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Breeding Birds

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1. Introduction

Little Tern
(Photo: Jan van de Kam)

In addition to 10-12 million migratory birds, the Wadden Sea also supports large numbers of breeding birds. For several breeding bird species like Eurasian spoonbill *Platalea leucorodia*, oystercatcher *Haematopus ostralegus*, avocet *Recurvirostra avosetta*, Kentish plover *Charadrius alexandrinus*, common redshank *Tringa totanus*, lesser black-backed gull *Larus fuscus*, gull-billed tern *Gelochelidon nilotica* and sandwich tern *Sterna sandvicensis,* the salt marshes, dunes and outer sands of the Wadden Sea are among the most important breeding sites in Northwest-Europe. Several species are included in Annex I of the EU-Bird Directive or listed as Species of European Concern (SPEC). At national level, many Wadden Sea breeding birds represent an important share of national breeding bird populations and are listed as Red List species.

Monitoring of breeding birds in the Wadden Sea has been carried out by the Joint Monitoring Group for Breeding Birds (JMBB) in the framework of the Trilateral Monitoring and Assessment Program (TMAP) since 1991 (Fleet *et al.*, 1994; Melter *et al.*, 1997; Rasmussen *et al.*, 2000; Koffijberg *et al.*, 2006). The monitoring scheme currently focuses on 35 species that are considered characteristic of the Wadden Sea ecosystem. Common breeding birds (eight species) are counted annually in 103 representative census areas evenly distributed over all regions and habitats. Colonial and rare breeding birds (27 species) are difficult to survey with census areas, so they are counted by annual complete counts across the entire Wadden Sea. In the past, a total count of all species, including common species, has been carried out every five years (1991, 1996, 2001, 2006). However, the interval has now been changed to six years, so the next survey is due in 2012). The monitoring scheme aims to assess and detect population size, distribution and population trends in Wadden Sea breeding birds. Fieldwork is standardized and carried out according to trilaterally harmonized methods (Hälterlein *et al.*, 1995) by nearly 500 ornithologists, mainly consisting of staff of NGOs, governmental bodies, site managers and volunteers. A so-called Quality Assurance Meeting (QAM) is organized regularly to provide a platform for exchange of field experience among participants and for discussion of specific counting pitfalls (*e.g.* Blew, 2003).

This chapter presents an update of the QSR 2004 (Koffijberg *et al.*, 2005). It mainly focuses on trends in numbers of breeding birds 1991-2006 and highlights some recent developments and related management issues. Finally an evaluation of the targets of the Wadden Sea Plan (1997) is made and recommendations are given regarding monitoring, research and assessment of management issues.

2. Trends in breeding birds 1991 – 2006

The results presented here were derived from the data that currently are being processed for the next trilateral breeding bird report on the total count of 2006 (Koffijberg *et al.*, 2009). All trend analyses have been carried out with the commonly used package TRIM from Statistics Netherlands (Pannekoek and van Strien 1999). Significance was tested for $p < 0.05$ by use of a Wald test.

2.1 Overall trends

Reliable trend estimates are available for 29 species for a period of 16 years (other species were too rare to allow proper trend estimates). Between 1991 and 2006 nearly half of the monitored species (13) have been subject to declines (Table 1). Furthermore, 8 species have increased whilst 7 species have remained stable. Gull-billed tern, for which the Wadden Sea is the only known breeding site in Northwest-Europe, is the sole species for which no significant trend could be detected. Today, this species is only breeding in the Schleswig-Holstein part of the Elbe Estuary, where recorded numbers fluctuate, although not significantly.

The rate of population change differs between species (Figure 1). With 11 out of 13 declining species, the strongest declines have been observed in waders. Dunlin *Calidris alpina schinzii*, ruff *Philomachus pugnax* and common snipe *Gallinago gallinago* still teeter on the verge of extinction and might well disappear before the next total count in 2012. All three species have also suffered major losses in other parts of their breeding ranges (Zöckler, 2002; Thorup, 2006), and their Wadden Sea breeding sites (mainly in Denmark) are only maintained by taking specific conservation measures (Thorup, 2003). Declines in dunlin are especially worrying as the small population in the Wadden Sea is part of the vulnerable Baltic population of the subspecies *schinzii*.

