Breeding Birds in the Wadden Sea in 2001

Results of the total survey in 2001 and trends in numbers between 1991 and 2001

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Colophon

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Trilateral Monitoring and Assessment Group

Joint Monitoring Group of Breeding Birds in the Wadden Sea

Contents

Editorial Foreword

With the publication of this report, it is the third time that a complete breeding bird survey of the entire Wadden Sea is presented in the framework of the Trilateral Monitoring and Assessment Program (TMAP) by the Joint Monitoring Group of Breeding Birds in the Wadden Sea (JMBB). The results of the first complete survey of breeding birds in the entire Wadden Sea, undertaken in 1990, were published in 1994 as the first issue; the results of the second complete survey of breeding birds in the Wadden Sea, carried out in 1996, were published in 2000 as the tenth issue of the publication series 'Wadden Sea Ecosystems' edited by the Common Wadden Sea Secretariat (CWSS).

The present Wadden Sea Ecosystem No. 22 includes the results of the 2001 total survey and the comparisons to the first and second surveys, ten respectively five years ago. This report reflects the fact that the joint breeding birds monitoring program has been operational for a long period of time, allowing for the analysis of long-time series. The next total count, the fourth one, is being carried out in 2006.

We would like to thank all those who contributed to the surveys and the report such as the field workers and organizations involved, the authors and, in particular, Kees Koffijberg and Lieuwe Dijksen. Only their continuous work input and enormous effort in handling the data set, evaluating the data and compiling the text and numerous figures together with Bernd Hälterlein, made this report possible.

Bettina Reineking
Common Wadden Sea Secretariat

July 2006

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The Joint Monitoring Group of Breeding Birds in the Wadden Sea

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June 2006

Summary

Outline and methods

The Wadden Sea ranks among the most important breeding areas in Western Europe for many coastal breeding birds, several of which are rare and threatened and listed as Annex I species and *Species of European Conservation Concern (SPEC)* under the EC Birds Directive. Trilateral monitoring of breeding birds is included in the framework of the *Trilateral Monitoring and Assessment Program (TMAP)* within the framework of the trilateral Wadden Sea cooperation between Denmark, Germany and the Netherlands. It is co-ordinated by the *Joint Monitoring Group of Breeding Birds (JMBB)* and focuses on 31 breeding bird species that are considered characteristic for the biodiversity in the Wadden Sea and which represent indicator species for monitoring the two targets concerning breeding birds addressed in the Wadden Sea Plan (favorable food availability and natural breeding success). Most of these species rely on the intertidal mud flats for feeding. The monitoring scheme aims to assess population sizes as well as distribution and trends for breeding birds throughout the Wadden Sea. Attention is also directed toward (1) impact of climate change; (2) response to contaminants that affect fitness of breeding birds; (3) impact of fisheries; (4) impact of recreational activities and (5) impact of agricultural changes (*e.g.* grazing) on salt marshes as natural breeding habitats for breeding birds.

Data collection varies among the 31 species monitored. Rare and colonial breeding birds, usually breeding concentrated in few areas and easily displaced from year-to-year, are covered annually in the entire Wadden Sea (*i.e.* the so-called 'Wadden Sea Area'; Figure 1). More abundant species are counted in 103 census areas that are representative for the Wadden Sea habitats (Figure 2). Once every five years, this category of species is also counted in the entire area. 'Total counts' were carried out in 1991, 1996 and 2001, the fourth one will be in 2006. Thus, once every five years, a complete overview of distribution patterns becomes available, whereas trend analyses focus on the annual censuses of rare and colonial breeding birds and common species in census areas. Fieldwork is standardised and follows trilateral guidelines described in a manual. Regular so-called 'Quality Assurance Meetings' are organised in order to test different census techniques, assess between-counter differences and train observers. Contributors to fieldwork are mainly volunteers, staff from site-managers and semi-governmental or governmental agencies (see Table 1 for details on co-ordination). This report aims to give feedback on the last total count in 2001 and is the third in a series of similar reports. It focuses on populations and distribution in 2001 and trends in populations between 1991 and 2001. Results are shown on a general level to give quick access to the data (chapter 3) as well as on species-level to highlight species-specific patterns (chapter 4).

Breeding bird populations in 2001

The total survey in 2001 recorded an overall number of 469,000 breeding pairs or territories (Table 2).

Nearly 70% of the breeding bird population is represented by gulls, with Black-headed Gull *Larus ridibundus*, Lesser Black-backed Gull *Larus fuscus* and Herring Gull *Larus argentatus* being most abundant species. Another 18% of the population are coastal waders, notably Oystercatcher *Haematopus ostralegus*, Avocet *Recurvirostra avosetta*, Northern Lapwing *Vanellus vanellus* and Common Redshank *Tringa totanus*. Among the rare breeding birds are Dunlin *Calidris alpina schinzii* and Ruff *Philomachus pugnax*, which have been subject to long-term declines and currently balance at the verge of extinction in the Wadden Sea. For 21 out of 31 species, the population in the Wadden Sea accounts for more than 1% of the NW-European population, nine of which are

Annex I species of the EC Birds Directive (Table 2, Figure 74). In an international context, the Wadden Sea represents a core breeding area for Eurasian Spoonbill *Platelea leucorodia*, Avocet, Gull-billed Tern *Gelochelidon nilotica* and Sandwich Tern *Sterna sandvicensis,* each supporting 33% to even 100% (Gull-billed Tern) of the NW-European population. For some scarce species like Red-breasted Merganser *Mergus serrator,* Mediterranean Gull *Larus melanocephalus* and Little Gull *Larus minutus*, the Wadden Sea is situated at the fringe of the European breeding range. Hence, breeding occurs in low numbers or irregularly. Many species (21 out of 30) prefer island breeding sites (Figure 9). This especially applies to colonial breeders like Great Cormorant *Phalacrocorax carbo*, Eurasian Spoonbill, gulls and terns as well as Hen Harrier *Circus cyaneus* and Short-eared Owl *Asio flammeus*. Occurrence of the latter two species is mainly associated with dune areas in the western Wadden Sea. Populations of Avocet, Great Ringed Plover *Charadrius hiaticula*, Kentish Plover *Charadrius alexandrinus*, Gull-billed Tern, Northern Lapwing and Black-tailed Godwit *Limosa limosa* mainly concentrate along the mainland coasts. Higher disturbance rates on islands (Kentish Plover and Great Ringed Plover on the beaches) and lower predation risk on islands due to the absence of large mammalian predators are probably important explanations for this pattern, as well as variation in available breeding and feeding habitat.

Overall trends 1991-2001

Overall trends in the Wadden Sea from 1991 to 2001 show significant population increases in 10 out of 31 species (Table 3). A comparison of Annex I-species of the EC Birds Directive and non-Annex I-species shows that the average trend in the latter group remained stable after 1996, whereas non-Annex I-species have further increased (Figure 11). The highest overall increase rates from 1991 to 2001 have been observed in Great Cormorant, Great Black-backed Gull *Larus marinus*, Eurasian Spoonbill, Lesser Black-backed Gull *Larus fuscus* and Mediterranean Gull (Figure 10). Nearly all these species have expanded their geographical breeding range in the past decade and also data collected after 2001 point at further increases. For many species, upward trends have been consistent over the entire period of 11 years. Only for Common Eider *Somateria mollissima* and Arctic Tern *Sterna paradisaea* were declines reported after 1996. For Common Eider this especially involved the large populaton in the Dutch part of the Wadden Sea.

Significant declines in the period from 1991 to 2001 have occurred in nine species, among them Great Ringed Plover, Kentish Plover, Northern Lapwing, Black-tailed Godwit, Common Tern *Sterna hirundo* and Herring Gull *Larus argentatus*. Dunlin, Ruff and Common Snipe experienced declines as well, and the first two species have become nearly extinct as breeding birds in the Wadden Sea. Great Ringed Plover and Kentish Plover have continued their downward trend after 2001. For Northern Lapwing, Black-tailed Godwit and Herring Gull, numbers recorded after 1996 indicate stabilisation. Common Tern has partly recovered from previous declines as well, except in the Netherlands, where its numbers decreased further until 2004.

Regional differences in trends

In several species, the trends observed are consistent throughout the Wadden Sea, and often in line with trends in neighboring countries, suggesting large-scale factors operating at population level. Examples are Great Cormorant, Common Gull *Larus canus*, Lesser Black-backed Gull, Arctic Tern and Little Tern *Sterna albifrons*. On the other hand, contrasting trends are found in the different sections of the Wadden Sea. A comparison of trends in 16 species which are abundant in all regions reveals that in the northern sections of the area, in Denmark and Schleswig-Holstein, upward trends dominate, and declines have been reported only for the few species that were stable or increased elsewhere in the Wadden Sea (Figure 12). In Niedersachsen and the Netherlands more species went down in numbers, *e.g.* Avocet, Herring Gull (both countries), Common Redshank (Niedersachsen), Hen Harrier, Oystercatcher, Black-headed Gull and Short-eared Owl (all Netherlands). Furthermore, Common Eider, which has small populations in Denmark, Schleswig-Holstein and Niedersachsen and increased in the 1990s, has shown a sharp decline in the main core breeding areas in the Dutch Wadden Sea since 1998. Backgrounds for these contrasting trends are not known in detail for all species, but might be associated with differences in national management policies, *e.g.* towards shellfish-fisheries (see below).

Some trends explained

Being a monitoring scheme, the surveys of breeding birds primarily aim to reveal trends in numbers, rather than giving sound evidence for their causes and backgrounds. To unravel underlying causes for the trends observed, more information regarding *e.g.* breeding success and mortality rates would be necessary. However, both parameters are not yet covered in TMAP. In addition, species-specific research based on the output of the monitoring results would give more detailed insight into the processes underlying the population changes. Research that has been carried out so far has shown that downward trends in some species are associated with *e.g.* human disturbance and lack of habitat dynamics (Kentish Plover and Great Ringed Plover in the entire Wadden Sea), mussel- and cockle-fisheries (Common Eider, Oystercatcher, perhaps Herring Gull in the Netherlands), habitat degradation in the dunes (perhaps Hen Harrier and Short-eared Owl in the Netherlands) and increase of predation risk (Avocet and Black-headed Gull in the Netherlands and Niedersachsen). The latter aspect has been mentioned in previous reports, but seems to have become more important and is also assumed to be the driving force behind displacement of colonies of *e.g.* Black-headed Gulls to the islands, where large mammalian predators are usually absent. Any improvement of barrier dams between the mainland and islands should therefore be considered with great caution.

The impact of climate change has not been assessed in detail yet, but considering expected trends in sea level rise as well as increases in mean high tides, storminess and precipitation, several species might be liable to floods or adverse weather conditions in the nesting or chick-rearing period. This especially refers to those species breeding on unsheltered and sparsely vegetated sites on outer sands, beaches and the seaward side of salt marshes, like Avocet, Kentish Plover, Great Ringed Plover, Common Tern, Arctic Tern and Little Tern (some of them already showing declines for other reasons). Interactions between salt marsh management and changes in breeding bird numbers so far has only been studied on a local scale and their impact on the trilateral trends observed for the period 1991-2001 is not entirely clear. In general, species diversity in salt marshes increases with low or no management regime due to an increase of passerine species. On the other hand, species preferring short vegetation to breed might benefit from some sort of livestock grazing or other agricultural management use. More studies are needed to unravel relationships between vegetation development and breeding birds (see below). Breeding birds and contaminants have been dealt with in a separate report. Today, the impact of contaminants is generally considered low, since major changes in contaminant levels occurred before 1990. Still, however, some populations (*e.g.* Sandwich Tern) have not recovered from the 'pesticide era' in the 1960s.

Target evaluation

The results from the trilateral breeding bird surveys from 1991 to 2001 show that the targets addressed in the Wadden Sea Plan are not met by a series number of species. Breeding success of at least Great Ringed Plover and Kentish Plover still suffers from human disturbance at many sites (along with lack of natural habitat dynamics). To what extent breeding success of other species affects the trends observed is less understood. A proper evaluation is not possible since breeding success in not monitored in a regular scheme and thus remains unknown for most species. Regarding the target of 'favourable food availability', intensive shellfish-fisheries in the Dutch part of the Wadden Sea (and previously also in Denmark) have had a major impact on breeding of Common Eider and Oystercatcher, and perhaps also Herring Gull. Declines in these species especially occurred in the Dutch Wadden Sea, where fishery intensity was highest. It is therefore concluded that the ban on mechanical cockle fisheries achieved in 2004-2005 has been an important step towards an improvement of the available food stocks for shellfish-eating species. With this decision, large-scale fisheries on cockles have now been phased out in the entire Wadden Sea. In addition, fisheries on blue mussels in the Dutch Wadden Sea have adopted new regulations as well. Research and monitoring of breeding and migratory birds will evaluate whether these measures will prove to be successful with regard to food stocks available to birds.

Regarding individual Annex I-species, trends for Hen Harrier, Avocet, Kentish Plover, Dunlin, Ruff, Sandwich Tern, Common Tern and Short-eared Owl all indicate an unfavourable conservation status in (at least a part of) the Wadden Sea (Table 4). Nearly all these species have continued to decline in the period from 2002 to 2004. Dunlin is on the brink of extinction and urgent conservation action might be necessary to save the last breeding sites in this species, which represents a separate subspecies (*schinzii*).

