as badly hit by drought as the Sahel.

Nearly all Garganey from Europe and Asia spend the winter in the Sahel, where they concentrate in the floodplains near Lake Chad, in the Inner Niger Delta and the Senegal Delta.

The dry savannas south of the Sahara are dotted with several large wetlands, such as the Inner Niger Delta. When rainfall is abundant, the area of the Inner Niger Delta flooded during the northern winter may be as large as Belgium or The Netherlands.

WHERE DO OUR MIGRANTS SPEND THE WINTER IN AFRICA?

Very few European migrants winter in the Sahara or in the tropical rainforests. For the Sahara this is what one would expect given the lack of food and cover. Forests, however, are teeming with birds, overwhelmingly of local origin. Perhaps this is the main reason why northern migrants are so rare here. The Collared Flycatcher is one of the few Paleartic species which is not deterred by competition and which coexists with the many African flycatcher species.

Most trans-Saharan migrants do not migrate beyond the transient zone between the desert and the Equatorial rainforest. This zone of arid and wooded savannas holds several very large wetlands. During the northern winter, birdlife in these marshes, as well as in the savanna, is dominated by migrants from Eurasia. Among the waterbirds, the numbers of local species (Whistling and Comb Duck) pale into insignificance beside the huge numbers of migrants (Garganey, Pintail, Shoveler). The same is true for the waders where the local Egyptian Plovers and Painted Snipes are pin-pricks amidst the flocks of Ruff and Little Stint. Similarly, the northern Sahel forests contain few African birds, but all the more European birds (like Iberian Chiffchaff, Olivaceous, Bonelli's and Subalpine Warblers).

During the northern winter, African bird species remain in, or move to, habitats with a relatively stable flood supply, whereas the European migrants flood the areas largely vacated by African species. The latter areas vary considerably in their food supply, both within and between years. Rainfall in the savannas falls in the few months prior to the arrival of Eurasian migrant. The amount of rainfall varies considerably from one year to the next, the very reason why migrants wintering in the Sahel face highly variable feeding conditions. Variations in rainfall have far-reaching consequences for 'our' birds in Africa, as will be shown.

From Sahara to rainforest only takes a (long) day's journey from north to south, during which the traveller witnesses a gradual change of landscape from dry, ochre and bare into wet, green and lush.

Changes in the Sahel

RAINFALL

Rain is a rare commodity in the Sahara (north of 15-20°N), but 1000 km to the south the annual rainfall amounts to 1000-3000 mm (Fig. 1). Between both extremes the rainfall gradually increases from north to south, and the landscape changes accordingly. The arid landscape of the Sahara turns gradually into forest, via dry and treeless savanna, wooded savanna and parkland. This zoning occurs along the entire southern edge of the Sahara, from the Atlantic Ocean to the Red Sea, a continent-wide swath of 5500 km.

The Sahel is usually defined as the zone where the annual rainfall is at least 100 mm and not more than 700 mm. The rainy season in the northern Sahel is restricted to July-September. In the southern Sahel the rains start a month earlier and end a month later. In most years, the Sahel is devoid of rain from October to May. For the migratory birds arriving in August and September, the green, grassy plains gradually turn into dust-covered, bare soil, wetlands become drylands and most trees shed their leaves. From the initially huge numbers of insects, either small (midges) or large (locusts), fewer and fewer remain. The problem faced by trans-Saharan migrants is not how to recuperate from the post-breeding migration hazards, but how to stay alive in the following months and - especially - how to find sufficient high-nutrition food to build up body reserves, necessary for the flight back home across the Sahara and Mediterranean Sea.

Rainfall is unpredictable in the Sahel, sometimes limited to a few cloudbursts in the rainy season. Local variations in the amount of rainfall are enormous. Nevertheless, taking all data from the many rainfall

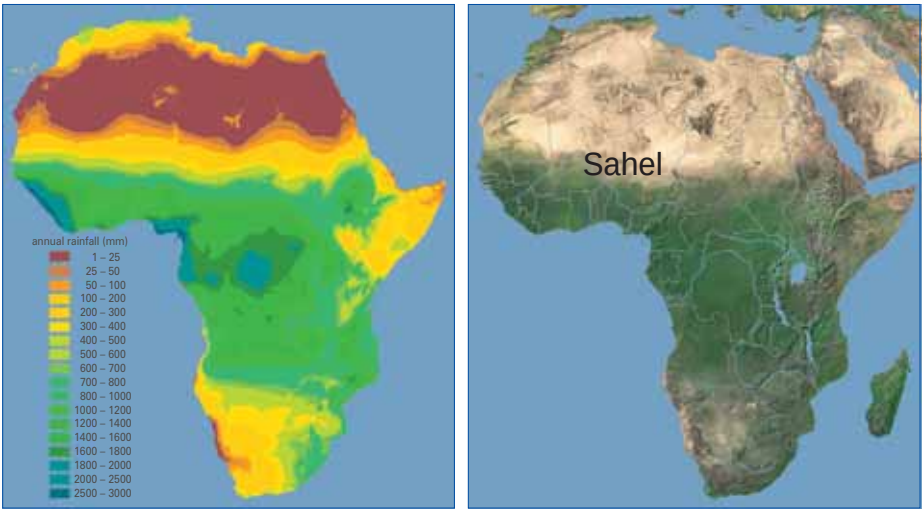


Fig. 1. The north of Africa is extremely dry and this holds - to a lesser degree - for the east and southwest. Central Africa, on the other hand, is extremely wet. South of the Sahara the transition from dry to wet south is amazing in its rapidity, with a doubling of rainfall for every 160 km southward.

stations into account, some years and periods clearly stand out across the entire Sahel. 1984, for instance, was catastrophically dry, whilst the 1950s were typified by high rainfall. Long series of meteorological data collected all over the Sahel are needed to elucidate the rainfall pattern for the entire region. The distribution and number of raining stations allow such an analysis from 1900 onwards (Fig. 2). These data allow two conclusions to be drawn.

First, there is, on average, a gradual decline of rainfall throughout the 20th century. Over a longer period, the trend is even more pronounced because the 19th century must have been, according to historical sources, rather wet.

Secondly, periods with high rainfall (around 1925 and 1955) are alternated with dry periods (around 1910, 1940, 1970). This cycle would predict high rainfall around 1985, but - in contrast - the rain steadily declined (or remained at a low ebb) throughout the 1960s, 1970s, 1980s and early 1990s, only to partly recover since then.

When the rainfall in the Sahel started to decline in the 1970s and 1980s, the general opinion was that the people in the Sahel were to blame. Deforestation, increasing livestock numbers and extension of farmland led to erosion and desertification, to such an extent that climate change seemed inevitable. Later research discovered, however, that the cause of the presumed regime shift must be sought beyond the Sahel, at least for a large part. Rainfall in the Sahel appears to depend on the sea surface temperate of the oceans: the Sahel is dry when the oceans in the tropics are relative cool and those in the subtropics relatively warm. If and how global warming is going to affect the Sahel is still uncertain. The most likely scenario predicts a further decline in rainfall by 10-20%, and possibly even by 40%. Between 1980 and 2005, the average temperature in the Sahel has increased by 1 °C, and current predictions allow for another increase by 2-7 °C in the next 80 years. This would prove to be disastrous in a part of the world already hot as it is.