Of the regularly breeding wader species, Kentish plover and great ringed plover *Charadrius hiaticula* show the highest rate of decline and have abandoned many breeding sites in the past decade. Both species are known to suffer from disturbance by beach recreation (Schulz, 1998; Tulp, 1998). In addition many temporarily used breeding sites (embankments, industrial areas) have been deserted as vegetation succession made habitat unsuitable to breed (Hälterlein, 1998). Besides, natural coastal dynamics – a prerequisite for creating suitable habitat for these species – is lacking at most sites due to coastal defense policies. Conservation measures (*i.e.* prevention of disturbance at potential breeding sites) have been carried out in several parts of the Wadden Sea, but failed to halt further declines. Kentish plover is still thriving only in Denmark, and hopefully further investigations will provide some clues as to what measures could improve the situation for both plovers. Furthermore, management measures in the 'Het Tij Geleerd' program in The Netherlands might be able to restore some of the coastal dynamics and provide new breeding opportunities.

Among the other wader species, black-tailed godwit *Limosa limosa* and Northern lapwing *Vanellus vanellus* have declined as well, demonstrating that the Wadden Sea does not always function as a 'last refuge' as has been suggested earlier (Rasmussen *et al.*, 2000). Even if breeding performance in the Wadden Sea is enhanced by less intensive farming (as shown e.g. on the island of Mandø in Denmark, which supports the best breeding site in Denmark), population trends in both species are highly dependent on the situation in agriculturally-managed marshland areas behind the seawall (Thorup and Laursen, 2008). Here, habitat changes due to intensification of farming and increased predation rates (see below) have had a serious impact on breeding birds. In Denmark, where the coastal marshes are part of the trilateral cooperation area, recent analyses show a decline of 60% in all breeding bird species, including six Annex 1 species that have disappeared recently (Laursen and Thorup, in press.).

Largest increases have been observed in a number of colonial breeding birds, notably Mediterranean gull *Larus melanocephalus*, great cormorant *Phalacrocorax carbo sinensis*, Eurasian spoonbill, lesser black-backed gull, great black-backed gull *Larus marinus* and common gull *Larus canus*. In particular, Mediterranean gull and Eurasian spoonbill have expanded their breeding range from the southwest to the northeast in the past decade and have colonized most parts of the Wadden Sea. In coming years, these species will probably extend their breeding range further north. Great cormorant has shown signs of stabilization in most inland colonies in Europe (Bregnballe *et al.*, 2003) but it still explores new breeding and feeding sites in the Wadden Sea. Only settlement in Denmark has been halted so far, as nests and eggs are controlled annually to prevent successful breeding and expansion of the population (Bregnballe and Eskildsen, 2009). Elsewhere, a lack of safe breeding sites (mainly islands) might become a limiting factor, resulting in a saturation of the current population level.

Table 1:
Summary of trends of breeding birds in the Wadden Sea in 1991–2006. Trend classification of significant trends is expressed as moderate increase (+), strong increase (++), stable (=), moderate decline (-) or strong decline (--). Non-significant trends are indicated by F ('fluctuating'). For 2001–2006 trends have been classified as increasing (INC) or declining (DEC= when difference in indices between 2001 and 2006 were >10%; changes of <10% have been classified as stable (STA). This classification merely gives an indication on recent developments. Not included are little egret, barnacle goose, Eurasian wigeon and pintail, i.e. species that have been added to the list of counted species recently.