Recommendations

The data in this report show that the trilateral monitoring by JMBB and TMAP is a powerful tool to assess population changes in breeding birds in the Wadden Sea. With the help of results from other research projects, we were able to explain some of the trends observed. However, a target evaluation regarding *e.g.* the parameter 'natural breeding success' (also with respect to contaminants) is still not possible since breeding success is not monitored regularly. The outline and methods of such a scheme were already tested in a pilot-project in the German Wadden Sea in 1996-97 and another national scheme started in the Dutch Wadden Sea in 2005. Hence, implementation on a trilateral level is ready and overdue for inclusion in the JMBB-program. Furthermore, we recommend improving data series on annual survival rates. Together with data on breeding success, this allows an integrated population monitoring, where backgrounds for trends become visible earlier and management and conservation action can be more directed toward the responsible causes. Caution should be taken that measures only apply to Annex I species of the EC Birds Directive. The Wadden Sea supports several species that are not listed on Annex I, but for which the Wadden Sea has an important share of the NW-European population, *e.g.* Oystercatcher, Great Ringed Plover and Black-headed Gull. The Red List of Wadden Sea breeding bird species has initially played an important role in this context, but has now partly been overruled by the EC Birds Directive (with a different selection of species). We therefore propose to adopt a 'List of Priority Species' to cover species not included in Annex I (Table 5). Thirdly, we recommend cross-over projects which reveal relationships between the data collected by the different monitoring schemes in the Wadden Sea. Such projects are promising with regard to management of dunes or salt marshes, since data on a trilateral level could be used to detect trends and interactions in vegetation development and trends in breeding birds. So far, such studies have only been carried out at a local scale. Insight into vegetation developments and responses of breeding birds would deliver sound data to underpin the ongoing discussions *e.g.* on salt marsh management.

Sammenfatning

Formål og metode

Vadehavet er et af de vigtigste yngleområder i Vesteuropa for mange kystfugle. Flere af dem er sjældne og truede og derfor opført på EF-fuglebeskyttelsesdirektivs Bilag 1 eller hører til de arter, som indgår i *Species of European Conservation Concern (SPEC)*. Overvågning af ynglefugle i Vadehavet indgår i det Trilaterale Overvågningsprogram *(TMAP)*, der koordineres af Moniteringsgruppen for Ynglefugle *(JMBB)*. Programmet fokuserer på 31 ynglende fuglearter, som er karakteristiske for biodiversiteten i Vadehavet og som repræsenterer indikatorarter, der egner sig til at opfylde de to målsætninger for ynglefugle i Vadehavsplanen (favorable fødesøgningsmuligheder og naturlig ynglesucces). De fleste af arterne er afhængig af tidevandsflader til fødesøgning. Overvågningen har til formål at vurdere og undersøge bestandsstørrelser, fordelinger og udviklingstendenser for ynglefugle i hele Vadehavsområdet, herunder også betydningen af 1) klimaændringer; 2) forurenende stoffer, som kan påvirke ynglefuglenes overlevelse; 3) fiskeri; 4) friluftsliv og 5) landbrugsmæssige forandringer (f.eks. græsning) på strandengene, der fungerer som naturlige yngleområder.

Indsamling af data varierer for de 31 arter, som indgår i programmet. Sjældne arter og arter som yngler i kolonier optælles hvert år i hele Vadehavet (i det såkaldte Vadehavsområde, Figure 1). Kolonirugende arter omfatter arter som yngler koncentreret i få områder som dog kan ændre sig fra år til år. Mere udbredte arter optælles i 103 optællingsområder som er repræsentative for naturtyperne i Vadehavet (Figure 2). Hvert femte år optælles alle de nævnte arter i hele Vadehavsområdet, hvilket kaldes en 'totaltælling'. Totaltællinger er udført i 1991, 1996 og 2001, og den fjerde vil finde sted i 2006. Således opnås en totaloptælling af alle arter og deres fordeling hvert femte år, hvorimod beregning af udviklingstendenser er baseret på årlige optællinger af sjældne arter samt arter der yngler i kolonier. Feltarbejdet er standardiseret og følger trilaterale retningslinjer, der er beskrevet i en manual. Regelmæssigt afholdes der møder for at kvalitetssikre optællingsmetoderne og sammenligne observatørernes resultater. Endvidere trænes optællerne i at anvende metoderne. Optællingerne i felten udføres især af frivillige amatører, personale fra forvaltninger samt fra halvofficielle og officielle styrelser (se Table 1 for koordinering af optællingerne). Denne rapport har til formål at give en tilbagemelding om resultatet fra den sidste totaltælling udført i 2001 og er den tredje i en serie af tilsvarende rapporter. Den fokuserer på bestande og fordelinger i 2001 og udviklingstendenser for 1991-2001. Data er vist på et generelt niveau for at give et hurtigt overblik over resultaterne (kapitel 3). Tilsvarende er hver art behandlet for artsspecifikke mønstre (kapitel 4).

Ynglefugle i 2001

Ved totaltællingen i 2001 blev der i alt registreret 469,000 ynglepar eller territorier (Table 2). Næsten 70% af ynglebestanden udgøres af måger med hættemåge, sildemåge og sølvmåge som de mest udbredte arter. Omkring 18% af bestandene er vadefugle, især strandskade, klyde, vibe og rødben. Blandt de sjældne ynglefugle er engryle og brushane som begge har været udsat for nedgange i antal igennem mange år, og som nu er nær ved at forsvinde. For 21 ud af de 31 arter, udgør bestandene i Vadehavet mere end 1%

af den nordvesteuropæiske ynglebestand. Blandt dem er ni arter anført på Bilag 1 i EF-fuglebeskyttelsesdirektiv (Table 2, Figure 74). I international sammenhæng, repræsenterer Vadehavsområdet et nøgleområde for Skestork, klyde, sandterne og splitterne, som udgør fra 33% til 100% (sandterne) af den nordvesteuropæiske ynglebestand. For nogle få arter som toppet skallesluger, middelhavssølvmåge og dværgmåge ligger Vadehavet på randen af deres udbredelsesområde. Derfor er disse arters yngleforekomster i vadehavsområdet få eller uregelmæssige. Mange arter (21 ud af 30) foretrækker at yngle på øer (Figure 9). Dette gælder især for kolonirugende arter som skarv, skestork, måger og terner foruden blå kærhøg og mosehornugle. Forekomsten af de to sidstnævnte arter er især knyttet til klitter i den vestlige del af området. Bestande af klyde, stor præstekrave, hvidbrystet præstekrave, sandterne, vibe og stor kobbersneppe er især koncentreret langs fastlandskyster. Høje forstyrrelsesniveauer (hvidbrystet præstekrave og stor præstekrave) og lav prædationsrate på øerne som følge af, at der ikke findes store rovpattedyr, er sandsynligvis en vigtig forklaring på disse fordelingsmønstre, ligesom variationen i de tilstedeværende yngle- og fødesøgningshabitater.

Udviklingstendenser 1991-2001

De overordnede udviklingstendenser for ynglefugle i Vadehavet i 1991-2001 viser signifikante stigninger i 10 ud af 31 arter (Table 3). En sammenligning med arterne på EF-fuglebeskyttelsesdirektivets Bilag 1 viser, at antallet af arter som stiger har været konstant siden 1996, hvorimod antallet af arter som ikke står på Bilag 1 er steget (Figure 11). Den højeste stigning i perioden 1991-2001 er observeret for skarv, svartbag, , skestork, sildemåge og middelhavssølvmåge (Figure 10). Næsten alle disse arter har udvidet deres geografiske yngleområde i de sidste 10 år og desuden viser dataindsamling efter 2001, at stigningen er fortsat. For mange arter har den stigende tendens været konsistent gennem hele den elleveårige periode. Kun for edderfugl og havterne har nedgange i antal været rapporteret efter 1996. For edderfugl vedrører dette særligt den store bestand i den hollandske del af Vadehavet.

Signifikante nedgange i 1991-2001 har fundet sted for ni arter, deriblandt stor præstekrave, hvidbrystet præstekrave, vibe, stor kobbersneppe, fjordterne og sølvmåge. Engryle, brushane og dobbelt bekkasin har også været udsat for nedgange, og de første to arter er næsten forsvundet som ynglefugle i Vadehavet. Stor præstekrave og hvidbrystet præstekrave har fortsat deres nedadgående udvikling efter 2001. For vibe, stor kobbersneppe og sølvmåge tyder tællinger efter 1996 på, at arterne har stabiliseret sig. Antallet af fjordterner har delvist rettet sig efter tidligere nedgange, undtagen i Holland, hvor de fortsat er gået tilbage indtil 2004.

Regionale forskelle i udvikling

For mange arter er den observerede udvikling konsistent i hele Vadehavsområdet og ofte på linje med udviklingen i nabolandene, hvilket tyder på, at der er en eller flere faktorer, som spiller en væsentlig rolle på bestandsniveau. Eksempler herpå er skarv, stormmåge *Larus canus*, sildemåde, havterne, og dværgterne. På den anden side findes der undertiden modsatrettede udviklingstendenser i forskellige dele af Vadehavet. En sammenligning af udviklingstendenser for 16 arter, som er udbredt i alle dele, afslører, at stigende tendenser er dominerende i den nordlige del af området, i Danmark og Slesvig-Holsten, og nedgange er kun rapporteret for få arter, som har været stabile eller stigende i andre dele af Vadehavet (Figure 12). I Nedresaksen og Holland er flere arter gået tilbage i antal, f.eks. klyde, sølvmåge (i begge lande), rødben (Nedresaksen), blå kærhøg, hættemåge og mosehornugle (Holland). Endvidere har edderfugl, som findes i små bestande i Danmark, Slesvig-Holsten og Nedresaksen, haft en kraftig nedgang i sit hovedyngleområde i Holland efter 1998. Baggrunden for disse modsatrettede tendenser kendes ikke i detaljer for alle arter, men kan hænge sammen med forskelle i nationale forvaltningsmåder, f.eks. i relation til muslingefiskeri (se nedenfor).

Forklaringer på nogle udviklingstendenser

Overvågningsprogrammet fokuserer primært på optælling af ynglefugle og påvisning af talmæssige udviklingstendenser og mindre på at give pålidelige forklaringer på deres årsager eller baggrunde. For at kunne udrede baggrunden for de observerede udviklingstendenser er det nødvendigt at indsamle mere information om f.eks. ynglesucces og dødsårsager. Disse to parametre er imidlertid endnu ikke dækket af TMAP. Endvidere er det ofte ønskeligt, at der foregår en artsspecifik forskning baseret på resultaterne af overvågning for at få mere detaljeret indsigt i de processer som ligger bag bestandsændringerne. Den forskning, som hidtil er udført har vist, at nedadgående udviklingstendenser for nogle arter er forårsaget af f.eks. menneskelig forstyrrelse og mangel på habitatdynamik (hvidbrystet præstekrave og stor præstekrave i hele Vadehavet), blåmusling- og hjertemuslingefiskeri (edderfugl, strandskade, måske sølvmåge i Holland), habitatforringelse i klitter (måske blå kærhøg og mosehornugle i Holland) og stigende risiko for predation (klyde og hættemåge i Holland og Nedresaksen). Det sidstnævnte aspekt har været nævnt i tidligere rapporter, men ser ud til at være af stigende betydning og formodes også at være den vigtigste faktor bag fordrivelse af kolonier af bl.a. hættemåge fra fastlandet til øerne, hvor der normalt ikke findes store rovpattedyr. Alle forbedringer af dæmninger til øer i Vadehavet må derfor overvejes med stor tilbageholdenhed for ikke at lette rovpattedyrs adgang.

Betydningen af klimaforandringer har endnu ikke været genstand for nærmere undersøgelse, men i betragtning af de forventede havspejlstigninger, stigninger i gennemsnitshøjvande, storme og nedbør vil flere arter blive berørt af oversvømmelser og forværrede vejrbetingelser i rede- og ungeperioden. Dette berører specielt de arter som yngler på ubeskyttede steder med sparsom vegetation på de ydre højsande, kyster og de havvendte strandenge som klyde, hvidbrystet præstekrave, stor præstekrave, fjordterne, havterne og dværgterne (nogle af disse arter udviser allerede nedgange forårsaget af andre årsager). Samspillet mellem forvaltning af strandenge og ændring i yngleantal er indtil nu kun undersøgt på lokalt niveau og dets effekt på et trilateralt niveau i 1991-2001 er endnu ikke klarlagt. Generelt viser resultaterne, at arter som yngler på strandenge med ingen eller en lav dyrkningsintensitet stiger på grund af et stigende antal arter af spurvefugle. På den anden side, fremmer kreaturgræsning eller slåning de arter som foretrækker en kort vegetation. Det er nødvendigt med flere undersøgelser for at udrede samspillet mellem vegetationsudvikling og ynglefugle (se nedenfor). Ynglefugle og forurenende stoffer er blevet behandlet i en særskilt rapport. I dag betragtes betydningen af forurenende stoffer som generel lav, fordi store forandringer i niveauet for forurenende stoffer skete allerede før 1990. Dog har nogle arter (f.eks. splitterne) ikke genvundet sit tidligere bestandsniveau fra før forureningen med pesticider fandt sted i 1960'erne.