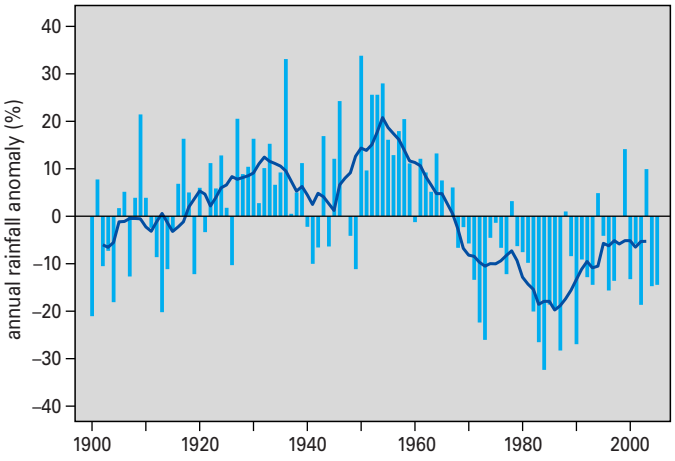


Fig. 2. The annual rainfall in the Sahel (bars), given as percent deviation from the average of the 20th century. The line shows the running mean calculated over an interval of 9 years (4 year before - 4 years after the year concerned).

RIVERS AND WETLANDS

A large part of rain in the northern tropics is drained off by rivers running through the Sahel, *i.e.* the Senegal and Niger River in West Afica and the Blue and White Nile in East Africa. The Chari and Logone River in the central part of West Africa empty into Lake Chad. These rivers feed the large floodplains and other wetlands in the semi-arid Sahel. The annual discharge of the rivers varies considerably. This is not caused

by variations in rainfall in the Sahel proper (being too low to have an impact on the river flow), but is closely correlated with the rainfall further south.

The Senegal, Niger, Chari, Logone and Nile lose a lot of water during their passage across the Sahel, due to evaporation and seepage. Especially in dry Sahel years, the rivers lose a large part of their flow. After a series of dry years the ground water table recedes and the rivers consequently lose even more water. River flows in the Sahel therefore not only depend on rainfall in the preceding months, but, to a large extent, to rainfall in earlier seasons. For example, in the Upper Senegal the rainfall declined by 29% between 1950 and 1985, from 1550 to 1100 mm, but the annual peak flow of the river in September declined by 60%, from 4500 to 1800 m^3/s.

Most Sahel rivers had a natural flow until about 1980, but this state has changed dramatically since then. Due to the construction of the Manantali dam in the Upper Senegal River, a huge reservoir of 11 km^3 came into being. During the rainy period a large part of the inflow is stored in the lake to be gradually released in the dry months. In this way electricity can be produced and irrigation of farmland is possible during the dry period. The Selingue dam has a similar impact on the Upper Niger River as the Manantali on the Senegal, although less dramatic. In North Nigeria and Cameroon dams have also affected the river flow, with dire consequences downstream for the seasonal floodplains and marshes.

By combining the daily flow of the rivers in the Sahel with satellite images, it was possible to reconstruct the annual surface area of the floodplains and subsequently compare this with changes in bird populations. Migratory birds concentrated in the floodplains (Night Heron, Purple Heron) show a clear relationship between flood extent and population change. However, population changes in bird species found in the savanna (White Sork) or wooded savanna (Wryneck) correlated better with variations in annual rainfall in the Sahel.

LONG-TERM CHANGES

People The key factor of change in the Sahel is the growth of the human population with 3% per year, causing a doubling of the population per 28 years. Around 1950, only 20 million people lived in the eight countries of the western Sahel (Chad,

Rainfall south of the Sahel converts tiny streams temporarily into wide rivers. After the rainy season has passed, the water level in Sahelian rivers and floodplains gradually declines again; in the Niger River near Mopti, for instance, between September (left) and February (right) by 3-5 cm daily.

Niger, Mali, Burkina Faso, Mauritania, Senegal, The Gambia, and Guinea-Bissau), contrasting with the 60 million at the start of the 21st century and an expected 130 million in 2030. The claim on the land increased proportionally. The average density is still low with 11 people per km² (for comparison: in 2009, this is 398/km² in The Netherlands), since the combined surface area of the just mentioned eight countries is 5.3 million km². However, even a low density of people can have a large impact on the environment. Moreover, there are large regional differences in the population density. Very few people live in the dry northern Sahel, but further south the density may increase to 200 inhabitants per km². River valleys and wetlands are especially crowded. Unfortunately, wetlands are also favoured by huge numbers of birds, and any change in land use may then have a large impact on migratory bird species.

Agriculture Only 1.6% of the total surface area of the eight western Sahel countries was cultivated by farmers in 1962, but forty years later this had increased to 4.1%. Farmers use no, or hardly any, fertilizers, but instead use fallow to improve soil fertility. The fraction of land laid fallow has shown a decline in past decades, however. Bird density and diversity on fallow land are higher compared with cultivated land. The declining acreage of fallow land must have negative consequences for migratory birds, but only few data are available to back up this statement.

During the Great Drought, farmers along the rivers started to use pumps to irrigate their land. Besides, large irrigation schemes have been constructed along the Senegal and Niger River, and also in Northern Nigeria and Cameroon. Wet rice fields attract many birds, but it is usually the common species that profit, such as Yellow Wagtails and Cattle Egrets. Scarce and rare species are concentrated in the floodplains and largely absent from irrigated fields. The latter therefore cannot be regarded as a substitute for floodplains lost to irrigation schemes.

Cattle breeding According to the FAO, Africa numbers more than 700 million cows, goats and sheep. Livestock are absent in the desert, and rare in high-rainfall areas along the equator, the latter giving rise to the designation of *Green Desert*. The presence of tse-tse flies has prevented the in-

Millions of people struggle for life in the Sahel. The question is how to sustain a decent living without further degrading the habitat

troduction of livestock in areas with frequent rains. Consequently, 60% of all African livestock is to be found in the Sahel.

Cattle breeders in the Sahel move long distances with their herds. They migrate to the north in the early rainy season and move back as the temporary food supply on the grass plains whithers or becomes depleted. Since livestock have to drink regularly, the grazing grounds do not extend beyond a distance of 15 km from rivers, lakes and (temporary) pools. This used to limit the radius of action. After thousands of wells had been constructed, many new grazing grounds came within grazing grasp. At present, an estimated 30% of the Sahel is being subjected to grazing with livestock.

The 400 million cows, goats and sheep in the Sahel remove the vegetation which used to be the food for huge numbers of antelopes, gazelles and other wild animals. Travelogues of the first Europeans visiting the area indeed refer to large flocks of wild animals. These original inhabitants of the grassy plains have virtually disappeared from the western Sahel, but not (yet) from the eastern Sahel (Chad, Central African Republic and Sudan). Especially South Sudan still harbours a suite of wild herbivores. The difference between west and east is most likely due to the human population, being higher in the western than in the eastern Sahel.