Species	DK	SH	NI	NL	Wadden Sea 1991–2006	Wadden Sea 2001–2006 tendency
Great cormorant *Phalacrocorax carbo*			+	++	++	INC
Eurasian spoonbill *Platalea leucorodia*			++	++	++	INC
Shelduck *Tadorna tadorna*	+	+	=	=	+	INC
Common eider *Somateria mollissima*	+	-	+	-	=	DEC
Red-breasted merganser *Mergus serrator*					++	DEC
Hen harrier *Circus cyaneus*			+	-	=	DEC
Oystercatcher *Haematopus ostralegus*	=	-	+	-	-	STA
Avocet *Recurvirostra avosetta*	F	+	=	-	-	STA
Great ringed plover *Charadrius hiaticula*	-	--	--	=	-	DEC
Kentish plover *Charadrius alexandrinus*	+	--	-	-	--	DEC
Northern lapwing *Vanellus vanellus*	F	-	-	-	-	DEC
Dunlin *Calidris alpina schinzii*					-[1]	DEC
Ruff *Philomachus pugnax*					--[1]	DEC
Common snipe *Gallinago gallinago*					-[1]	DEC
Black-tailed godwit *Limosa limosa*	-	+	-	-	-	DEC
Eurasian curlew *Numenius arquata*			F	-	-	DEC
Common redshank *Tringa totanus*	+	=	-	-	-	DEC
Turnstone *Arenaria interpres*	too rare to allow trend classification					
Mediterranean gull *Larus melanocephalus*				+	++	INC
Little gull *Larus minutus*	too rare to allow trend classification					
Black-headed gull *Larus ridibundus*	F	=	=	=	=	DEC
Common gull *Larus canus*	+	+	++	=	++	STA
Lesser black-backed gull *Larus fuscus*	++	++	++	++	++	STA
Herring gull *Larus argentatus*	+	=	-	-	-	DEC
Great black-backed gull *Larus marinus*	F	++			+	DEC
Gull-billed tern *Gelochelidon nilotica*	-	+	-		F	DEC
Sandwich tern *Sterna sandvichensis*	F	-	F	+	=	INC
Common tern *Sterna hirundo*	--	=	-	=	-	DEC
Arctic tern *Sterna paradisaea*	=	=	=	=	=	DEC
Little tern *Sterna albifrons*	+	=	=	+	=	DEC
Short-eared owl *Asio flammeus*			=	-	=	DEC

[1] trend classification not possible due to lack of data; classification is based on results of the surveys in 1991, 1996, 2001 and 2006.