Vurdering af målsætninger

Resultaterne fra den trilaterale ynglefugleovervågning i 1991-2001 viser at målsætningerne i Vadehavsplanen endnu ikke er opfyldt for flere arter. I det mindste er ynglesuccesen for stor præstekrave og hvidbrystet præstekrave stadig nedsat på grund af menneskelig færdsel i mange områder (sammen med mangel på naturligt habitatdynamik). I hvilken udstrækning ynglesuccesen for andre arter påvirker den observerede udviklingstendens er mindre kendt. En nærmere evaluering er ikke mulig, da ynglesuccesen ikke er undersøgt ved en regelmæssig overvågning og den er derfor ukendt for de fleste arter. Med hensyn til målsætningen vedr. 'favorabel fødetilgængelighed', har det intensive muslingefiskeri i det hollandske Vadehav (og tidligere også i den danske del) haft stor betydning for ynglende edderfugl og strandskader, og måske også på sølvmåge. Nedgange for disse arter har især vist sig i det hollandske Vadehav, hvor muslingefiskeriet var mest intensivt. Derfor, har forbudet mod mekanisk hjertemuslingefiskeri indført i 2004-2005 været et vigtigt skridt mod forbedring af den tilgængelige fødemængde for arter der lever af muslinger. Med denne beslutning er hjertemuslingefiskeri i stor skala udfaset i hele Vadehavet. Desuden er blåmuslingefiskeriet i den hollandske del af Vadehavet underlagt nye reguleringsbestemmelser. Undersøgelser og monitering af yngle- og trækfugle vil evaluere, hvis disse tiltag viser sig at være virkningsfulde med hensyn til at sikre tilstrækkelig store fødemængder for fuglene.

Med hensyn til arterne på EF-fuglebeskyttelsesdirektivs Bilag 1 viser udviklingstendenserne for blå kærhøg, klyde, hvidbrystet præstekrave, engryle, brushane, sandterne, fjordterne og mosehornugle en ufavorabel beskyttelsesstatus i (det mindste i dele af) Vadehavet (Table 4). Næsten alle disse arter er forsat med at falde i 2002-2004. Engryle er på nippet til at forsvinde og hastende beskyttelsestiltag kan være nødvendige for at rede de sidste yngleområder for denne art, som repræsenterer en selvstændig underart (*schinzii*) af almindelig ryle.

Anbefalinger

Denne rapports data viser, at det trilaterale overvågningsprogram forestået af JMBB og TMAP er et godt redskab til at vurdere bestandsændringer for ynglefugle i Vadehavet. Ved hjælp af resultater fra andre forskningsprojekter har vi været i stand til at forklare nogle af de observerede udviklingstendenser. Dog er en vurdering af målsætningen om 'naturlig ynglesucces' (også med hensyn til forurenende stoffer) endnu ikke mulig, da ynglesucces ikke overvåges regelmæssigt. Omfanget og metoderne af et sådant program blev allerede undersøgt i en forundersøgelse i det tyske Vadehav i 1996-97 og et andet nationalt program blev startet i det hollandske Vadehav i 2005. Derfor er en implementering på trilateralt niveau nu klar til indførelse i JMBB-programmet. Endvidere anbefaler vi at forbedre dataserier for årlige overlevelsesrater. Sammen med data om ynglesucces giver dette en integreret bestandsmonitering, hvor baggrundene for udviklingstendenserne bliver synlige tidligere, så forvaltnings- og beskyttelsesinitiativer kan fokusere på de tilgrundliggende årsager. Det understreges, at forholdsreglerne kun omfatter de arter, som er anført på EF-fuglebeskyttelsesdirektivs Bilag 1. Vadehavet huser adskillige arter, som ikke er anført på dette bilag, men for hvilke Vadehavet har en vigtig andel af den nordvesteuropæiske bestand, f.eks. af strandskade, stor præstekrave og hættemåge. Rødlisten for ynglefugle i Vadehavet spillede oprindeligt en vigtig rolle i denne sammenhæng, men er nu delvist overgået af EF-fuglebeskyttelsesdirektivet (med et andet udvalg af arter). Vi foreslår derfor en 'Liste over prioriterede arter' til også at dække de arter som ikke står i EF-fuglebeskyttelsesdirektivs Bilag 1. (Table 5). For det tredje anbefaler vi overlappende projekter som giver sammenhæng mellem data indsamlet gennem forskellige overvågningsprojekter i Vadehavet. Disse projekter er lovende med hensyn til forvaltning af klitter og strandenge, da data på et trilateralt niveau kan bruges til at vise udviklingstendenser og samspil i vegetationsudvikling og tendenser for ynglefugle. Indtil videre har sådanne undersøgelser kun været gennemført på lokalt plan. Indsigt i vegetationsudvikling og påvirkning på ynglefugle kunne give værdifulde oplysninger til underbygning af løbende diskussioner om bl.a. forvaltning af strandenge.

Zusammenfassung

Anlass und Methode

Für viele Küstenvogelarten gehört das Wattenmeer zu den wichtigsten Brutgebieten in Westeuropa. Mehrere von ihnen sind selten und gefährdet bzw. werden im Anhang I der EG-Vogelschutzrichtlinie aufgeführt oder zählen zu den Arten, für die Europa eine besondere Schutzverantwortung trägt *(Species of European Conservation Concern, SPEC)*. Die Erfassung der Brutvögel ist Bestandteil des *Trilateral Monitoring and Assessment Program (TMAP)* und wird von der *Joint Monitoring Group of Breeding Birds (JMBB)* koordiniert. Das Monitoring konzentriert sich auf 31 Brutvogelarten, die charakteristisch für die Biodiversität des Wattenmeeres sind und sich als Indikatorarten eignen, die ökologischen Ziele des Wattenmeerplanes, die für Vögel relevant sind (günstige Nahrungsverfügbarkeit und natürlicher Bruterfolg), zu überwachen. Die meisten dieser Arten sind auf die eulitoralen Wattflächen als Nahrungsgebiet angewiesen. Das Monitoring zielt darauf ab, die Populationsgrößen der Brutvögel, ihre Verbreitung und die Trends der Bestandsentwicklung im gesamten Wattenmeer zu bestimmen und zu bewerten, auch im Hinblick auf (1) den Einfluss der Klimaänderung, (2) Schadstoffe, die die Fitness der Brutvögel beeinflussen können, (3) Fischerei, (4) Erholungsaktivitäten, (5) Änderung der landwirtschaftlichen Nutzung von Salzwiesen, dem natürlichen Bruthabitat vieler Arten.

Die Art der Datenerfassung variiert zwischen den 31 Arten. Seltene Arten und Koloniebrüter, die normalerweise in wenigen Gebieten, welche sich zudem von Jahr zu Jahr ändern können, konzentriert sind, werden jährlich im gesamten Wattenmeergebiet erfasst (Abb. 1). Häufigere Arten werden in 103 „Census-Areas" gezählt, die repräsentativ für die Wattenmeer-Habitate sind (Abb. 2). Einmal alle fünf Jahre werden diese Arten zudem im gesamten Gebiet erfasst. Diese Gesamtzählungen wurden 1991, 1996 und 2001 durchgeführt, die vierte Gesamtzählung findet 2006 statt. So erhalten wir alle fünf Jahre einen vollständigen Überblick über die Verteilungsmuster im gesamten Wattenmeer. Die Trendanalysen basieren auf den jährlichen Erfassungen der seltenen Arten, der Koloniebrüter sowie der häufigen Arten in den „Census-Areas". Die Erfassungen erfolgen hoch standardisiert gemäß einer trilateral einheitlichen Methodenanleitung. Regelmäßig werden so genannte „Quality Assurance Meetings" organisiert, um die verschiedenen Erfassungsmethoden zu testen, die Unterschiede zwischen verschiedenen Zählern abzuschätzen und die Beobachter zu schulen. Die Erfassungen werden hauptsächlich von Ehrenamtlichen, Mitarbeitern von gebietsbetreuenden Vereinen und halbstaatlichen oder staatlichen Einrichtungen durchgeführt (siehe Tab. 1 für Details und Koordination). Mit diesem Bericht, dem dritten in einer Reihe ähnlicher Berichte, soll ein feedback zur Gesamterfassung 2001 gegeben werden. Im Mittelpunkt stehen zum einen die Populationsgrößen und die Verteilung der Bestände 2001, zum anderen die Brutbestandsentwicklung der einzelnen Arten zwischen 1991 und 2001. Die Ergebnisse werden sowohl als Übersichten präsentiert, um einen schnellen Zugang zu ermöglichen (Kapitel 3), als auch auf Artebene, um die artspezifischen Muster hervor zu heben (Kapitel 4).

Brutbestände 2001

Die Gesamterfassung von 2001 ergab die Summe von 469,000 Brutpaaren oder Brutrevieren der ausgewählten Arten (Tab.2). Nahezu 70 % aller Brutvögel sind Möwen, die häufigsten Arten sind Lachmöwe, Heringsmöwe und Silbermöwe. Weitere 18 % sind Watvögel, vor allem Austernfischer, Säbelschnäbler, Kiebitz und Rotschenkel. Zu den seltenen Brutvögeln gehören Alpenstrandläufer und Kampfläufer, die beide nach lang anhaltenden Rückgängen kurz vor dem Aussterben stehen. Von 21 der 31 Arten nehmen die Wattenmeerbestände mehr als 1% der Nordwesteuropäischen Population ein, neun dieser Arten stehen im Anhang I der EG-Vogelschutz-Richtlinie (Tab. 2, Abb. 74). Im internationalen Kontext stellt das Wattenmeer für Löffler, Säbelschnäbler, Lachseeschwalbe und Brandseeschwalbe das Kernbrutgebiet dar, da hier jeweils 33% der NW-Europäischen Population brüten, bei der Lachseeschwalbe sind es sogar 100%. Für einige seltene Arten wie Mittelsäger, Schwarzkopfmöwe und Zwergmöwe liegt das Wattenmeer dagegen am Rande ihres europäischen Verbreitungsgebietes. Entsprechend treten sie in niedrigen Zahlen bzw. unregelmäßig auf. Viele Arten (21 von 30) bevorzugen Inseln als Brutgebiete (Abb. 9). Das trifft insbesondere für Koloniebrüter wie Kormoran, Löffler, Möwen und Seeschwalben zu, aber auch für Kornweihe und Sumpfohreule, die vor allem in den Dünengebieten des westlichen Wattenmeeres vorkommen. Die Brutpopulationen von Säbelschnäbler, Sandregenpfeifer, Seeregenpfeifer, Lachseeschwalbe, Kiebitz und Uferschnepfe dagegen konzentrieren sich entlang der Festlandküste. Für einige Arten sind höhere Störungsraten auf den Inseln (See- und Sandregenpfeifer) hierfür wichtige Erklärungsmuster während für andere ein niedrigeres Prädationsrisiko aufgrund fehlender Raubsäuger (bei den Koloniebrütern auf den Inseln) als Ursache anzuführen ist. Darüber hinaus spielen Unterschiede in den verfügbaren Brut- und Nahrungshabitaten eine wichtige Rolle.

Gesamttrends 1991-2001

Bei 10 von 31 Arten zeigen die Gesamttrends im Wattenmeer von 1991 bis 2001 signifikante Zunahmen (Tab. 3). Ein Vergleich der Bestandstrends der Anhang-1-Arten der EG-Vogelschutzrichtlinie mit solchen, die dort nicht aufgeführt sind, zeigt, dass der durchschnittliche Trend in der ersten Gruppe nach 1996 stabil blieb, während die anderen weiter zunahmen (Abb. 11). Die höchsten Gesamt-Zuwachsraten waren 1991-2001 bei Kormoran, Mantelmöwe, Löffler, Heringsmöwe und Schwarzkopfmöwe zu verzeichnen (Abb. 10). Fast alle diese Arten haben ihr Verbreitungsgebiet im letzten Jahrzehnt ausgeweitet, auch die Daten nach 2001 weisen auf eine weitere Zunahme hin. Nur bei Eiderente und Küstenseeschwalbe wurden nach 1996 Abnahmen festgestellt. Für die Eiderente betrifft dies insbesondere die große Population im niederländischen Teil des Wattenmeeres.

Signifikante Abnahmen traten 1991-2001 bei neun Arten auf, unter ihnen Sand- und Seeregenpfeifer, Kiebitz, Uferschnepfe, Flussseeschwalbe und Silbermöwe. Alpenstrandläufer, Kampfläufer und Bekassine erfuhren ebenfalls Abnahmen, die ersten beiden Arten sind mittlerweile im Wattenmeer nahezu ausgestorben. Bei Sand- und Seeregenpfeifer hat sich der Abwärtstrend nach 2001 fortgesetzt. Die Zahlen für Kiebitz, Uferschnepfe und Silbermöwe weisen dagegen nach 1996 auf eine Stabilisierung der Bestände hin. Auch die Flussseeschwalbe hat sich von früheren Bestandsrückgängen erholt, allerdings nicht in den Niederlanden, wo sich die Abnahme bis 2004 fortsetzt.