The *Great Drought* in the 1970s and 1980s greatly diminished the number of livestock, but numbers have recovered since then. At the start of the 21st century, the Sahel counted twice as many cows and three times as many sheep and goats as 40 years earlier. Without grazing the Sahel would look completely different. Not only would there have been many more indigenous trees and shrubs, but also huge seed and fruit stocks from grasses and shrubs. The increased grazing pressure effectively reduces the availability of seeds and fruit, with negative consequences for species like European Turtle Dove and Common Whitethroat. Other species may have profited from the increase in livestock, for instance birds following the herds (Cattle Egret, Yellow Wagtail). This may be also true for species depending on locusts and grasshoppers. The present grazing pressure results in a more open landscape with fewer trees and shrubs, providing, for the moment, excellent feeding and breeding grounds for local grasshoppers. The latter form a reliable food resource for many acridivorous bird species. However, notorious locust-eaters, such as Lesser Kestrel and Montagu's Harrier, do not appear to have increased in numbers.

It is hard to imagine how the Sahel would look like without human action. Although the human population density is low, large areas are grazed annually or burned in the dry season.

In the long run, livestock grazing prevents afforestation, but it also has a direct impact on the vegetation cover, and thus on the food supply of birds feeding on the ground. The photo shows at the right side an area where, because of an experiment, livestock has been excluded.

Forest The people living in the Sahel need wood to cook their meal. Each day, children and women collect dead wood or cut off branches from the trees near the villages. City dwellers often use charcoal, which is transported from afar. The increased need of fuel led to an ever expanding impact on trees away from human habitation. Moreover, many acacias died in the northern Sahel during the Great Drought. Further to the south, forests were successively depleted and trees in agricultural fields were removed, resulting in a more open, park-like or bare landscape. The deforestation in the Sahel is clearly evident from comparisons between high-resolution satellite images and detailed aerial photographs taken dozens of years ago.

Nowadays, there is much afforestation going on, mainly with Neem (an exotic from Burma) in the villages and towns, *Prosopis* (an exotic from Chile, to prevent sanddrifts), and Eucalyptus (an exotic from Australia). These tree species are not attractive to European migrants, as their foliage and bark harbour few insects. These new forests offer the migrants no solace from the loss of indigenous forests.

Pictures of the same savanna in Senegal in 1984 and 1993 show the clearing of acacias; the trees still present have lost many branches due to cutting.

Bird captures In Mali and Senegal lead shot costs 46 euro cent, too expensive for hunters to shoot small birds. Shooting is therefore targeted at large species living in flocks, such as Glossy Ibis. However, most birds ending up in the cooking pot are not shot, but captured. We estimate that people in the Inner Niger Delta capture up to 70,000 Garganey annually, using standing nets at night, and still larger numbers of Ruff. Especially in dry years this method of capturing birds is lucrative.

Another method of getting hold of free-flying protein in the Sahel, as well as elsewhere in Africa, involves the use of snares. The numbers thus captured must be large, but we have no indication of how large. Barn Swallows are captured on their nocturnal roosts with umbrella-like devices tipped with glue, and during the daytime 'fished' from the air with a flying termite attached to a thin thread with a hook. In this way, millions of Barn Swallows are captured each year in SE Nigeria, SW Cameroon and the Central African Republic.

The numbers of captured birds has increased over the years, not only because there are more people, but also because nylon nets, not available before 1960, are now widely used. The opportunities to trade captured birds have also improved, either by storing them (ice) or by fast transportation to the market (improved road system).

Garganey in the Inner Niger Delta are easy to capture in the weeks prior to the return migration, when most floodplains have dried out and the birds are concentrated in the few remaining wet areas.

The time has gone that Nile Perches of 1.5 m were captured in the Inner Niger Delta. The fish do not have the time to grow that old. For fish-eating birds (here Spotted Redshanks and Little Egrets) food supply has increased as small fish abounds. The dark side of this trend is that many birds are killed by hooklines.

Fish capture The handful of extensive floodplains and marshes in the Sahel attract many water birds. The floodplains become flooded between August and December, and gradually dry up thereafter. Hundreds of thousands of fishermen capitalise on this seasonal regime and capture the drifting fish with temporary dams, fykes and nets. Fishing nowadays is so effective and massive that - although it may seem unlikely - nearly all available fish is removed. As a consequence, the average life expectancy of fish does not exceed half a year anymore.

In 1960, the fishermen in the Inner Niger Delta used nets with a mesh width of 50 mm, compared with 33-41 mm in 1985. At present, fishermen started using plastic nets with a mesh width of only 10 mm. The fish have adapted to this predation pressure by reproducing at a much earlier age. Big fish of 50 cm and more have become scarce in the course of the past years. Although the fishermen nowadays employ more nets, the daily capture per fisherman has declined over the years. For fish-eating birds, this overexploitation has not yet harmful consequences, since the decrease in average fish size meant a boost in food supply. Nevertheless, the increased fishing still has a direct negative impact on the birds, because many thousands perish each year in fykes and due to hooklines.

THE DECLINE OF WETLANDS

Senegal Delta The Senegal Delta has a unique ecosystem because sea water can enter the floodplains, hence the gradient from marine to fresh. In the past an area of 3400 km² was inundated in wet years, but in the course of the years the Senegal Delta has been embanked. The floodplains were turned into irrigated farmland, mainly rice fields; other floodplains were inadvertedly transformed into salt plains. Before the construction of dams, the water level varied by 3.5 m during the course of the season. After the construction of the Manantali dam in the upper river and the Diama dam in the river mouth, the variation in water level was reduced to 0.5 m. Not much is left of the floodplains in the Senegal Delta. Permanent water bodies have become overgrown with dense vegetation, to the chagrin of people and to the detriment of wildlife: extensive cattail stands or dense floating mats of exotic, invasive plant species (Water Lettuce, Kariba Weed) now cover huge areas of open water. No wetland in West Africa has changed to the extent as the Senegal Delta. From the hundreds of thousands of Ruff counted in the 1970s, no more than 30,000 remained after 2000. At the same time Black-tailed Godwits declined from 20,000 to about 3000. In contrast, dabbling ducks stand out with up to 20,000 Shovelers, 100,000 whistling ducks, 150,000 Pintails and 200,000 Garganey.

Some of the ecological disasters associated with the loss of the floodplains were offset by the creation of National Parks. The Djoudj was appointed as National Park in 1971, the Diawling in 1991 (each 160 km²). These parks are not, fortunately, 'paper parks', for without enforced protection, the breeding colonies of Long-tailed Cormorants, White Pelicans, herons and egrets would have disappeared. Both sites are now important wetlands for migratory bird species.

Black-tailed Godwits and Ruff have all but disappeared from the Senegal Delta, but other waterbirds were able to persevere, despite the large changes following the embankment of the floodplains.