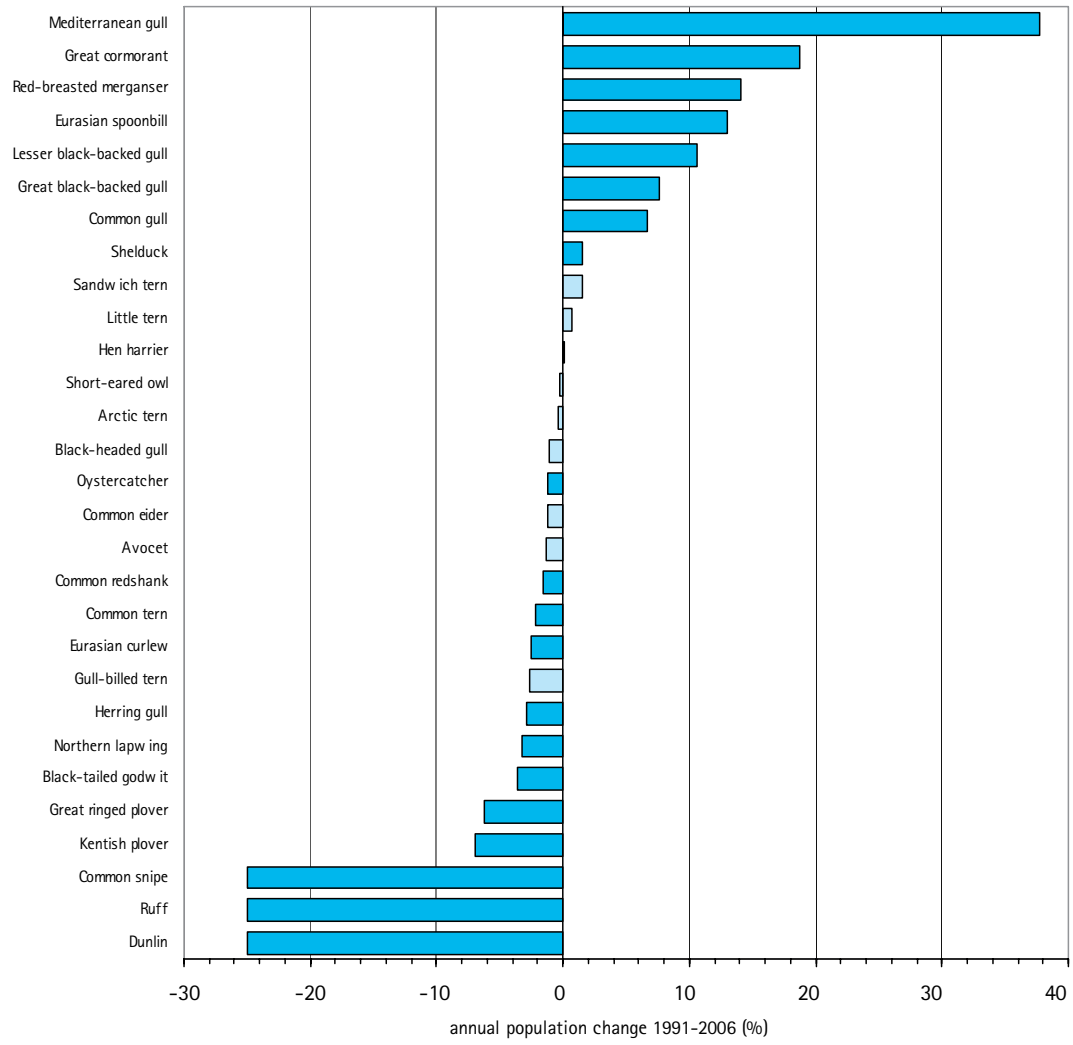

Figure 1: Trends in breeding birds 1991–2006, expressed as the rate of annual population change (in %). Non-significant changes are marked light-blue. Population changes in common snipe, ruff and dunlin are estimated from the data of the total counts 1991, 1996, 2001 and 2006.

2.2 Recent developments

For many species, the trends in 1991-2006 are consistent throughout the whole 16-year period. However, changes in indices between 2001 and 2006 suggest that some formerly thriving species or species with a long-term stable trend are tending to decline recently. This especially applies to common eider, arctic tern *Sterna paradisaea* and little tern *Sterna albifrons*. All three species have shown nearly annual declines since 2001, and their populations have suffered losses of 20-40% in the last five years. In common eider, downward trends have been reported already for a longer term in the important breeding areas in The Netherlands, due to limited mussel stocks that were depleted by fisheries (see below). The small populations of red-breasted merganser, gull-billed tern and great black-backed gull have tended to go down as well recently, but numbers are rather small and it is not clear if the observed trends are part of natural fluctuations or indicate a structural decline. On the other hand, rates of decline in oystercatcher and avocet have been lower from 2001 onwards, indicating that the long-term negative trend in these species seems to have leveled off. Increases in common gull and lesser black-backed gull have leveled off as well, suggesting that existing colonies are at saturation level and that perhaps density-dependent factors are starting to operate.

2.3 Regional differences in trends

Given the large geographical range and differences in management, it is not surprising that many species do not show comparable trends within the four sections of the Wadden Sea (Table 1, Figure 2). Regional differences in trends are important in several aspects. They might provide a first clue