Regionale Unterschiede in den Trends

Bei einigen Arten treten die beobachteten Trends im gesamten Wattenmeer auf, und stimmen oft auch mit den Trends in den Nachbarländern überein, was auf großräumige Faktoren auf Populationsebene hinweist. Beispiele dafür sind Kormoran, Sturmmöwe, Heringsmöwe, Küstenseeschwalbe und Zwergseeschwalbe. Andererseits treten auch gegenläufige Trends in den verschiedenen Teilen des Wattenmeeres auf. Ein Vergleich der Trends von 16 Arten, die in allen Regionen häufig sind, zeigt, dass in Schleswig-Holstein und Dänemark Bestandszunahmen dominieren und hier nur bei wenigen Arten, die im übrigen Wattenmeer stabil sind oder zunehmen, Abnahmen zu verzeichnen sind (Abb. 12). In Niedersachsen und den Niederlanden nahmen mehr Arten ab, z.B. Säbelschnäbler, Silbermöwe (beide Länder), Rotschenkel (Niedersachsen), Kornweihe, Austernfischer, Lachmöwe und Sumpfohreule (alle Niederlande). Zudem zeigte die Eiderente, die nur kleine Brutpopulationen in Dänemark, Schleswig-Holstein und Niedersachsen hat und dort in den 1990ern zunahm, einen deutlichen Bestandseinbruch in den Haupt-Brutgebieten im niederländischen Wattenmeer nach 1998. Die Hintergründe für diese gegensätzlichen Trends sind im Detail nicht für alle Arten bekannt, könnten aber in Zusammenhang mit Unterschieden in den nationalen Management-Strategien, z.B. bei der Muschelfischerei (s.u.), liegen.

Einige Trend-Erklärungen

Als Monitoringprogramm zielt die Erfassung der Brutvögel vor allem darauf ab, Trends in den Bestandszahlen aufzuzeigen, Beweise für die Ursachen und Hintergründe der beobachteten Trends kann es alleine in der Regel nicht liefern. Um die zugrunde liegenden Ursachen aufzudecken, wären mehr Informationen z. B. zu Bruterfolg und Mortalitätsrate notwendig. Beide Parameter werden aber vom TMAP noch nicht abgedeckt. Um einen Einblick in die den Populationsänderungen zugrunde liegenden Prozesse zu erhalten, ist es darüber hinaus erforderlich, auf der Grundlage der Monitoring-Ergebnisse artspezifische Untersuchungen durchzuführen. Bisher durchgeführte Untersuchungen haben einige Erklärungen für die abnehmenden Trends geliefert, so z.B. menschliche Störungen und fehlende Habitatdynamik (See- und Sandregenpfeifer im gesamten Wattenmeer), Miesmuschel- und Herzmuschelfischerei (Eiderente, Austernfischer, eventuell auch Silbermöwe in den Niederlanden), Lebensraumverschlechterung in den Dünen (eventuell Kornweihe und Sumpfohreule in den Niederlanden) oder der Anstieg des Prädationsrisikos an der Küste (Säbelschnäbler und Lachmöwe in den Niederlanden und Niedersachsen). Der letzte Aspekt wurde bereits in früheren Berichten erwähnt, aber er scheint an Bedeutung gewonnen zu haben und es ist anzunehmen, dass vor allem das gestiegene Prädationsrisiko auch zu der Verlagerung von Kolonien z.B. der Lachmöwe auf die Inseln führte, wo Raubsäuger normalerweise fehlen. Jeder Ausbau von festen Verbindungsdämmen zwischen Festland und Inseln ist daher äußerst kritisch zu betrachten.

Der Einfluss der Klimaänderung wurde noch nicht im Detail bewertet, angesichts des erwarteten Meeresspiegelanstieges, der Zunahme des mittleren Hochwassers, der Sturmereignisse und der Niederschläge ist aber davon auszugehen, dass einige Arten durch Überflutungen und widrige Wetterbedingungen während der Brut- oder Aufzuchtzeit davon betroffen sein könnten. Das gilt insbesondere für die Arten, die in ungeschützten und spärlich bewachsenen Bereichen auf Sänden, Stränden und in den unteren Salzwiesen nahe der Hochwasserlinie brüten, wie Säbelschnäbler, See- und Sandregenpfeifer, Fluss- und Küstenseeschwalbe sowie Zwergseeschwalbe (von denen einige schon aus anderen Gründen Bestandsabnahmen zeigen). Wechselbeziehungen zwischen Salzwiesenmanagement und Veränderungen der Brutvogelzahlen wurden bisher nur in lokalem Maßstab untersucht und der Einfluss auf die festgestellten trilateralen Trends zwischen 1991 und 2001 ist nicht vollständig klar. Grundsätzlich steigt die Artenvielfalt in wenig oder gar nicht genutzten Salzwiesen wegen der Zunahme von Singvogelarten an. Andererseits kommen bestimmte Formen der Beweidung oder andere Arten des Salzwiesenmanagements Arten zu gute, die vorzugsweise in kurzer Vegetation brüten. Um die Beziehungen zwischen Vegetationsentwicklung und Brutvögeln zu verstehen, sind weitere Untersuchungen erforderlich (s.u.). Das Thema Brutvögel und Schadstoffe wurde bereits in einem anderen Bericht behandelt. Da die größten Veränderungen in der Schadstoffbelastung bereits vor 1990 stattfanden, wird der Einfluss von Schadstoffen gegenwärtig als gering eingeschätzt. Dessen ungeachtet haben sich einige Populationen (z.B. Brandseeschwalbe) noch immer nicht vollständig von der "Pestizid-Ära" in den 1960ern erholt.

Bewertung der Wattenmeer-Ziele

Die Ergebnisse der trilateralen Brutvogelerfassung von 1991-2001 zeigen, dass die im Wattenmeerplan formulierten Ziele bei einer Reihe von Arten nicht erfüllt werden. Das Ziel „natürlicher Bruterfolg" wird zumindest bei Sand- und Seeregenpfeifer nicht erreicht, beide Arten leiden noch immer in vielen Gebieten unter menschlichen Störungen (zusammen mit dem Mangel natürlicher Lebensraumdynamik). In welchem Ausmaß der Bruterfolg bei anderen Arten die festgestellten Trends beeinflusst, ist bislang nur wenig bekannt. Weil der Bruterfolg nicht regelmäßig erfasst wird, ist eine Bewertung nicht möglich und bleibt für die meisten Arten unbekannt. Hinsichtlich des Ziels „günstige Nahrungsverfügbarkeit" hatte die intensive Muschelfischerei im niederländischen Teil des Wattenmeeres (und früher auch in Dänemark) einen großen Einfluss auf den Brutbestand von Eiderente und Austernfischer, vielleicht auch Silbermöwe. Diese Arten nahmen vor allem im niederländischen Wattenmeer ab, wo die Fischereiintensität am höchsten ist. Das 2004/05 erreichte Verbot der Herzmuschelfischerei war somit ein wichtiger Schritt zur Verbesserung der Nahrungsverfügbarkeit für muschelfressende Arten. Mit dieser Entscheidung wurde die in großem Maßstab durchgeführte Herzmuschelfischerei nun im gesamten Wattenmeer eingestellt. Zusätzlich wurde auch die Fischerei auf Miesmuscheln im niederländischen Wattenmeer neu geregelt. Monitoring und ökologische Begleitforschung der Brut- und Gastvögel werden zeigen, ob diese Maßnahmen im Hinblick auf die Nahrungsverfügbarkeit für Vögel erfolgreich waren.

Bei den Anhang-I-Arten der EG-Vogelschutzrichtlinie weisen die Trends für Kornweihe, Säbelschnäbler, Seeregenpfeifer, Alpenstrandläufer, Kampfläufer, Brandseeschwalbe und Sumpfohreule auf einen ungünstigen Erhaltungszustand (zumindest in Teilen) des Wattenmeeres hin (Tabelle 4). Fast alle diese Arten nahmen von 2002 bis 2004 weiter ab. Der Alpenstrandläufer steht kurz vor dem Aussterben. Um die letzten Brutplätze dieser Art, die einer eigenen Unterart (*schinzii*) angehört, zu erhalten, sind Schutzmaßnahmen dringend erforderlich.

Empfehlungen

Die Daten dieses Berichtes zeigen, dass das trilaterale Monitoring von JMBB und TMAP ein leistungsfähiges Werkzeug ist, um Änderungen in den Brutvogelpopulationen im Wattenmeer festzustellen. Mit Hilfe der Ergebnisse anderer Forschungsprojekte sind wir in der Lage, einige der beobachteten Trends zu erklären. Trotzdem ist eine Zielbewertung bezüglich der Parameter „natürlicher Bruterfolg" (auch im Hinblick auf Schadstoffe) nicht möglich, da die Erfassung des Bruterfolges nicht Bestandteil des Programms ist. Design und Methodik eines solchen Programms wurden bereits 1996 -97 im deutschen Wattenmeer getestet, und im niederländischen Wattenmeer wurde 2005 ein nationales Programm begonnen. Die Implementierung auf der trilateralen Ebene ist somit vorbereitet und eine Übernahme in das JMBB-Programm überfällig. Weiterhin empfehlen wir, die Informationen zur jährlichen Überlebensrate zu verbessern. Zusammen mit den Daten zum Bruterfolg ist dann ein integriertes Populationsmonitoring möglich, mit dem die Hintergründe für die Trends früher sichtbar werden und Management- und Schutzmaßnahmen jeweils direkter bei den spezifischen Ursachen ansetzen können. Dabei ist zu beachten, dass die Maßnahmen nicht nur auf die Arten des Anhang I der EG-Vogelschutz-Richtlinie ausgerichtet werden, da auch für andere Arten, die nicht im Anhang I aufgeführt sind, das Wattenmeer von besonderer Bedeutung ist, weil ein wesentlicher Anteil ihrer NW-europäischen Population hier brütet, z.B. Austernfischer, Sandregenpfeifer und Lachmöwe. Ursprünglich hat die Rote Liste der Brutvögel des Wattenmeeres eine wichtige Rolle in diesem Zusammenhang gespielt, inzwischen ist aber die EG-Vogelschutz-Richtlinie, die eine andere Auswahl von Arten trifft, von größerer Relevanz. Wir schlagen daher vor, eine „Liste der prioritär zu schützenden Arten" zu erarbeiten, die auch Arten einschließt, die nicht in Anhang I der EG-Vogelschutz-Richtlinie aufgeführt sind (Tab. 5). Außerdem empfehlen wir interdisziplinäre Projekte, um die Zusammenhänge zwischen den Daten aus verschiedenen Programmteilen des TMAP aufzudecken. Viel versprechend sind solche Projekte in Bezug auf das Management von Dünen und Salzwiesen, da einheitliche Datensätze auf trilateraler Ebene genutzt werden können, um Trends und Korrelationen von Vegetationsentwicklung und Brutvogelbeständen herauszuarbeiten. Bislang wurden solche Untersuchungen nur auf lokaler Ebene durchgeführt. Kenntnisse der Vegetationsentwicklung und die Reaktion von Brutvogelbeständen liefern belastbare Daten, um die anhaltenden Diskussionen zum Salzwiesenmanagement im gesamten Wattenmeer untermauern zu können.

Samenvatting

Inleiding en werkwijze

De Waddenzee behoort tot de belangrijkste broedgebieden voor kustbroedvogels in West-Europa, waaronder een aantal bedreigde soorten, zogenaamde *Species of European Conservation Concern (SPEC)* en soorten die voorkomen op bijlage 1 van de Europese Vogelrichtlijn. Monitoring van broedvogels in de Waddenzee is onderdeel van het *Trilateral Monitoring and Assessment Program* (TMAP). De inventarisaties worden gecoördineerd door de *Joint Monitoring Group of Breeding Birds* (JMBB) en richten zich op 31 vogelsoorten die karakteristiek zijn voor de biodiversiteit van de Waddenzee en die een indicatorrol vervullen bij evaluatie van de doelstellingen die in het Waddenzeeplan worden genoemd (‚voldoende voedselbeschikbaarheid' en ‚natuurlijk broedsucces'). De meeste van deze soorten zijn voor hun voedsel afhankelijk van het intergetijdegebied. Het doel van de inventarisaties is het signaleren van aantalsontwikkelingen en het in kaart brengen van de verspreiding van broedvogels in de Waddenzee. In een bredere context worden de gegevens gebruikt om na te gaan (1) welke veranderingen optreden als gevolg van klimaatveranderingen: (2) in hoeverre belasting met toxische stoffen de conditie en het broedsucces van broedvogels beïnvloeden: (3) welke invloed uitgaat van visserij; (4) welke rol recreatie speelt als mogelijke bron van verstoring en (5) welke invloed het agrarisch beheer van kweldergebieden (bijv. grazend vee) heeft op de broedvogels.