Inner Niger Delta The Inner Niger Delta in Mali is huge. On topographical maps from the 1960s, a total surface of 36,000 km² is designated as floodplain. When the water level starts to rise in July in the southwestern part of the Delta, the plains in the northeast are still dry. By the time that the northern plains become flooded two months later, the water level is already declining in the south. The area covered by water at any one time amounts to 25,000 km². Such a large flood extent is only possible when the combined inflow of Niger and Bani, the major tributary, exceeds 55 km³ in the rainy season. In most years, the inflow is smaller. During the disastrous drought in 1984, the inflow was only 15 km³, and the flood extent did not exceed 5500 km².

The Inner Niger Delta not only stands out because of its size, but also due to its hydrological dynamics. Between July and December the water rises by more than 6 m in wet years, to decline by the same amount in the following months. In extremely dry years, however, the flood level rises only by 3 m. For waterbirds the large annual differences in flood extent are a matter of life and death. A high flood guarantees a multitude of pools and lakes with shallow water throughout the northern winter, at least up to the time of departure to the breeding grounds. Conversely, during a poor flood most water bodies dry up long before March. Waterbirds are then forced to concentrate along the edge of the river and in the few permanent lakes connected to the river. Many birds then die from starvation or are easy prey to the local people. In wet years the birds are more thinly dispersed across the entire delta, and the local people do not even attempt to catch them. The drier the Inner Niger Delta the fewer migrants survive the northern winter.

Large numbers of waterbirds have been counted in the Inner Niger Delta, among which 900,000 Garganey, 300,000 Pintails, 25,000 Glossy Ibis, 9000 Gull-billed Terns and 3500 Caspian Terns. For these species, this constitutes a substantial part of the entire population. The significance of this area for European migrants can hardly be overestimated.

The Inner Niger Delta is for the larger part covered by grasses adapted to large variations in water level. The local name for these grasses, having stems up to 6 m, is *bourgou*. Birds feeding in these floating meadows may easily be missed during standard waterbird counts; this is particularly true for small or unobtrusive bird species. Their numbers were estimated from 1617 density counts in random plots (3 ha, on average) stratified according to habitat and water depth. This resulted, for example, in totals of 315,000 Cattle Egrets and 960,000 Yellow Wagtails for the entire Inner Niger Delta. Both totals are close to the numbers counted at nocturnal roosts. The density counts also suggest the presence of 50,000 Purple Herons and 183,000 Squacco Herons. These are, compared with the European breeding population, huge numbers. We have to conclude that many birds wintering in the Inner Niger Delta must originate from Asia.

During the flood the Inner Niger Delta is covered with floating grasses. During the deflooding, herons walk on a dense mat of floating stems, here on top of a water column of 1 m deep. The photo shows five Purple Herons, but the six Squacco Herons which we put up later, are still hidden in the vegetation.

Compared with other wetlands in the Sahel, capturing waterbirds is widespread in the Inner Niger Delta. The main threat comes, however, from outside. Large irrigation works and a water reservoir in the Niger upstream of the Delta take so much water that the floodplains are now already 7.5% smaller than in the natural situation. Since 2007 another dam in the Bani River has been constructed; a second dam in the Bani and a large dam in Guinea are under study. Were these dames constructed, the Inner Niger Delta is going to lose another 15-20% of its floodplains. Another danger is a large dam downstream of the Inner Delta; large areas will be permanently flooded, opening the way to the invasion of cattail (as in the Senegal Delta).

Lake Chad and surroundings From 1870 to 1970 Lake Chad was very large, varying in size between 15,000 and 25,000 km^2. Lake size declined to 5000 - 10,000 km^2 since 1980. Between June and December the water level increases, due to rainfall and to the discharge of the Chari and Logone Rivers, and declines thereafter due to evaporation. As a consequence, on average 2000 km^2 is deflooded annually. In dry years, evaporation is larger than the inflow, which results in a decline of the water level. In wet years, it is the other way around. Although climate has been considered as the only culprit for the smaller Lake Chad (e.g. the movie *An Inconvenient Truth*), the main reason is water loss due to irrigation along the Logone and Chari Rivers.

Before 1973, Lake Chad was a large, shallow lake with 90% open water. The rest was covered with reed, cattail, papyrus and *bourgou*. The northern half dried up after 1973 and became partly covered by *Prosopis*, an exotic tree species. The southern half covers 1500 km^2 of open water and 3500 km^2 of seasonal floodplains with a *bourgou* vegetation.

All in all, birdlife in Lake Chad must have changed a lot, but hard data are lacking. We know that only few birds use the open water and the dense vegetation of cattail and papyrus, but also that the floodplains attract many waterbirds during de-

flooding. Although Lake Chad was reduced in size, the floodplains increased in size, which spells good news for foraging birds. Aerial counts show that between 1999 and 2007 400,000 to 700,000 Garganey were present, about the same as counted in the 1980s. Unfortunately, the older counts were incomplete, so a decline (as found in Pintail: 550,000 counted in the 1980s, but only 50,000 to 200,000 twenty years later) is likely.

Lake Fitri, situated 300 km east of Lake Chad, is a mini Lake Chad. Its surface area varies between 400 and 1300 km^2. Aerial counts show that large numbers of waterbirds can be present, among which 100,000 whistling ducks.

Large floodplains are found 100 to 300 km south of Lake Chad, along the Chari and Logone, of which Waza-Logone (8000 km^2) in Chad and northern Cameroon is well studied. The water level varies seasonally with only 50 cm. Two complete bird counts reveal its significance for local species (12,000 Black-headed Herons, 7200 Black Herons, 1800 Marabou Storks and 3600 Sacred Ibis), but also for migrants (23,000 Squacco Herons, 900 Eurasian Marsh Harriers and 146,000 Ruff).

The Hadejia-Nguru floodplains are situated west of Lake Chad in North Nigeria. The size of the inundated area varies annually, depending on the river discharge, between 300 and 3600 km^2. There are 20 dams upstream of the Hadejia-Nguru, of which the two largest are operational since 1972 and 1992. The floodplains have been reduced by all these dams to 300-500 km^2. A large part of the water withheld in the reservoirs during the wet season is released in the dry months to follow. Consequently, a part of the floodplains remains covered by water and has subsequently been overgrown with cattail. The 11 bird counts, performed between 1988 and 1998, show that numbers are related to the size of the floodplains: 300,000 waterbirds were counted in wet years (145,000 Gargeney and 60,000 Ruff), but only 50,000 in dry years.

Sudd The Sudd is a floodplain along the White Nile in South Sudan. Much rain in central East Africa drains to Lake Victoria. The discharge of the White Nile depends mainly on the level of Lake Victoria. In the wet year of 1964 35,000 km^2 of the Sudd was flooded. The flooded area gradually declined in the years thereafter to about 10,000 km^2 at the start of the 21st century.