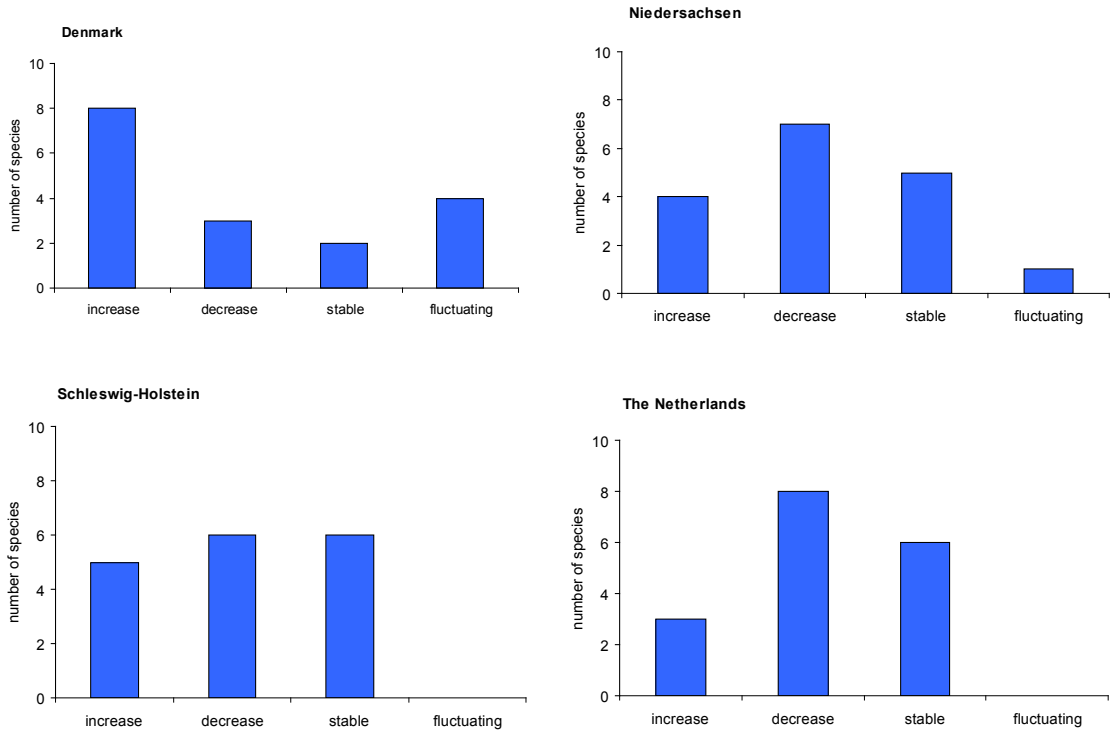

Figure 2: Summary of regional trends 1991–2006. Given is the number of species in each trend category for the four respective Wadden Sea countries. 'Fluctuating' represents non-significant trends. Only species that occur in relevant numbers in all four countries have been included (N = 17).

about the mechanisms that have caused bird populations to decline, especially when also comparing breeding success in the next years (after implementation of this parameter in TMAP has been completed). When analyzing the 17 species that breed all over the Wadden Sea, it is obvious that most populations breeding in the Danish Wadden Sea are generally doing well. The large number of fluctuating trends in this section of the Wadden Sea is probably a result of the small size of the Danish part of the Wadden Sea (and thus smaller breeding populations in many species). In the other three sections of the Wadden Sea different developments are more or less balanced, although in Niedersachsen and The Netherlands declining species are clearly dominating.

In most species no specific pattern in regional trends could be detected. However, remarkable differences in regional trends were found in oystercatcher (increase in Niedersachsen, declining or stable numbers elsewhere), great ringed plover (stable in The Netherlands, declining elsewhere) and Kentish plover (increase in Denmark, declining elsewhere). All three species are declining on the scale of the Wadden Sea. Furthermore, a south-north gradient appears in population trends of shelduck (increasing to stable towards the north), avocet (declining to increasing, apart from small fluctuating population in Denmark) and herring gull (declining to increasing). Further analysis is necessary to unravel the mechanisms causing these patterns.

2.4 Comparison with the QSR 2004

The last QSR 2004 (Essink *et al.*, 2005) included a trend assessment of Wadden Sea breeding birds for 1991-2001. In several species, recent developments have caused trends to change when looking at the whole 1991-2006 period and decreases

have become more pronounced (Figure 3). This is mainly due to negative trends in populations of oystercatcher and avocet. Even if the rate of decline has tended to level off recently, populations in both species have declined by 20-30% since 1996. Common redshank has changed its previous status as stable into a declining trend, mainly as a result of declines of up to 40-50% in The Netherlands and Niedersachsen in some recent years. Besides, former increases in arctic tern and little tern have now turned into stable trends, with a recent tendency to decline (see previous section). Thus, several typical Wadden Sea breeding birds, including Annex 1 species (avocet, arctic tern, little tern) and/or species that breed in the Wadden Sea in internationally important numbers (oystercatcher, common redshank) are currently showing negative trends. Of the 14 Annex 1 species breeding in the Wadden Sea, five species show a long term decline, and an additional four species show a recent tendency to decline. Hence, the conservation status of many breeding birds has become worse compared to QSR 2004.