De werkwijze bij de inventarisaties verschilt per soort. Zeldzame soorten en koloniebroedvogels, die geconcentreerd broeden in specifieke gebieden, worden jaarlijks in de hele internationale Waddenzee (de ‚*Wadden Sea Area*', vgl. Figuur 1) in kaart gebracht. Voor algemene soorten is een netwerk van 103 steekproefgebieden opgezet die alle habitats van het gebied op representatieve wijze vertegenwoordigen (Figuur 2). Deze gebieden worden eveneens jaarlijks onderzocht. Eens in de vijf jaar wordt er een volledige inventarisatie georganiseerd en worden alle 31 soorten in het hele gebied geteld. Dergelijke tellingen waren er in 1991, 1996, 2001; de volgende wordt uitgevoerd in 2006. Daarmee is eens in de vijf jaar een volledig overzicht van de verspreiding van alle soorten beschikbaar. Trendanalyses worden uitgevoerd met de jaarlijks onderzochte soorten en steekproefgebieden. Het veldwerk wordt volgens gestandaardiseerde methodieken uitgevoerd, vastgelegd in een speciale handleiding. Geregeld worden er bijeenkomsten georganiseerd (‚*Quality Assurance Meeting*') om telmethodieken te ijken, inzicht te krijgen in verschillen tussen waarnemers en waarnemers te trainen. Een groot deel van het veldwerk wordt uitgevoerd door vrijwilligers, medewerkers van terreinbeheerders en een klein aantal professionele tellers van (regionale) overheidsdiensten (Tabel 1). Dit rapport geeft een overzicht van de resultaten van de volledige telling in 2001 en is de derde in een serie van vergelijkbare rapportages. Centraal staan de populaties en verspreiding in 2001 en aantalsontwikkelingen over 1991-2001. Indien mogelijk worden ook actuele ontwikkelingen na 2001 gesignaleerd. In hoofdstuk 3 zijn de belangrijkste resultaten op toegankelijke wijze samengevat; hoofdstuk 4 geeft details per soort.

Broedvogels in 2001

De volledige inventarisatie in 2001 leverde voor alle soorten samen 469.000 broedparen of territoria op (Tabel 2). Hiervan heeft bijna 70% betrekking op meeuwen, vooral Kokmeeuw, Kleine Mantelmeeuw en Zilvermeeuw. Daarnaast gaat het bij 18% van alle broedvogels om steltlopers, met name Scholekster, Kluut, Kievit en Tureluur. Uitgesproken zeldzaam zijn Bonte Strandloper (ondersoort *schinzii*) en Kemphaan. Beide zijn sterk afgenomen en staan op de rand van uitsterven als broedvogel in de Waddenzee. Voor 21 van de 31 soorten heeft de broedpopulatie in de Waddenzee betrekking op meer dan 1% van de totale NW-Europese populatie (Tabel 2, Figuur 74). Internationaal gezien is vooral het voorkomen van Lepelaar, Kluut, Lachstern en Grote Stern van belang, elk met meer dan een derde (Lachstern zelfs 100%) van de NW-Europese populatie. Voor andere soorten ligt de Waddenzee aan de rand van het verspreidingsgebied, bijv. Middelste Zaagbek, Zwartkopmeeuw en Dwergstern. Het voorkomen is daardoor niet jaarlijks (Dwergmeeuw) of het gaat steeds om kleine aantallen. De meeste soorten (21 van 30) komen in grootste aantallen tot broeden op eilanden (Figuur 9), vooral in kolonies broedende soorten als Aalscholver, Lepelaar, meeuwen en sterns. Hetzelfde geldt voor Blauwe Kiekendief en Velduil, die voornamelijk in duingebieden in de westelijke Waddenzee broeden. Kluut, Bontbekplevier, Strandplevier, Lachstern, Kievit en Grutto daarentegen vinden we voornamelijk langs de kust van het vaste land. Achtergronden voor deze verschillen in verspreiding moeten we zoeken in mate van verstoring (groter op de stranden van de eilanden bij de beide plevieren) en vooral het risico van predatie, dat op de eilanden door het ontbreken van zoogdieren als Vos en marterachtigen veel geringer is als langs het vasteland. Daarnaast zullen het voorkomen van geschikt broedhabitat en de ligging van de voedselgebieden de verspreiding primair bepalen.

Aantalsontwikkelingen 1991-2001

Een analyse van de trends over 1991-2001 laat voor 10 van de 31 soorten een significante toename zien (Tabel 3). Opvallend daarbij is, dat soorten van bijlage 1 van de Vogelrichtlijn na 1996 gemiddeld stabiele aantallen laten zien, terwijl overige soorten gemiddeld nog toenemen (Figuur 11). Soorten die na 1991 de sterkste jaarlijkse groei lieten zien zijn Aalscholver, Grote Mantelmeeuw, Lepelaar, Kleine Mantelmeeuw en Zwartkopmeeuw (Figuur 10). Al deze soorten hebben in de afgelopen jaren hun broedgebied in Europa uitgebreid en ook gegevens verzameld na 2001 wijzen op verdere toename. Voor de meeste soorten zijn de aantalsontwikkelingen vergelijkbaar over de hele periode van 1991-2001. Aleen bij Eider en Noordse Stern is na 1996 sprake van een trendbreuk en een afname. Voor Eider gaat het hier voornamelijk om de (grote) broedpopulatie in de Nederlandse Waddenzee.

Significant afnemende soorten in 1991-2001 (9 soorten) zijn o.a. Bontbekplevier, Strandplevier, Kievit, Grutto, Visdief en Zilvermeeuw. Bonte Strandloper, Kemphaan en Watersnip namen eveneens sterk af, maar door hun schaarse voorkomen zijn ze moeilijk in trendberekeningen te vangen. Bonte Strandloper en Kemphaan lopen grote kans in de nabije toekomst als broedvogel in de Waddenzee te verdwijnen. Voor Kievit, Grutto en Zilvermeeuw lijkt na 1996 sprake van stabilisatie op een lager niveau. Visdief laat eveneens herstel zien van de eerdere afname, behalve in de Nederlandse Waddenzee waar de aantallen verder afnamen in 2002-2004.

Regionale verschillen in aantalsontwikkeling

Bij veel soorten zijn de aantalsontwikkelingen in de hele Waddenzee vergelijkbaar en vaak ook overeenkomstig de trend in omringende landen en gebieden. Dit gaat op voor bijv. Aalscholver, Stormmeeuw, Kleine Mantelmeeuw, Noordse Stern en Dwergstern. Daar staat tegenover dat de Waddenzeelanden onderling soms (sterk) van elkaar verschillen. Uit een vergelijking van trends voor 16 soorten die in de hele Waddenzee voorkomen, blijkt dat in het noordelijk deel van de Waddenzee (Denemarken en Sleeswijk-Holstein) de meeste soorten het beter te doen dan in Nedersaksen en Nederland (Figuur 12). Hier namen slechts enkele soorten af die in de westelijke Waddenzee stabiel bleven of in aantal groeiden. In Nedersaksen en Nederland daarentegen doen veel soorten het juist slechter, o.a. Kluut en Zilvermeeuw (beide landen), Tureluur (Nedersaksen), Blauwe Kiekendief, Scholekster, Kokmeeuw en Velduil (Nederland). Daarnaast heeft Eider, die ten oosten van de Eemsmonding in slechts kleine aantallen broedt, sinds 1996 een sterke afname laten zien in de Nederlandse Waddenzee. In veel gevallen is niet geheel duidelijk welke oorzaken achter deze contrasterende ontwikkelingen schuil gaan; in ieder geval bij een aantal soorten is een grote rol voor de schelpdiervisserij aannemelijk, omdat juist daar grote verschillen in intensiteit en regulatie bestaan tussen de verschillende landen (zie onder).

Oorzaken achter de trends verklaard

Het trilaterale broedvogelmeetnet is in de eerste plaats bedoeld als monitoringproject voor aantallen en verspreiding van broedvogels in de Waddenzee. Het zoekt dus niet naar verklaringen voor de waargenomen ontwikkelingen; het signaleert slechts dat er iets verandert. Om meer inzicht in de achtergronden voor de verschillende trends te krijgen zouden extra paramaters onderzocht moeten worden, zoals broedsucces en overleving, die beide niet in TMAP zijn ondergebracht. Daarnaast is specifiek onderzoek van belang, bijv. volgend op signalen vanuit de monitoring. Resultaten van onderzoek dat tot dusverre aan verschillende soorten is uitgevoerd heeft laten zien dat een aantal soorten onder druk staan van recreatie en andere menselijke verstoringsbronnen (Bontbekplevier en Strandplevier in de hele Waddenzee), schelpdiervisserij de voedselbeschikbaarheid van een aantal soorten negatief heeft beïnvloed (Eider, Scholekster en wellicht ook Zilvermeeuw in Nederland), habitatveranderingen mogelijk Blauwe Kiekendief en Velduil op de Nederlandse eilanden negatief in de kaart spelen en het predatierisico langs de vastelandskust is toegenomen. Dit laatste manifesteert zich vooral in Nederland en Nedersaksen (o.a. Kluut en Kokmeeuw), en leidde bij bijv. Kokmeeuw tot een verschuiving van kolonies naar de eilanden. Predatie werd ook in voorgaande rapportages genoemd, maar de mate waarin en/of de gevolgen ervan lijken recent groter te zijn geworden. Dit betekent ook dat verbetering van eventuele verbindingen (dammen) van het vasteland naar de eilanden met grote voorzichtigheid bekeken moeten worden, omdat juis via dergelijke verbindingen de grotere predatoren (zoogdieren als Vos en marterachtigen) zich gemakkelijk kunnen verplaatsen.

Het gevolg van klimaatveranderingen is tot dusverre niet in detail geanalyseerd, maar gezien de verwachte trends in zeespiegelrijzing, verhoging van gemiddeld tij bij vloed en meer storm en regen zijn een aantal soorten op termijn gevoelig voor stormvloeden of slecht weer in de nest- en kuikenfase. Dat gaat vooral op bij soorten die in schaars begroeide, onbeschutte terreinen broeden, zoals Kluut, Strandplevier, Bontbekplevier, Visdief, Noordse Stern en Dwergstern op zandplaten, stranden en de rand van de kwelder. Een aantal van deze soorten nemen om andere redenen ook nu al af, en een grotere invloed van klimaatveranderingen zou dus een extra druk op de populatie betekenen. Effecten van veranderingen in kwelderbeheer zijn tot dusverre op een aantal locaties onderzocht, met name in de Duitse Waddenzee. In hoeverre de hier opgetreden veranderingen (afname beweidingsintensiteit) invloed hebben gehad op de hier besproken trends over 1991-2001 is nog onzeker. Onderzoek tot nu toe heeft laten zien dat de diversiteit aan soorten op minder intensief beheerder kwelders toeneemt, vooral door toename van zangvogels. Daar staat tegenover dat soorten die een kortere vegetatie prefereren baat hebben bij een zekere mate van beheer, bijv. in de vorm van beweiding. Nader onderzoek, vooral in de vorm van analyses van bestaande gegevens, is nodig om deze aspecten verder te ontrafelen. Broedvogels en belasting met contaminanten zijn onderwerp van een speciaal TMAP-project. Tegenwoordig is de belasting zo laag dat invloed op broedvogeltrends niet waarschijlijk is; bovenal omdat grote veranderingen in vervuilingsniveau plaatsvonden voor de start van het broedvogelmeetnet in 1991. Niettemin is het echter nog steeds zo dat de populatie van een soort als Grote Stern zich nog niet heeft hersteld van de sterke verontreinigingen in de jaren zestig.

Evaluatie Waddenzee Targets

De hier besproken resultaten van de broedvogelmonitoring laten zien dat bij een aantal soorten de doelen die in het Waddenzeeplan worden geformuleerd niet worden gehaald. Dit betreft het broedsucces van Bontbekplevier en Strandplevier, dat wordt beïnvloed door gebrek aan dynamische habitats en verstoring door mensen. In hoeverre ook bij andere soorten het broedsucces de waargenomen aantalsontwikkelingen bepaald is minder duidelijk. Het broedsucces wordt als zodanig niet met een afzonderlijk monitoringprogramma gevolgd, zodat gegevens alleen beschikbaar zijn bij soorten die extra zijn onderzocht. Ten aanzien van de doelstelling voldoende voedsel beschikbaar te hebben, is duidelijk geworden dat met name de mechanische schelpdiervisserij in het Nederlandse deel van de Waddenzee (eerder ook in Denemarken) een belangrijke rol heeft gespeeld bij de afname van Eider, Scholekster en mogelijk ook Zilvermeeuw, speciaal in het Nederlandse deel van de Waddenzee. Het stopzetten van de mechanische kokkelvisserij in de Nederlandse Waddenzee in 2004-2005 is dus een belangrijke stap voorwaarts om de voedselbeschikbaarheid voor schelpdieretende vogels te vergroten. Mosselvisserij blijft toegestaan in de Nederlandse Waddenzee, maar wordt onderworpen aan een onderzoeks- en monitoringprogramma om eventuele effecten op vogels goed in kaart te brengen.

Kijken we naar de ontwikkelingen bij bijlage I soorten van de Vogelrichtlijn, waarvoor de lidstaten van de EU verplicht zijn een gunstige staat van instandhouding te bewerkstelligen, dan springen negatieve trends bij Blauwe Kiekendief, Kluut, Strandplevier, Bonte Strandloper, Kemphaan, Grote Stern, Visdief en Velduil in het oog. Deze soorten lieten in de hele Waddenzee, of delen daarvan, in 1991-2001 een significante afname zien (Tab. 4). Sterk bedreigd is vooral Bonte Strandloper, waarvan het voorkomen in de Waddenzee zich op de rand van uitsterven beweegt. Bovenal gaat het hier om een speciale ondersoort *schinzii*, die ook elders in Europa onder druk staat. Zonder speciale maatregelen verdwijnt deze soort waarschijnlijk als broedvogel uit de Waddenzee.