The water level in the Sudd varies seasonally by only 50 cm, a big difference compared with the other Sahelian floodplains. A large part of the area is permanently covered by water and overgrown with dense vegetations of reed, papyrus and cattail. Very little is known of the birds in the Sudd. We expect few waterbirds in the densely vegetated marshlands, apart from rails and some reed warbler species. On the other hand, the area is very extensive and access on foot or by boat is difficult. Moreover, human density is low. The large bird species have been counted three times along aerial transects between 1979 and 1981. In this way 3% of the entire area (69,000 km^2) was covered. After extrapolation, 5000 - 6500 Shoebill Storks and 15,000 - 37,000 Black Crowned Cranes were estimated to occur in the Sudd, more than anywhere else in Africa. High numbers were also estimated for Goliath Herons and six stork species. Smaller bird species were not counted, so numbers and species of most migrants in the Sudd are still in the dark. Similarly, no information is available whether species composition and numbers have changed in relation to the size of the flooded area. At present, the complicated political situation prevents a full assessment of the ornithological significance of the Sudd.

SUMMARY

The wetlands in the Sahel have gradually lost ground in the wake of a decline in rainfall. This process accelerated after 1970, due to embankment of floodplains and the construction of water reservoirs and irrigation works upriver. Regulation of the river discharge resulted in a decline of flood extent and an enlargement of the area being permanently covered by water. This reduction of dynamics led to a change in the vegetation, being negative for waterbirds. If the bird density counts in the Senegal and Inner Niger Deltas were representative for all Sahelian floodplains, the number of waterbirds in these areas must have declined by 40% since 1960.

Population trends in Sahel migrants

Which indications do we have that the changes in the Sahel have repercussions on the birds which spend the northern winter there? We have to distinguish between long-term changes, such as the impact of habitat loss from deforestation, and short-term variations due to annual fluctuations in rainfall or locust abundance.

WINTER MORTALITY IN DRY YEARS

We have several clues that fewer birds survive the winter in the Sahel in dry years.

- In dry years waterbirds are forced to concentrate in fewer sites, which makes them highly vulnerable to catching with standing nets by the local people. In the Inner Niger Delta very few Garganey are offered for sale on the market in wet years, but up to 70,000 are traded in dry years. The same difference was found in Pintail and Ruff.
- All bird species for which we analysed the ring recoveries showed the same pattern: many recoveries in dry years, few in wet years. Since rings reported from the Sahel mainly refer to birds shot or captured, this indicates differential human predation (although not necessarily differential winter survival).
- That winter survival actually differs during dry and wet years in the Sahel is visible in the return rate of birds on the breeding grounds. From a ringed population of British Lesser Whitethroats, only 4% of the adult birds returned after the disastrously dry winter of 1984, against 10-25% after wet years. Essentially the same results were found for White Storks, Sand Martins and Common Whitethroats, with lower return rates after dry Sahel years.

The higher mortality in dry Sahel years is mainly driven by food shortage, a mechanism also known from elsewhere in Africa. Barn Swallows in the Okavango Delta in Botswana, for example, have lower weights in dry years (when insects are scarce) than in wet years (insects abound), and their moult takes 1-2 months longer. Garganey and Ruff are also known to suffer from food shortage in dry years. Garganey attempt to compensate by extending their feeding bouts into daytime, but to no avail; they are in such a poor condition during extreme droughts that they can be approached closely. Garganey and Ruff have to increase their body weight by 40% to be able to fly back to Europe, but during droughts they lose weight instead and are doomed to die in their wintering quarters.

THE IMPACT OF SAHEL CONDITIONS ON RETURN MIGRATION AND BREEDING PERFORMANCE

The birds returning from Africa to their northern breeding areas have to fly many thousands of km. They need extra body reserves to fuel their intercontinental flight and therefore start fattening 1-2 months before their planned departure. Whimbrels on the Banc d'Arguin (Mauritania), for example, increase their daily food intake in the pre-migratory period by 40% compared with their consumption in the months before.

The birds wintering in the Sahel do the same, but they have to fatten up in a desiccated landscape where not a drop of rain has fallen in the past six months and where food resources have dwindled. Putting on weight is particularly difficult in dry Sahel years. The chances are that they depart with insufficient fuel reserves to successfully navigate the Sahara, resulting in high mortality. This is borne out by the ring recoveries from the Sahara. Considering the slim chance of reporting a ringed

bird from the Sahara (*de facto* an empty quarter), and the short time it takes to cross the desert (a few days at most), the comparatively high reporting rate in the Sahara in spring, set against the reporting rate in the Sahel, came as a surprise. In the EURING database, for instance, only two recoveries of Common Redstarts came from the Sahel, the wintering area where they spend six months each year, but 99 were reported from the Sahara, nearly all from April. The same dichotomy was found in Spotted Flycatchers and several warbler species. Many more recoveries were reported in spring than in autumn, despite the fact that the number of migrants in autumn is at least twice as high as in spring (with a higher proportion of young, inexperienced birds). The higher number of spring recoveries is an indication that crossing the Sahara in spring is a more exacting enterprise than in autumn.

An analysis of the recoveries furthermore shows that the number of reported birds from the Sahara in spring is higher after a dry year in the Sahel than after a wet year. This was found in, for example, White Storks, Barn Swallows, Yellow Wagtails, Reed Warblers, Common Chiffchaffs, Willow Warblers and Spotted Flycatchers. Apperently, even birds not wintering in the Sahel are affected by droughts in this region, as visible in the Barn Swallow (which winters well south of the Sahel); this species refuels along the way and is therefore vulnerable when encountering adverse conditions in the Sahel in dry years.

These data show that many birds cross the desert with insufficient body reserves after having experienced dry conditions in the wintering quarters. The alternative would have been to extend the pre-migratory fattening period, and thus postpone the return flight to the breeding areas. Black-tailed Godwits indeed arrived later in Portugal after a dry year in their African wintering areas. Similarly, the arrival of Barn Swallows in Spain during the last 60 years appeared to be positively related with rainfall in the Sahel and to a lesser degree with spring temperature in Spain.

During the last dozens of years many European long-distance migrants started to return earlier on the breeding grounds. Many researchers have related this trend to climate change. That may be true, but ignores the obvious relationship between rainfall in the Sahel and arrival date in Europe: birds return earlier after a wet year in the Sahel. Since rainfall in the Sahel shows some increase between 1985 and 2005 (especially after 1990), the advanced arrival in past years may partly be attributed to the conditions in the Sahel. The impact of climate change on the arrival of long-distance migrants on the breeding grounds is presumably smaller than suggested so far and needs to be studied over more years.

The circumstances in the Sahel also have an impact on the breeding performances of long-distance migrants. White Storks are known to skip or delay breeding after a dry Sahel year, although the reproductive output of those that do breed is similar to that after a wet year. British Sedge Warblers and Lesser Whitethroats have a lower fledging success after dry Sahel years. The difference with the breeding performance after wet years was not large, though, and was not found in other long-distance migrants. That is hardly surprising. Even if birds arrive in a good condition after a wet Sahel year, they may still have to face a cool and wet summer. On the other hand, birds arriving late and in poor condition may encounter favorable feeding conditions in their breeding area and thus may recuperate fast and have a high reproductive output.