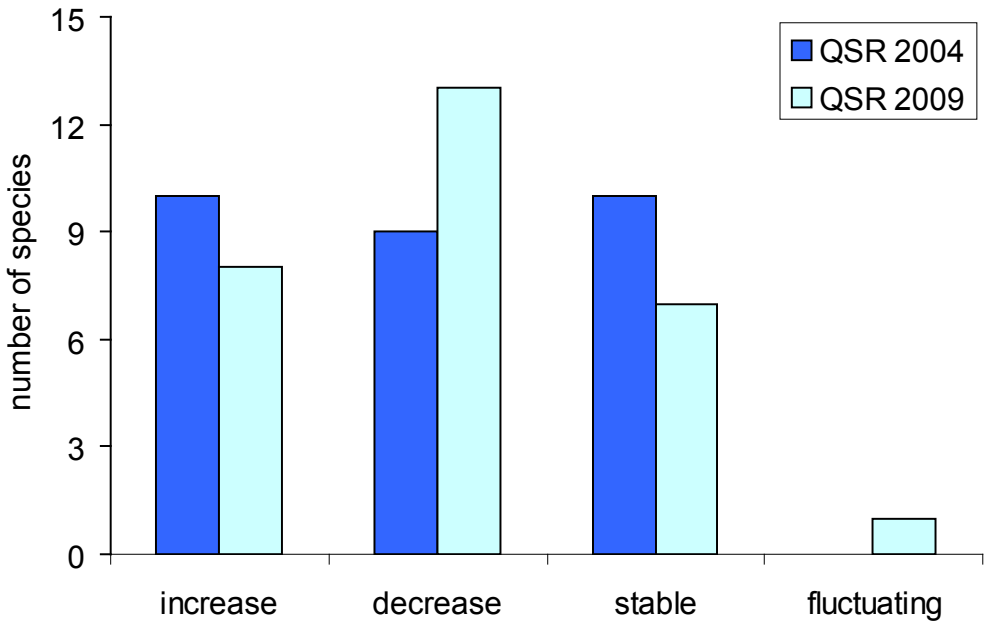

Figure 3: Summary of trends in the Wadden Sea based on assessment in 1991–2001 (QSR 2004) and 1991–2006 (QSR 2009). Compared to the previous QSR, negative trends have become more pronounced.

3. Target evaluation

The current Wadden Sea Plan (1997) puts forward two targets that are considered relevant for breeding birds: (1) favorable food availability and (2) natural breeding success. Two other bird targets, natural flight distances and sufficiently large and undisturbed moulting sites, are aspects that are mainly dealt with in migratory and wintering birds (see Laursen *et al.*, 2009). Being designed as a monitoring scheme, the data from the breeding bird surveys provide excellent information on the state of the Wadden Sea breeding birds, but they do not always provide information on the mechanisms that have caused bird numbers to change. Hence, it is mainly specific research carried out in the past decade, triggered by reports on declines, that has pointed at some processes going on in the Wadden Sea.

Regarding the target favorable food availability, especially shellfish-eating birds received much attention, particularly because of declines in the Dutch Wadden Sea in the 1990s. For oystercatcher and herring gull *Larus argentatus*, downward trends in breeding birds also coincide with negative trends observed in migratory birds (that are part of the same population dealt with in the breeding birds' scheme). Migratory and wintering common eider *Somateria mollissima* have been subject to declines as well, although only breeding bird numbers in the Netherlands (i.e. the core breeding area within the Wadden Sea) have gone down significantly so far. All three species have suffered from the limited stocks of food. This especially applies to blue mussels *Mytilus edulis* in the Dutch Wadden Sea, that were depleted mainly by shellfish fisheries at the beginning of the 1990s (Desholm *et al.*, 2002; Rappoldt *et al.*, 2003; Ens *et al.*, 2004; Leopold *et al.* 2004; Verhulst *et al.*, 2004; Kats 2007). In the eastern part of the Dutch Wadden Sea some recovery of mussel beds has been observed recently, but overall stocks remain much lower than before 1990 and a population recovery in shellfish eating (breeding) birds has not been observed so far. For oystercatcher, Van de Pol *et al.* (2007) have also shown that the chance of flooding (due to more stormy weather) in the breeding season has increased and has had a negative impact on breeding performance. This clearly demonstrates the possible impact of changing weather patterns as part of global climate change (also affecting other breeding birds breeding on the fringe of water and land). In herring gull, the general abandonment of open rubbish dumps will have contributed to the negative trend as well (Koffijberg *et al.*, 2006). Apart from the rather well-investigated shellfish-eating birds, the role of available food stocks in other species groups is largely unknown and has not been investigated in detail so far. In shellfish-eating birds, the long-term decline and low current population level demonstrate that their conservation status is not satisfactory at the moment.