Aanbevelingen

De gegevens in dit rapport laten zien dat de trilaterale monitoring zoals dat door JMBB en TMAP wordt georganiseerd onmisbaar is bij het signaleren van ontwikkelingen in aantallen en verspreiding van broedvogels in de Waddenzee. Vooral met behulp van gegevens van speciaal onderzoek was het bovendien mogelijk bij een aantal soorten nader in te gaan op de achtergronden van de waargenomen ontwikkelingen. Echter, een belangrijke doelstelling als ‚natuurlijk broedsucces', zoals geformuleerd in het Waddenzeeplan, kan niet worden gevolgd met alleen het monitoren en tellen van broedparen. Monitoring van broedsucces is ondanks een verkennende studie in 1996-97 tot dusverre niet opgenomen in TMAP. In 2005 is bovendien een start gemaakt met een monitoringprogramma van broedsucces in de Nederlandse Waddenzee, zodat inmiddels veel ervaring beschikbaar is hoe een dergelijke monitoring trilateraal vormgegeven kan worden en niets de implementatie ervan in de weg staat. Naast jaarlijkse monitoring van broedsucces is het van belang meer te weten te komen over de overleving van broedvogels in de Waddenzee. De op die wijze opgezette integrale monitoring van broedvogels geeft sneller zicht op de veranderingen die in de broedpopulaties plaatsvinden, geeft directer aan waar de knelpunten voorkomen, en geeft dus ook het beleid sneller een signaal dat bijsturing van bestaand beleid of nieuwe maatregelen noodzakelijk is. Eventuele maatregelen moeten niet alleen worden beperkt tot soorten die op bijlage 1 van de Vogelrichtlijn staan. Ook voor verschillende soorten die niet in bijlage 1 worden genoemd, is de Waddenzee in internationale context van groot belang als broedgebied, bijv. Scholekster, Bontbekplevier en Kokmeeuw. Deze soorten werden tot dusverre afgedekt met de Rode Lijst van broedvogels in de Waddenzee (1996), maar door implementatie van het Europese Natura 2000 netwerk is deze Rode Lijst wat op de achtergrond geraakt. We pleiten dan ook voor een aanvullende lijst van soorten die niet zijn opgenomen in bijlage 1 van de Vogelrichtlijn, maar toch in belangrijke aantallen in de Waddenzee voorkomen (Tabel 5).

Ten derde willen we onderzoek aanmoedigen waarbij gebruik wordt gemaakt van de bestaande gegevensseries die in het kader van de diverse TMAP-programma's worden verzameld. Tot dusverre hebben analyses vooral plaatsgevonden op het eigen project, zoals in dit rapport de broedvogels. Nu van verschillende parameters langere tijdsseries beschikbaar zijn, is het aan te bevelen ook vergelijkende analyses uit te voeren over verwante projecten, bijvoorbeeld vegetatieveranderingen en broedvogels. Vaak is dergelijk onderzoek op enkele locaties wel uitgevoerd, maar ontbreekt het aan mogelijkheden de resultaten op grotere schaal toepassing te laten vinden. Analyseren van dergelijke gegevens levert belangrijke bouwstenen aan voor de discussie over bijv. het optimale beheer van kweldergebieden.

1. Introduction

The Wadden Sea supports a large number of breeding birds and is one of the most important breeding areas in Western Europe for many species. Among them are species like Eurasian Spoonbill *Platalea leucorodia*, Avocet *Recurvirostra avosetta*, Kentish Plover *Charadrius alexandrinus* and Gull-billed Tern *Gelochelidon nilotica*, for which the Wadden Sea is a hot spot within the European breeding range. Moreover, some of them represent Species of European Conservation Concern (SPEC) and are important for European biodiversity. Furthermore, 14 breeding birds are listed as Annex I-species of the EC Birds Directive. Several species are also included in national Red Lists in Denmark, Schleswig-Holstein, Niedersachsen or the Netherlands, emphasizing the importance of the area for vulnerable and threatened species on a national scale as well. Monitoring of numbers and distribution of breeding birds is a part of the Trilateral Monitoring and Assessment Program (TMAP), which was established in 1989 within the framework of the trilateral Wadden Sea co-operation between Denmark, Germany and the Netherlands. In addition, monitoring in the Wadden Sea is embedded in international conventions and treaties such as the EC Birds- and Habitats Directive, the Ramsar Convention and the African-Eurasian Waterbird Agreement (AEWA). The objectives of the monitoring scheme according to the TMAP manual are to assess and detect:

- Population sizes and distribution of breeding birds throughout the Wadden Sea as well as population trends;
- Impact of climate changes on breeding bird populations;
- Response of breeding birds to contaminants that affect fitness of breeding birds;
- Impact of fisheries on breeding bird populations;
- Impact of recreational activities on breeding bird populations;
- Impact of agricultural changes (*e.g.* grazing) on salt marshes as natural breeding habitats of birds.

The Joint Monitoring Program for Breeding Birds focuses on 31 breeding bird species that are considered characteristic for the biodiversity in the Wadden Sea and that are representative indicator species to fulfil the aims listed above and monitor the targets concerning breeding birds addressed in the Wadden Sea Plan. Co-ordination is carried out by the Joint Monitoring Group of Breeding Birds (in short JMBB), which includes representatives from the national co-ordinators and the Wadden Sea Secretariat. Data collection includes a complete census of all selected 31 species in the entire Wadden Sea, carried out once every five years. Besides, annual censuses are carried out of colonial breeding birds and some rare bird species, as well as of all species in 103 sample plots (census areas) of all species. The complete census is carried out to assess population size and distribution. Annual surveys of the colonial and rare breeding birds and annual counts in the census areas aim to detect population trends.

So far, two complete censuses have been carried out, in 1991 (Fleet *et al.,* 1994) and in 1996 (Rasmussen *et al.,* 2000). Results of the surveys in census areas have been reviewed for 1990-1994 (Melter *et al.*, 1997). The current report presents the results of the third complete census in 2001 and reviews trends in numbers for the period 1991-2001. Its aim is to report to the Trilateral Working Group (TWG) and to give feedback to all, often voluntary, observers whose effort was essential to collect all field data. Furthermore, the data presented here were used in the 2004 update of the Quality Status Report (Koffijberg *et al.,* 2005a). In addition, some data from a recent highlight report from 2003-2004 (Koffijberg *et al.*, 2005b) have been incorporated here to give insight into trends after 2001.

The frame of the report is somewhat different from previous reports. After a description of the methods and coverage (chapter 2), the results are first presented as a general review (chapter 3) in order to give an overall picture of populations and trends and give quick access to the results. Separate species accounts (chapter 4) present the data on species-level and give more details considering breeding status, breeding habitat, distribution and potential explanations for the observed trends. Some of the baseline data concerning numbers and coverage are included as Annexes.

2. Survey Area and Methods

2.1 Survey Area

Monitoring of breeding birds in the Wadden Sea focuses on the so-called Wadden Sea Area, *i.e.* the area for which trilateral policies are operating (see Essink *et al.*, 2005). The delineation of this area on the mainland coast generally follows the main dike, or, where a main dike is absent, the high water line at spring tide. It also includes the estuaries of the Rivers Ems (inland as far as Leer), Weser (Elsfleth), Elbe (Glückstadt/Wischhafen), Eider (Tönning) and Varde Å, *i.e.* the brackish water limit up to three nautical miles from the baseline. Furthermore, all islands, Halligen in Schleswig-Holstein and outer sands are included. Additionally, some adjacent marsh areas behind the seawall in Denmark and Schleswig-Holstein are part of the Wadden Sea Area, *i.e.* recent embankments (coastal wetlands) in Schleswig-Holstein and coastal meadows between Tønder and Ribe in Denmark. However, the Lauwersmeer area (an embankment of the former Lauwerszee) in the Netherlands is not included. Figure 1 gives an overview of the Wadden Sea Area covered during breeding bird surveys.

All countries use some sort of site-division to collect and process field data (*e.g.* Dijksen, 1993; Hälterlein, 1998; Hälterlein *et al.*, 2000). For the purpose of this report, these areas have been combined into 56 census regions (see Table 1) which represent the division of dots in the distribution maps in chapter 4 and which are similar to the census regions used in previous trilateral breeding bird reports.

Figure 1: Wadden Sea Area and areas covered for monitoring of breeding birds in 1990-2001.

Country	Size in ha	No. of regions	No. of census areas	Size census areas (ha)	Co-ordination
Denmark	43,684	13	10	1,285	National Environmental Research Institute, Kalø
Schleswig-Holstein	41,796	15	21	6,510	Nationalparkamt, Tönning
Niedersachsen	26,111	17	25	3,728	Staatliche Vogelschutzwarte[1], Hannover
The Netherlands	44,788	11	47 [2]	6,752	SOVON Vogelonderzoek Nederland, Beek-Ubbergen

[1] now part of Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz/NLWKN
[2] formerly 35, but small plots at close range have now been treated separately (plots along the coast of Noord-Holland, coast Groningen, Dollard).

Table 1: Organisation of the Joint Monitoring Program for Breeding Birds in the Wadden Sea. Size (in ha) gives the size of the surveyed area, number of regions refers to the number of census regions used to express distribution patterns, number of census areas refers to the number of sample plots that are used to assess trends in common species, see Figures 1 and 2 for locations of census regions and census areas and Annex 2 for list of census areas.

2.2 Outline of the Monitoring Scheme

The Joint Monitoring Program for Breeding Birds focuses on 31 target species that are considered characteristic Wadden Sea breeders and mainly (but not exclusively) depend on the intertidal mud flats to feed (Appendix 1). The selection of species includes colonial and rare breeders like Hen Harrier *Circus cyaneus*, Avocet, Black-headed Gull *Larus ridibundus* and Arctic Tern *Sterna paradisaea*. Besides, common and more widespread breeding species are covered, *e.g.* Oystercatcher *Haematopus ostralegus*, Northern Lapwing *Vanellus vanellus* and Common Redshank *Tringa totanus*. Colonial and rare breeding birds are counted annually at all breeding sites. They are concentrated at few sites or easily displace from year to year. Therefore, it is essential to collect annual information concerning breeding numbers and distribution in order to allow reliable trend estimates. In Table 3 this group of species is listed under 'Method 1'. Common breeding species are counted annually in census areas (Figure 2). Only once every five years (starting 1991) is this group of species covered in a complete survey. Annual trends in these species are assessed by using the data of the census areas ('Method 2' in Table 3). These census areas have been set up as a representative sample for all habitats in the entire Wadden Sea. Some changes in the location of census areas were made in 1999, after an evaluation had shown that the distribution of census areas regarding the different habitats was not sufficient (van Turnhout, 1999). In Schleswig-Holstein, coastal wetlands are not covered by census areas.

2.3 Fieldwork

Collection of field data and interpretation of the results in the breeding bird surveys is currently carried out according to standardized trilateral guidelines. It includes counts of territories (*e.g.* coastal waders), counts of adult individuals attending colonies (colonial breeding birds) and counts of nests

(some colonial breeding birds). A major step towards further harmonization of survey methods and interpretation was made with the implementation of a trilateral manual (Hälterlein *et al.*, 1995). Previously, data were collected according to national guidelines (*e.g.* Hustings *et al.*, 1985; Brunckhorst *et al.*, 1988) that were slightly different among the three countries. The trilateral guidelines by Hälterlein *et al.* (1995) give a general review of fieldwork carried out in the Wadden Sea (planning and organization) and provide census strategies for different habitats, colonial breeding birds, territorial breeding birds as well as a detailed species-by-species description of methods and interpretation of field data. As a result of the implementation of the manual, methods used might differ somewhat between the 1991 and 1996-2001 surveys. Today, the preferred method for assessing colony sizes is to count all individuals in the colony and divide them by 0.7. Before 1994, nest counts were often carried out or a different factor (*e.g.* 0.5) was used to estimate the numbers of breeding pairs (Melter *et al.*, 1997; Rasmussen *et al.*, 2000). However, research on methods has shown that the strategy of counting individuals often provides a more reliable estimate of colony size, since not all birds might have a nest during the nest-count. Moreover, counting individuals is