POPULATION DECLINES AFTER DRY SAHEL YEARS

If mortality in long-distance migrants during winter and spring migration depends on the circumstances in the wintering area, annual fluctuations rainfall and flood

extent in the Sahel should be reflected in the breeding population, either directly or with a delay. Indeed, after the dry Sahel winter of 1990/1991 Common Whitethroats declined across Europe, on average by 18.5%. The winter of 1994/95 was wet and the population increased in much of Europe, on average by 17%; Sedge Warblers even increased with 40%.

Winter mortality of long-distance migrants depends on rainfall in the wintering areas, but also on population size. In 1968, when rainfall in the Sahel dipped after a series of very wet years, Common Whitethroat numbers crashed. In the much drier years in the 1970s and 1980s, Whitethroats showed smaller declines. The explanation must be that the population had already declined to very low numbers in 1969, lessening the competition with congeners when conditions further deteriorated. Winter mortality therefore relates to rainfall (and its correlates), but is also density-dependent.

A nice example of density-dependence is provided by Black-crowned Night Herons breeding in the Camargue, where the number of nests since 1967 varied between 230 and 940 (see Fig. 3). The numerical fluctuations closely follow the extent of the floodplains in the Inner Niger Delta (where many winter); for each extra 100 km² of floodplain, 3.6 nests of Night Herons were added to the local population. Population growth was largest after wet Sahel years (up to 50%) and when numbers were small to begin with (little competition). Declines were noticed after dry years, especially when the breeding population was large (much competition). The same combined impact of winter drought (measured by rainfall, rather than flood extent as used in Black-crowned Night Herons) and population size was found in the Sand Martin (Fig. 4).

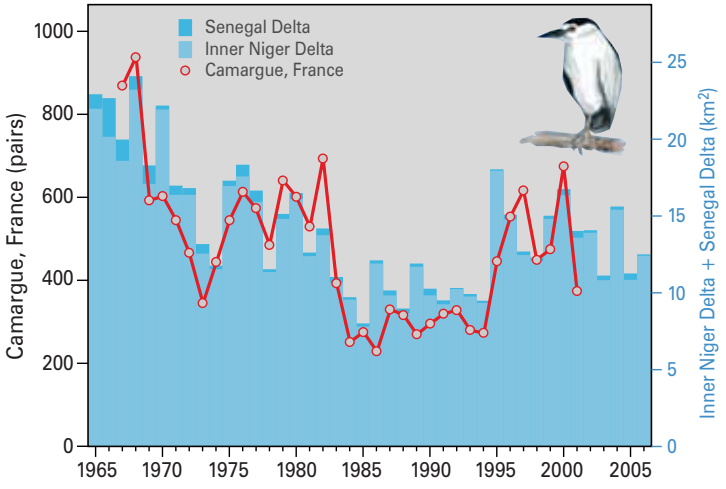


Fig. 3. Number of breeding pairs of the Black-crowned Night Heron in the Camargue (left-hand axis), compared with the maximum flood extent in the Senegal Delta and Inner Niger Delta in the preceding winter (right-hand axis).

Populations of various other wetland birds, such as Purple Heron and Sedge Warbler, have increased since 1995 - just as the Night Heron - when floodplains recovered from drought-related reductions in the 1970s and 1980s. The presumed increase of bird exploitation in Africa and habitat degradation on the breeding grounds, have apparently - generally speaking - a much smaller impact on these species.

CONTINUOUS DECLINE

The vicissitudes of wetland-inhabiting long-distance migrants depend largely on the meteorological and hydrological conditions in their wintering area. If corrected for that, the apparent long-term decline in

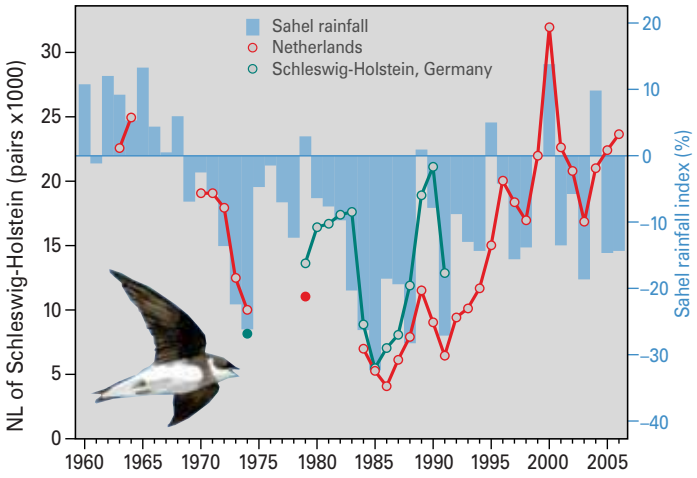


Fig. 4. Numbers of breeding pairs of Sand Martins in Schleswig-Holstein (northern Germany) and The Netherlands showed wide fluctuations (left-hand axis. The trends are highly synchronised and are related to rainfall in the Sahel in the preceding winter (blue bars; right-hand axis).

these species disappears. This is very different in migrants wintering in savanna and wooded savanna: the decline remains, independent of rainfall.

The Wryneck declined with 75% between 1965 and 1990 across Europe. Thereafter, the population remained stable, albeit at a low level. The decline was steepest during the drier Sahel years. Small recoveries have been noted in the few years with an above-average rainfall in the Sahel, but such small upsurges were insufficient to prevent a collapse of the population.

An even longer time series is available for the Common Redstart. Since 1911 nestbox occupation has been monitored in The Netherlands. Initially, the Redstart was, after the Great Tit, the most common bird species, occupying 30% of the boxes. During the 20th century this has gradually decreased to less than 1% since 1970. Concomitant changes in the breeding habitat may also have played a role, but similar trends were found in farmland, orchards, gardens and forests elsewhere in The Netherlands, Switzerland and Germany. Based on ten long time series from West and Central Europe, the Redstart is supposed to have declined by 95% between 1940 and 2000 (Fig. 5). The average decline amounted to 4.7% per year, being largest in dry Sahel years but also evident during wet Sahel years. This shows that, beside Sahel rainfall, other factor(s) may be involved.

The Common Redstart in the Sahel is a bird of open savanna woodland. We frequently recorded the species in the Acacia forests in the Sahel. Redstarts must have lost a considerable part of their winter habitat due to deforestation. If so, we would expect the same trends in Olivaceous, Bonelli's and Subalpine Warbler, species occupying the same habitat in the Sahel. Bonelli's Warbler indeed show a decline, but trend data for the other species are lacking or of insufficient length. Redstarts clearly illustrate the point that long time series in monitoring schemes are of vital importance to understand long-term fluctuations in population size: the longer, the more reliable. Although Redstart numbers have been largely stable, or slightly increasing, during the last 20 years, the present population level is still ten times lower than 30-40 years before.