Breeding success is another important target in assessing the status of breeding birds. An important issue that has been pointed at in several recent assessments is the lack of breeding success due to presumed high predation rates. Declines in avocet at least for some sites in Niedersachsen and the eastern Wadden Sea in The Netherlands, seem to be associated with low reproduction rates due to high predation risk, mainly of red fox *Vulpes vulpes* (Willems *et al.*, 2005, de Boer *et al.*, 2007; Melter and Vaas, 2008). Predation is also know to play a role in common redshank (Thyen *et al.*, 2005), black-headed gull (Oltmanns, 2003; Koffijberg *et al.*, 2006) and common tern *Sterna hirundo* (Dijksen and Koks 2003), and also has contributed to the declines in many farmland-breeding waders (Teunissen *et al.*, 2005; Langgemach and Bellebaum, 2005, Thorup and Laursen, 2008). But, its impact at Wadden Sea scale is not clear as breeding success has not been monitored yet and specific studies to quantify predation rates in the Wadden Sea are scant. Birds breeding on the mainland coast are especially susceptible to predation, as usually important mammalian predators like red fox or mustelids are absent on most islands. This probably also explains that species like avocet and black-headed gull are doing better on island-breeding sites (trend 1991-2006: stable) than along the mainland coast (trend: 1991-2006 decline). However, in common redshank only, trends in Niedersachsen differ from the expected pattern (stable on islands and declining mainland), but at the scale of the entire Wadden Sea, populations both on islands and along the mainland coast are going down. Trends in common tern are opposite the picture that would be expected from predation risk: populations on the mainland coast are performing better than those on islands. In this species, food availability might be a better explanation for the observed trends (Brenninkmeijer *et al.* 1997; Stienen *et al.*, 2009; cf. recent declines in arctic tern and little tern), but again, this aspect has not been investigated in detail. Breeding on the fringe of land and water, terns are also susceptible to flooding during the breeding season, as has been demonstrated frequently for breeding sites like the island of Griend in the Dutch Wadden Sea (Stienen *et al.*, 2009; cf. oystercatcher mentioned previously).

Breeding success is an important parameter that has not been monitored trilaterally so far. Hence, a proper evaluation of the target for natural breeding success is not possible yet. The pilot project 1996-97 (Exo *et al.*, 1996; Thyen *et al.*, 1998) showed the importance of this parameter and previous QSR have recommended that breeding success should be monitored (de Jong *et al.*, 1999; Essink *et al,.* 2005). Therefore, the recent decision to include monitoring of breeding success as a parameter in TMAP is a major advance. It will be fully implemented in the breeding season of 2010, but some fieldwork has already started in 2009. In The Netherlands, a monitoring program on breeding success has been carried out since 2005, initially as part of an investigation of shellfish-eating birds (Willems *et al.*, 2005) and now in the framework of a governmental monitoring and research project (de Boer *et al.* 2007). For three of the six species surveyed in The Netherlands (oystercatcher, avocet and herring gull), it was shown that downward trends observed in these species in the Dutch Wadden Sea are indeed triggered by a poor breeding performance. Extension of monitoring of breeding success to other parts of the Wadden Sea would enable a better insight into the mechanisms that cause changes in breeding bird populations (and e.g. the role of predation). It would also help to build understanding of regional differences in the patterns observed and their possible links to management issues or other TMAP parameters like contaminants in bird eggs (Becker and Muñoz-Fuentes, 2004).