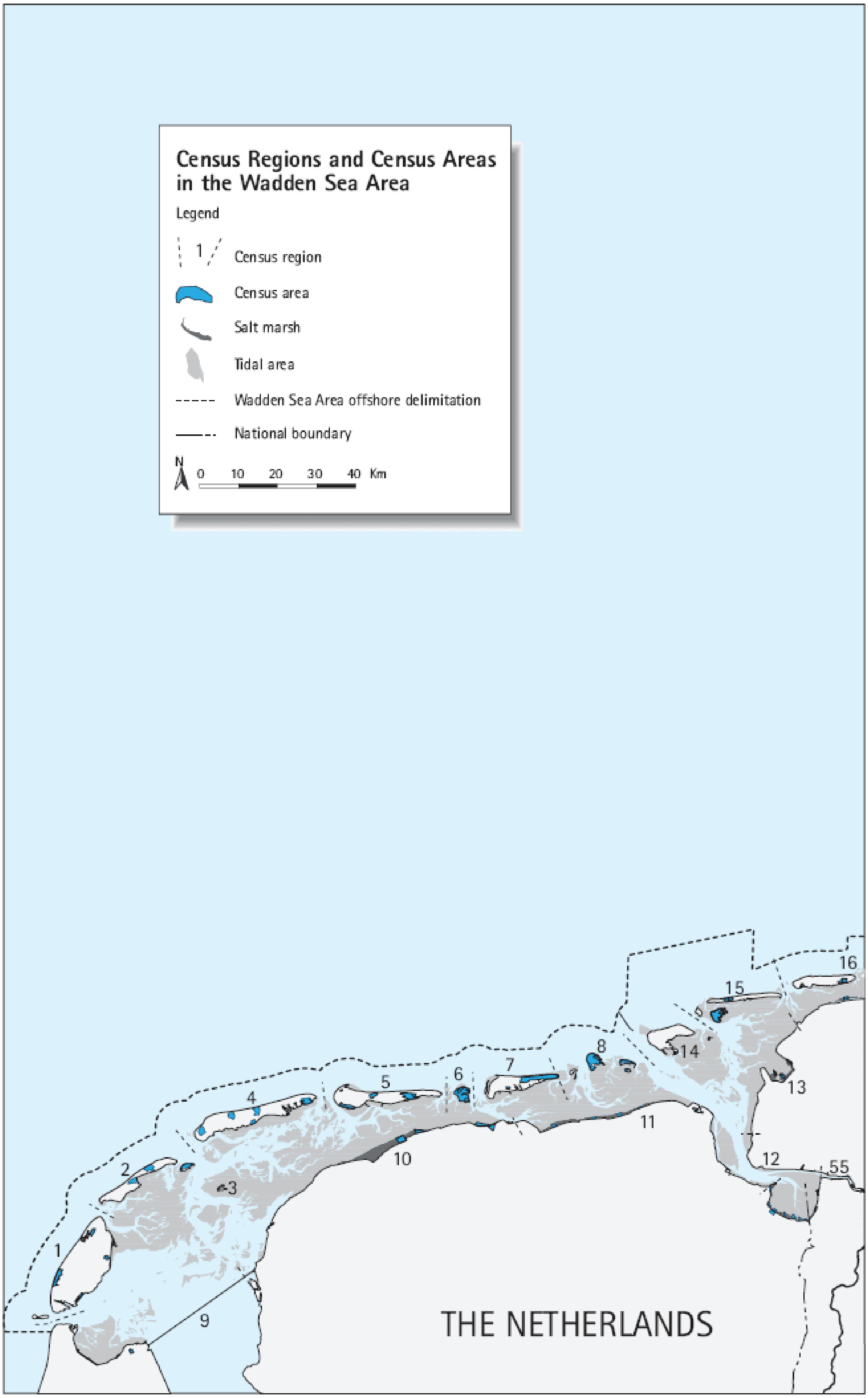
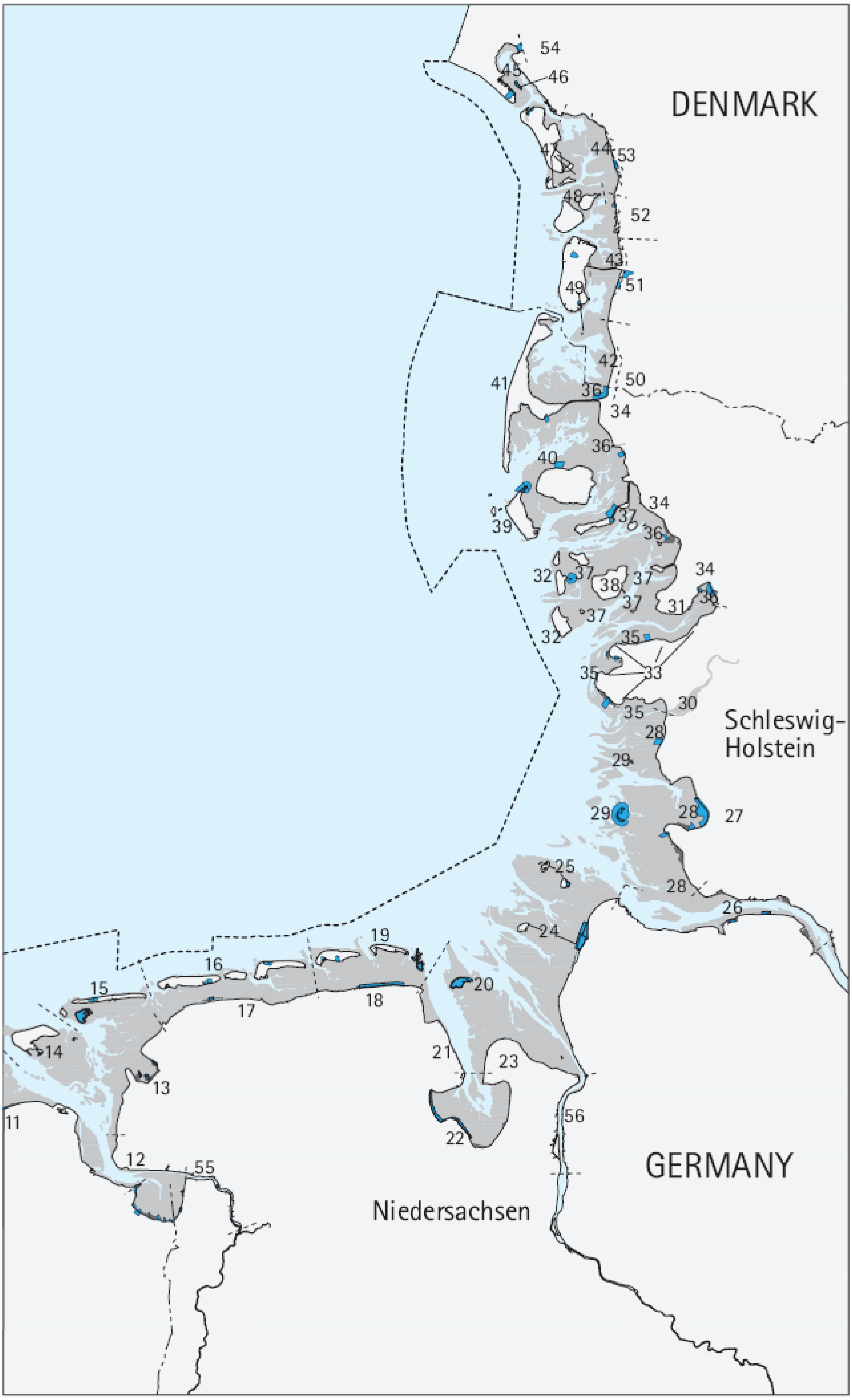


Figure 2:
Map of census regions and census areas in the Joint Monitoring Program for Breeding Birds in the Wadden Sea that were used in this report to calculate trends for common breeding birds. A complete list of census areas is included in Annex 2.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less disturbing because it can be carried out much more quickly and without walking extensively through colonies. Using the factor of 0.7 accounts for the pairs for which the non-breeding partner is not present in the colony.

The precise strategy for assessing the number of breeding pairs differs among sites and often depends on site-specific conditions like accessibility of the area for the observer, vegetation type and risk of disturbance. However, the same method is always used at the same site from year-to-year, *i.e.* the data for one site are not subject to changes in counting method and therefore provide reliable input for trend analysis. Also, the countries use slightly different methods. In Niedersachsen and Schleswig-Holstein, colonies of Great Cormorant *Phalacrocorax carbo*, Eurasian Spoonbill and gulls are counted by airplane (Grünkorn, 1998), whereas in the Netherlands and Denmark these species are assessed by ground-based counts. Furthermore, surveys in censur areas in the Netherlands also follow national guidelines of the Common Breeding Bird Census (BMP) within the Network Ecological Monitoring, which request a slightly higher counting effort compared to trilateral standards (van Dijk, 2004). For other species, more intensive studies also have been conducted to focus on conservation measures. The extent to which changes in counting strategy could affect the estimated numbers of breeding pairs is discussed in the species account in chapter 4.

During 1993-2001, a series of seven 'Quality Assurance Meetings' was carried out to validate census techniques and check between-observer differences during surveys. Blew (2003) has analysed the results of these meetings and concludes that census errors made during counts are similar to those given in the literature, *i.e.* about 20% on average, regardless of the size of the colony or number of birds present. Furthermore, there was a tendency to underestimate colony size when compared to reference data yielded by *e.g.* the regular aerial survey. So far, several counts have been conducted during 'Quality Assurance Meetings' and their results have been used extensively for training purposes in those areas where turnover of observers is higher, *e.g.* in Niedersachsen and Schleswig-Holstein.

2.4 Coverage

2.4.1 Coverage of the Total Survey in 2001

Overall coverage in 2001 was similar to the surveys in 1991 and 1996. Apart from some minor gaps, nearly all breeding sites and important concentrations of breeding birds in the Wadden Sea were counted. Country-specific details on coverage are stated below. The census regions mentioned refer to the units in Figure 2, also used for the distribution maps in chapter 4.

Denmark

All census regions were covered. However, Eurasian Curlew *Numenius arquata* at Rømø and Common Snipe *Gallinago gallinago* at Rømø and Fanø were were poorly covered in 2001. Grassland and arable fields in the polders ('*marsken'*)

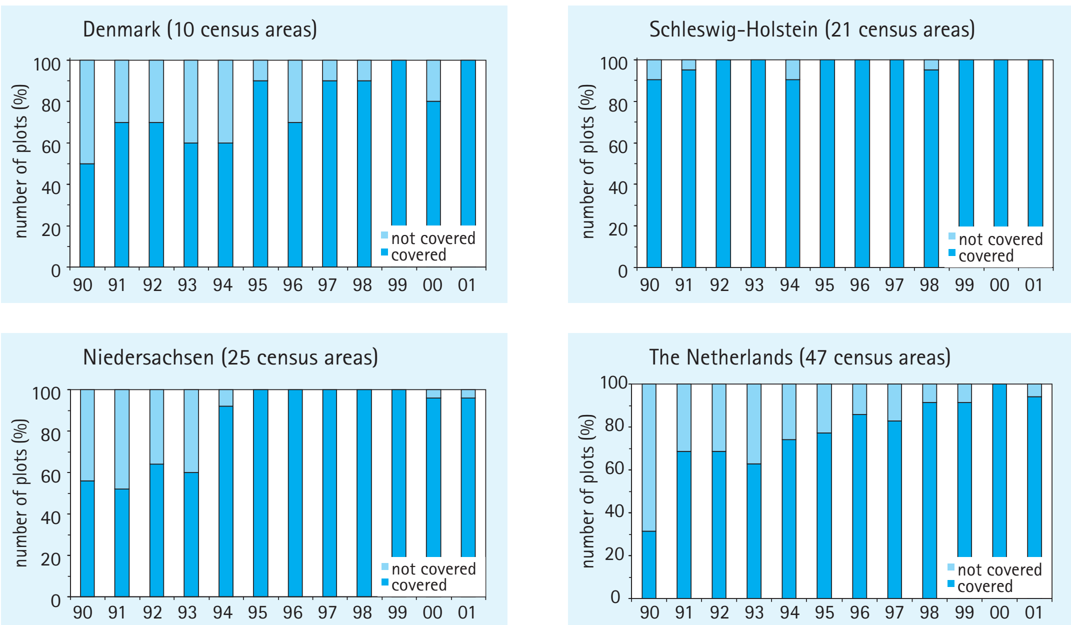


Figure 3: Coverage of census areas in 1990-2001.

between Tønder and Ribe (important for coastal waders, in particular Northern Lapwing) had better coverage in 2001 than in 1996 for all species. In 1991, these inland sites were not included in the census at all.

Schleswig-Holstein

All census regions were covered; there were no differences between the 1996 and 2001 (and 1991) surveys. Population sizes of Eurasian Oystercatcher, Northern Lapwing and Common Redshank in inland areas on the islands of Föhr, Pellworm and Nordstrand were assessed by extrapolating data of sample plots which cover 20% of the area.

Niedersachsen

All census regions were covered; with no differences between the 1996 and 2001 (and 1991) surveys.

The Netherlands

All census regions were covered. However, some small changes in site-coverage occurred between the 1996 and 2001 surveys. The common breeding birds in inland polders on the island of Texel (6444 ha coastal meadows) were covered in 1996 but not in 2001 (and in 1991). For reasons of comparison, these 1996 data have been omitted, since they represent only an incidental count, and will also be left out in future counts. This especially affects numbers of coastal waders (*e.g.* Oystercatcher, Northern Lapwing and Common Redshank). All rare and colonial breeding birds were covered at Texel during all surveys. At the other islands (Vlieland, Terschelling, Ameland, Schiermonnikoog) all inland polders with coastal meadows were counted during the three complete surveys, except for Schiermonnikoog in 1996 (only rare and colonial breeders covered). Along the mainland coast, data for common breeding birds in Eemshaven (area 12a, Eems/Dollard) were included in 2001 but not in previous surveys. This area supports small numbers of Oystercatcher, Common Redshank and Black-tailed Godwit *Limosa limosa*. Furthermore, data were lacking for two salt marsh areas along the Groningen coast. Numbers in this area have been estimated with densities from neigbouring sites (see chapter 2.5).