ARE NUMBERS OF LONG-DISTANCE MIGRANTS GOVERNED BY CONDITIONS IN THE BREEDING OR IN THE WINTERING AREAS?

If numbers of long-distance migrants fluctuate in synchrony with Sahel rainfall, the chances are pretty good that population size is determined in the wintering area. But what to think of steady declines partly

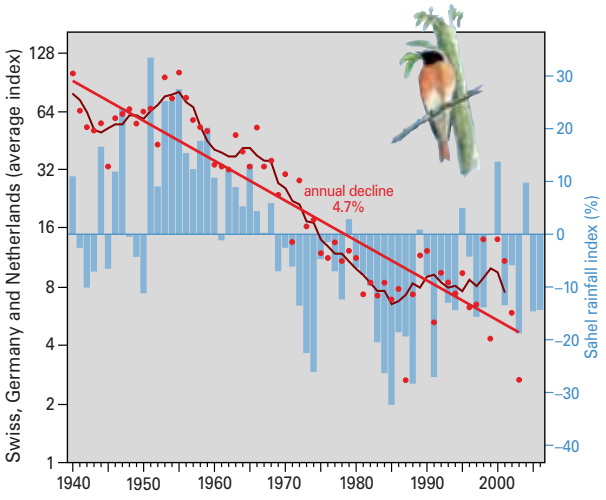


Fig. 5. Common Redstart trend in 10 study areas (forests, parks and orchards) in Switzerland, Germany and The Netherlands. The average in 1940 is set at 100, the other years are indexed relative to 1940. The black line shows the average decline as running mean, averaged over 9 years. The average annual decline amounts to 4.7% (red line). The decline can be compared with the rainfall in the Sahel (blue bars; right-hand axis). The decline was steeper after a dry Sahel winter, and less so after a wet Sahel year. NB: population size on the left-hand axis is presented on a logarithmic scale.

or wholly irrespective of rainfall in the Sahel? Are then conditions in Africa still at the core of the observed trend direction, as plausible for Redstart (deforestation), or are problems on the breeding grounds to blame? This question is relevant because so many long-distance migrants are in rampant, and continuous, decline in the past decades. This surely hints at a common denominator in Africa.

One of these species is the Back-tailed Godwit. More Godwits are shot in Africa during dry winters, but this has no impact on the population trend in NW Europe. Much more important is the intensification of farming in Europe: very few Godwits are able to produce fledglings in the intensively managed grasslands of Western Europe, where the majority of the nominate race breeds. It is saying a lot that 30% of the ringed Dutch Black-tailed Godwits recovered in Africa in the 1950s and 1960s were in their first year of life, against not a one since 1990. This explains why Black-tailed Godwit numbers in Senegal and Guinea-Bissau (where the NW European birds spend the winter) have declined by 80%, whilst the birds in the Inner Niger Delta (where East-European birds winter, a population much less subjected to changes in farmland) remained largely stable.

Of the European species wintering in the Sahel and adjacent vegetation zones, the Black-tailed Godwit may be an exception in that conditions on the breeding grounds have an overriding impact on trends. A comparison of trends in long-distance migrants depending more or less on the Sahel reveals that the Sahel has become a trouble zone. Of the 73 species wintering in the Sahel, 49 (67%) show a consistent decline. Migrants wintering further south fare better: only 9 of the 25 species showed decline in 1970-2005 (36%). The same pattern is found within species. In Swedish Chiffchaffs, the subspecies wintering in the Sahel shows a large decline, but the subspecies wintering in South Europe and North Africa is doing fine. Although the available studies are still inadequate to pinpoint the relative importance of changes on the breeding and wintering grounds, and in between, on bird numbers, the overwhelmingly poor performance of long-distance migrants is a telling story. More than one factor may be involved, but Africa (notably the Sahel) most likely plays a key role.

Of the bird species wintering in Africa there was a decline in 70% of the birds breeding in western Europe, but only in 20% of eastern European birds (Fig. 6). Obviously, this may be attributed to the large change in the landscape in West Europe

compared to the (still) small changes in East Europe. But that is not the entire story. The majority of the birds from eastern Europe spend the winter in the eastern Sahel (and southward to South-Africa), and most birds from West Europe in the western Sahel (Fig. 7). The western Sahel is more densely populated and the landscape has also changed more. This is likely a major, additional explanation why long-distance migrants from West Europe are more often in decline than their congeners from east Europe.

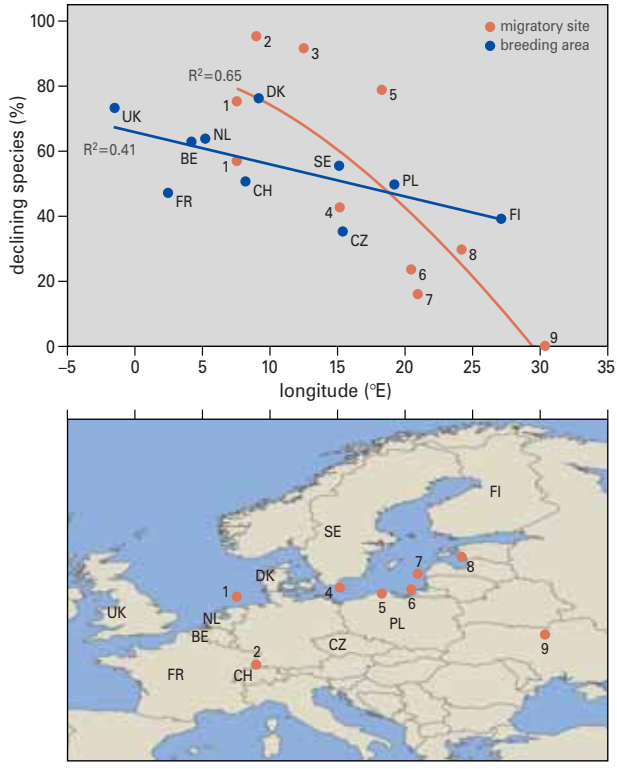


Fig. 6. Many long-distance migrants wintering in Africa have declined between 1950 and 2007, but the proportion of long-distance migrants in decline is smaller in East than in West Europe. Blue symbols refer to breeding populations in ten countries (abbreviations; see map), red symbols to numbers captured in a standardised way during the spring or autumn migration (figures; see map).

Fig. 7. Long-distance migrants from West Europe on average have a more westerly distribution in the Sahel than those from East Europe; the extent of overlap various between species. This may be illustrated with recoveries south the Sahara of Glossy Ibis (left; including some recoveries north of the Sahara) and the Eurasian Marsh Harrier (right).