4. Conclusions and Recommendations

4.1 Summary and conclusions

Analyses of trends of Wadden Sea breeding birds in 1991-2006 show that 13 of the 29 analyzed species are in decline. Recent counts suggest that (further) declines also occur in common eider, arctic tern and little tern. Declining trends are most obvious in waders: 11 of 13 declining species are in this group and they include both salt marsh breeding species like oystercatcher, avocet and common redshank and more farmland-dependent species like Northern lapwing and black-tailed godwit. Dunlin, ruff and common snipe have nearly gone extinct and their survival is mainly dependent upon management of their remaining breeding sites in Denmark. Backgrounds of the observed trends are only partly known. At least in some species it has been demonstrated that breeding success has been low for many years, but as breeding success has not been monitored trilaterally so far its impact on Wadden Sea level can not be quantified. Depleted food stocks have had a negative impact on especially shellfish-eating species (common eider, oystercatcher and herring gull), but to what extent other species are also affected by food availability is unknown. In Kentish plover and great ringed plover, disturbance caused by outdoor recreation and habitat changes are important limitations that prevent a recovery from the long-term declines observed in both species. At least at local scale, some species have suffered an increase in predation rates (notably avocet, but possibly also other species breeding on the mainland coast), demonstrating how important it is to keep islands free from mammalian predators. The impact of other factors, like changes in salt marsh management, climate change and/or changes in the Wadden Sea ecosystem are largely unknown yet. Compared to the QSR 2004, negative trends have become more dominant, suggesting that the conservation status in many species has become worse recently. The evaluation of the targets of the Wadden Sea Plan shows that at least some shellfish-eating breeding birds are affected by less favorable food availability. Breeding success has not been monitored yet, but at least in some declining species it has been demonstrated in national schemes that declining populations are associated with a poor breeding performance.

4.2 Recommendations

Following recommendations in previous QSR, incorporation of the parameter of breeding success in TMAP in 2009-2010 is one of the most important achievements in breeding bird monitoring in the past decade. It will produce a major gain in knowledge of the backgrounds of changes in bird populations and the cause of the recent declines in many species. Furthermore, following collaboration between the responsible ministry, fishery societies and NGOs, changes have been made to working practices in shellfish (mussel) fisheries in The Netherlands in 2009. These aim to produce a sustainable method of mussel exploitation for human use without affecting food stocks for shellfish-eating birds and to increase the likelihood of mussel beds recovering. For future management, monitoring and research the following measures are recommended:

4.2.1 Management and conservation

- Improve conservation status of beach-breeding species (Kentish plover, great ringed plover, little tern) by prevention of disturbance from outdoor recreation;
- Improve a more bird-friendly management of the most important agriculturally-managed marshland areas behind the seawall;
- Prevent increase of predation risk at island breeding-sites by reducing the possibilities of ground predators reaching the islands (e.g. when improving dams);
- Adapt targets in the Wadden Sea Plan to the conservation objectives in the EU Birds and Habitats Directives;
- Data collection in monitoring of changes in shellfish fisheries;
- Data collection in conservation measures taking place in dune areas.

4.2.2 Monitoring and research

- Initiate studies that deal with salt marsh management and its impact on breeding birds, i.e. link data from different TMAP parameters to get insight into what extent changes in salt marsh vegetation (and management) affect breeding bird densities;
- Initiate studies to assess the current decline in terns, mainly by involving data series on fish monitoring;
- Encourage ringing of breeding birds in the Wadden Sea to enable assessment of mortality rates, emigration and immigration, and their role in population declines.

Furthermore, in coming years years, a system of so-called alert limits will be established. So far, presentation of trend data has been quite basic, using simple symbols to indicate declining, sta-

ble, increasing and fluctuating populations. This approach requires some general knowledge of population dynamics in breeding birds. Moreover it is sensitive to annual variation in numbers as it does not take into account the species' biology. In the United Kingdom, alert-limits have been established successfully to indicate trends in bird numbers and initiate conservation action that has to be taken when alerts are flagged (Atkinson et al., 2006). Alerts are pre-defined trend classifications that express population changes within certain time-windows (e.g. 5, 10 or 25 years). When declines exceed certain threshold values (e.g. 25 or 50%), an alert is flagged. Alerts are flagged for short- and long-term changes. Moreover biological filters can be applied to analyze a species' biology (e.g. short- versus long-lived). The use of alerts will be introduced along with regular updates of

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