WHY SOME LONG-DISTANCE MIGRANTS SHOW AN INCREASE

Not all long-distance migrants wintering in Africa are in decline. Six species show a clear increase, which can be accounted for by species-specific responses to the impact of man's activities:

- The upsurges in species like Little Egret, Osprey, Eurasian Marsh Harrier and Montagu's Harrier are recoveries from depletion in the past (due to persecution and use of pesticides), effectuated by legal protection and bans on the use of organochlorines in farming. Moreover, the lower hunting pressure on White Storks and Ospreys in North Africa and South Europe improved the annual survival rate.
- Although the Osprey is doing poorly in Sahelian wetlands, this has no impact on the population level since the large majority winters along the West African coast.
- The European Spoonbill in NW Europe has increased from 150 to 2500 pairs in the past 40 years. Wintering numbers in the Senegal Delta remained stable, but the number of birds wintering on the Banc d'Arguin (Mauritania) boomed, and an increasing number of Spoonbills nowadays remains in SW Europe to winter. Other species, such as White Stork, Eurasian Marsh Harrier and Little Egret, also increasingly winter in Europe rather than in Africa, profiting from warmer winters, new food supplies and better protection.

Hence, the increase of these six long-distance migrants is not related to circumstances in the Sahel, but rather to changes elsewhere. A flexible migratory strategy may be profitable.

Year-round protection of migratory bird species

EFFECTIVE BIRD PROTECTION IN THE SAHEL

Effective protection of migratory bird species demands safeguarding breeding and wintering areas, and - if necessary - also stopover sites used during migration. But how to protect our migrants in Africa? Certainly not by, as now occurs with our support, embanking floodplains and constructing dams in rivers. Also, not by, again with western support, planting non-indigenous tree species which are largely avoided by Palearctic migrants (which would, instead, profit from the restoration of indigenous forests).

The construction of dams and dikes in the Senegal River, made possible with western support, converted the floodplains in the Senegal Delta into large rice polders. However, at the same time two large bird sanctuaries were delineated where protection was (and is) enforced. These reserves harbour huge numbers of Palearctic migrants, beside large colonies of African waterbirds. Although Black-tailed Godwits and Ruff have nearly disappeared from the Senegal Delta, many other species are still present in large numbers.

Another example of successful protection refers to the Black-headed Heron in North Cameroon. This African species breeds in colonies of some dozens up to 150 nests, but in the village Andirni the local colony increased well beyond that number; in 2001 even 2479 nests were counted! This was possible through the active involvement of wardens of the nearby Waza National Park living in this village. Their presence guaranteed an undisturbed breeding site, something not to be found in the wider surroundings, not even in the Waza National Park itself. Protection is also the key to success in two flood forests in the Inner Niger Delta, where up to 80,000 breeding pairs of 16 species (mainly Cattle Egret, egrets, Long-tailed Cormorants and other fish-eating species) are found in the Dentaka Forest alone. Nowadays, such sites are extremely rare in the Sahel, and - apart from a telling figure of the biological richness of the area, - it is a reminder of how few sites remain in the Sahel for birds to settle and nest without disturbance. These sites need constant vigilance in order to prevent the local populace from exploiting the colonies to extinction. On the other hand, it shows that if birds are offered protection, they respond immediately. Actual protection of our migrants in Africa is thus possible.

EFFECTIVE PROTECTION OF LONG-DISTANCE MIGRANTS IN EUROPE

Suppose that the Black-crowned Night Herons in the Camargue, due to habitat management, can exploit a larger number of breeding and feeding sites. Taking this opportunity may not automatically lead to a population increase, since population size in this species is mainly regulated by conditions on the African wintering grounds. For most long-distance migrants, the relative impact of the winter period on population fluctuations is unknown. Notwithstanding this lack of knowledge, it is obvious that effective protection of the breeding areas is necessary no matter what. The Black-tailed Godwit illustrates it all: despite huge efforts on the breeding grounds and along the migratory pathway, both in manpower and in money, the decline continues unabated, and even accelerates. Without a fundamental change in farming practices in NW Europe, the decline will continue.

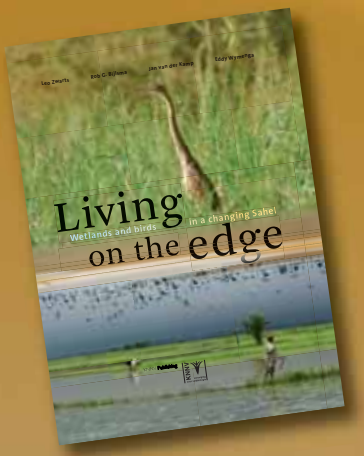

No matter how important the wintering area may be for the annual survival of birds, it is the breeding area where the offspring is raised. Without offspring, a population is doomed to extinction. A good example is the Black-tailed Godwit breeding in farmland. Large-scale changes in the West European grasslands have dealt a deathblow to Black-tailed Godwits. The above pictures, taken in Fryslân (northern part of the Netherlands), show a productive grassland with many flowers (already a far echo from the grasslands in the early 20th century, but good Godwit habitat) and a monoculture of a single-species, highly productive grassland where birds are almost completely absent and where successful breeding is anathema. The latter fields nowadays predominate.

Natura 2000 is an initiative of the European Union to create a network of sites in order to protect threatened habitats and species across Europe. It is not just paper work, since EU Members are obliged to take nature protection seriously. In total 194 (sub)species are protected by *Natura 2000*, listed in Appendix I of the European Bird's Directive. At least 50 of these winter in Africa south of the Sahara, of which 20 in wetlands (i.e. Glossy Ibis, Osprey, Great Snipe, Aquatic Warbler), 2 in forests (European Honey Buzzard and Levant Sparrowhawk), 20 in wooded savannas (*e.g.* Booted Eagle, European Nightjar, Barred Warbler, Lesser Grey Shrike) and 8 in savannas (*e.g.* Black Stork, Lesser Kestrel, Corn Crake, Tawny Pipit).

The success of *Natura 2000* depends on the selection of sites, and their subsequent management. However, to safeguard populations of long-distance migrants from declines, conservation of their breeding grounds is in itself inadequate. These birds live in multiple jeopardy, and protection of their wintering areas and stopover sites is just as important. This will prove to be an important challenge for future nature conservationists: bird protection does not stop at the borders of Europe but extends well into Africa.



Many tens of thousands of Ruff are annually captured in Mali; on the market of Mopti they are sold for 17 euro cent apiece. In the few weeks before their departure to Europe, they are in high demand due to their thick layer of fat. Since the captured birds have survived the rigours of winter, and thus belong potentially to those standing a good chance of returning to the breeding grounds, and most of them are females, this human predation can have a serious impact on the population level.



What have Greenlandic Wheatears, Siberian Ruff, Dutch Black-tailed Godwits, Kazakh Squacco Herons and Spanish Subalpine Warblers in common? At first sight, not much. Except that they spend the winter in Africa. Of the 500 species breeding in Europe, altogether 2 billion breeding pairs, a quarter cross the Sahara. These long-distance migrants fare badly compared with short-distance migrants and residents. Most species migrating to Africa show a – often catastrophic – decline, especially those wintering in the Sahel. Where have all the European Turtles Doves gone? What is going on south of the Sahara? Or are the changes in the breeding area to blame? This brochure summarises *Living on the edge: Wetlands and birds in a changing Sahel,* a book which deals with the vicissitudes of Eurasian birds wintering in the Sahel, set in a context of climate change and habitat degradation.