Moreover, part of the 2001 survey in the Netherlands was conducted in 2002 due to the foot and mouth disease. After an outbreak of the disease in Friesland, major restrictions for public access to rural areas were introduced. These included all mainland salt marshes in the provinces Friesland and Groningen, which were closed to public for most of the breeding season to avoid further expansion of the disease. In Groningen, it remained possible to count rare and colonial breeders on the salt marshes, but not all sample plots and other species outside the plots. The latter were both covered in 2002. In Friesland, no survey was possible, and the entire census (with full coverage) was done in 2002.

2.4.2 Coverage of Census Areas 1990-2001

In this report, 103 census areas were analysed to calculate trends for common breeding birds in the period 1991-2001 (Figure 2). Especially after 1996, coverage of these plots was nearly 100% (Figure 3). Before 1995-1996, lower coverage was achieved in Denmark, Niedersachsen and the Netherlands (about 60-65% of all plots). Especially in the Netherlands, for many plots data are missing from 1990, the first year of the project (only 30% of all census areas were counted). In trend analyses, missing counts have been corrected for by imputing. Due to the gaps in 1990, analyses have been carried out from 1991 onwards (see chapter 2.5).

2.5. Data Processing and Analyses

All data compiled in this report have first been processed and checked at national level by the coordinators in Denmark, Schleswig-Holstein, Niedersachsen and the Netherlands. Subsequently, two databases were set up for further analysis, one containing the results for each species per census region (see chapter 2.4.1) and one containing the results of the 103 census areas. Numbers and species are tabulated in Annex 3.

Although coverage was high, especially the series of census areas contained missing years, notably in the first half of the 1990s (Figure 3). For these missing years, estimates were calculated by the commonly used TRIM package (*Trends and Indices for Monitoring Data*). This package produces estimates for gaps in data series according to trends in neighboring plots, or plots in the same region. (Pannekoek and van Strien 1999). Region has been defined here as the other census areas in the respective part of the Wadden Sea, *i.e.* Denmark, Schleswig-Holstein, Niedersachsen and the Netherlands. In Denmark, analysis was more difficult since not only coverage, but also size of the plots differed between the first and second half of the 1990s. With the original census data, numbers in the first half of the 1990s were adapted to the size of the plots in the second half of the 1990s to arrive at a comparable series of data. These adapted data were used for further analysis. All trend analyses refer to the period 1991-2001.

For the results of the total survey, only minor gap-filling was necessary for two Dutch saltmarsh areas (Westpolder and Julianapolder in Groningen), for which data in 2001 were lacking. For these areas, estimates were calculated by multiplying densities of a sample plot covering 30% of this area. Data collected in 2002 were re-calculated to 2001 using the change in numbers between 2001 and 2002 in the census areas.

Trend analyses were carried out with TRIM. This uses log-linear regression to calculate and assess trends (Pannekoek and van Strien, 1999). Trends were tested for significance at $P = 0.05$ by use of a Wald test.

2.6 Factors Affecting Breeding Bird Populations

2.6.1 Weather

Weather conditions are one of the main natural constraints for breeding birds in the Wadden Sea. Before the breeding season, especially the population of resident species like the Oystercatcher are susceptible to severe cold occurring in winters like 1995/96 and 1996/97 (Camphuysen *et al.*, 1996). Furthermore, low temperatures in the second part of the breeding season might affect survival of chicks, as *e.g.* shown for Avocet in connection with temperatures in June (Hötker and Segebade, 2000). Perhaps the largest threat for coastal breeding birds is the risk of flooding as a result of stormy weather. When occurring in May or June, this may result in complete failure in breeding colonies and single settlements of many species. Species breeding in exposed areas such as low dunes or on beaches (*e.g.* Great Ringed Plover *Charadrius hiaticula*, Kentish Plover, terns) are even more susceptible to flooding since they will also suffer from less exceptional high tides. A summary of important weather parameters is given in Figures 4-7.

Cold Winters

In general terms, average winter temperatures in the western part of the Wadden Sea are higher than in the northern part of Schleswig-Holstein and Denmark (cf. Figure 4). The occurrence of ice-winters, however, tends to be more generalized. Within the period covered in this report, the winter of 1995/96 was exceptionally cold in December-February, and mass-starvation was reported in *e.g.* Oystercatcher (Camphuysen *et al.*, 1996). In 1996/97 temperatures were also below average, but for a much shorter period (January) than during the previous winter. Short cold-spells also occurred in 1991, 1994 (both in February) and 2001 (January). Exceptionally mild winters were 1991/92, 1997/98 and, especially, 1999/2000 (no days at all with maximum temperatures below zero). Of the complete surveys, especially 1996 was affected by the preceding cold winter and subsequent low temperatures in early spring.

Spring Temperatures

During 1991-2001, five out of 11 breeding seasons had temperatures above average in all sections of the Wadden Sea (Figure 5), which is in accordance with the general tendency for higher temperatures in recent years. Especially 1992 was very warm. Cold weather prevailed in the 1991 and 1996 breeding seasons. In 1991, May and June temperatures remained below long-term mean values, whereas in 1996 April and May were cold.

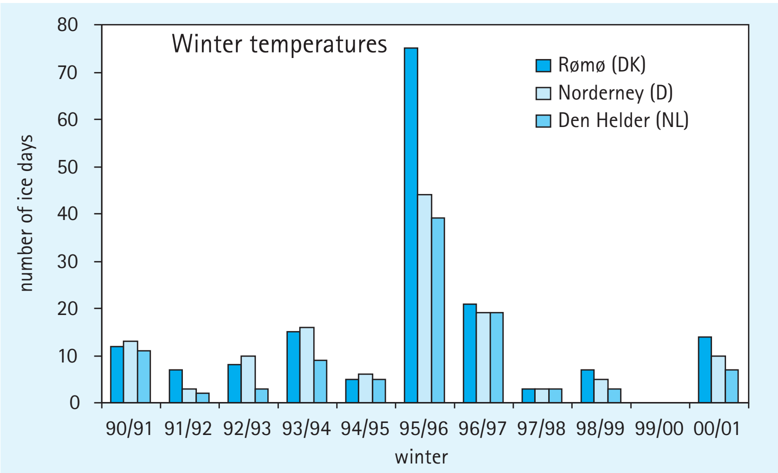


Figure 4: Winter temperatures in the Wadden Sea in 1990/91 – 2000/01, expressed as the number of ice-days (i.e. days with maximum daily temperature < 0°C).

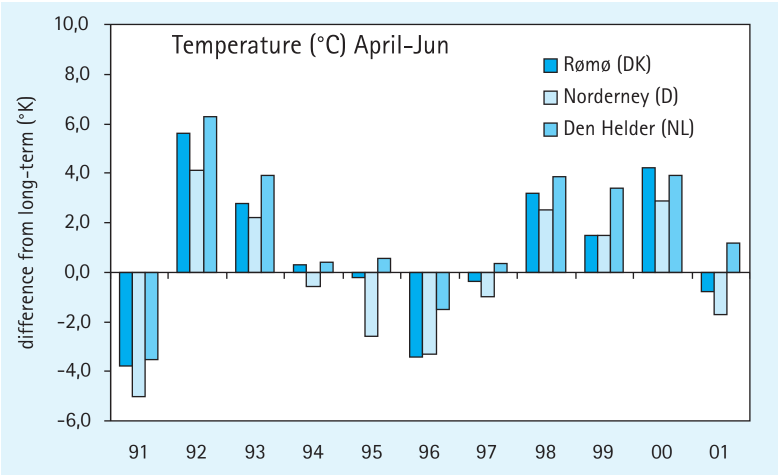


Figure 5: Spring temperatures in 1991-2001, expressed as the difference from long-term average daily temperatures in April-June. This difference was calculated by summarising the difference between actual monthly average temperatures and long-term averages. Positive values designate a warm spring compared to the average, negative values a cold spring.

In 1995/96, the cold period in December-February only phased out slowly in March and April, with many days having minimum temperatures below zero. It is likely that the initial cold spring in 1996 delayed breeding, whereas in 1991 especially chick survival in June might have been affected. Rasmussen *et al.* (2000) report delayed breeding in Denmark in 1996 for Oystercatcher and Redshank. Thus, of the complete surveys, conditions in both 1991 and 1996 were worse than in 2001.

Precipitation

Patterns of the amount of precipitation were highly variable during 1991-2001 (Figure 6). On average, 1991 (April and June), 1995 (May-June) and 2000 (April) were very wet breeding seasons in most parts of the Wadden Sea. In 1997, only the northern part of the Wadden Sea had more than average rainfall. The cold spring of 1996 coincided with extreme drought during an extensive part of the breeding season and was characterized by a long delay in vegetation growth (affecting breeding habitat and thus settlement of territories, see above). Furthermore, (extremely) dry weather occurred in April 1997, June 1992 and June 1993. Also here, highest impact has to be expected for the complete surveys in 1991 and 1996.

2.6.2 Flooding

During 1991-2001, water tables above mean high tide occurred in all breeding seasons (Figure 7). From 1994-99 there were frequent high tides in April, but being so early in the breeding season, these probably had low impact on breeding birds. Especially flooding in May and June may lead to failure of clutches and drowned chicks. This occurred during all complete surveys in June, and in 1996 also on several occasions in May. Also, 1994 and 1995 had frequent high tides in June. The precise impact of such high tides is difficult to estimate since it depends not only on the ground level of the salt marshes and outer sands, but also varies according to wind direction. In the Nether-

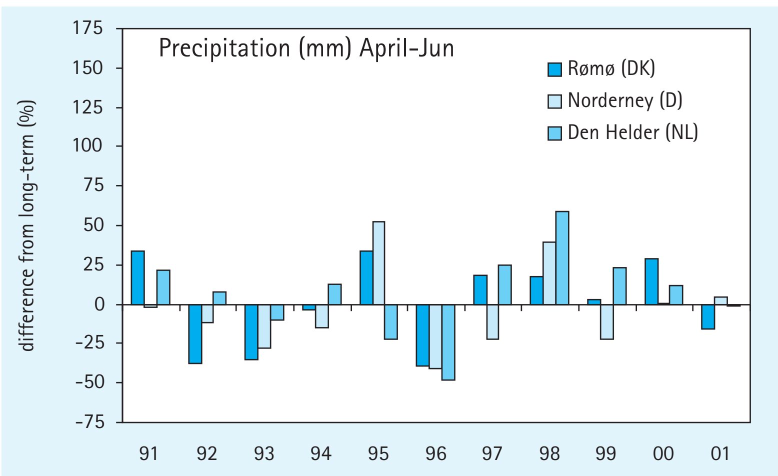
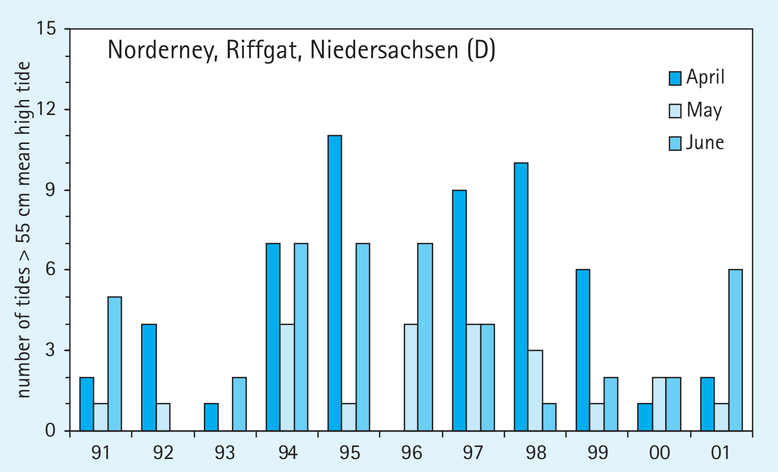
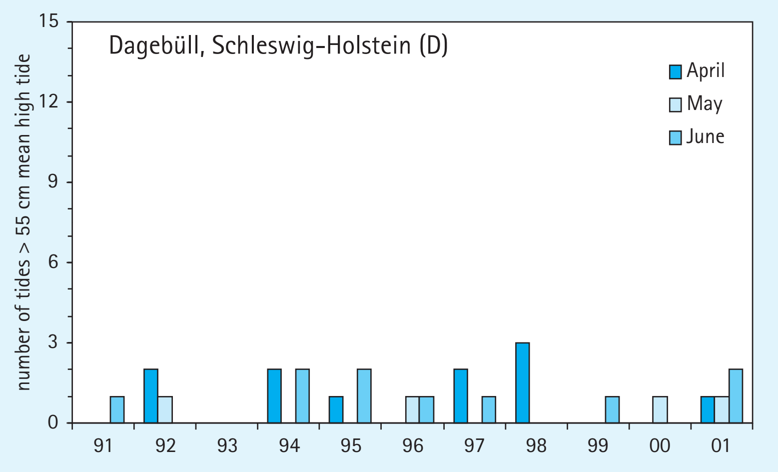


Figure 6: Precipitation in 1991-2001, expressed as the difference in % from the long-term average in April-June. Presentation similar as temperature in Figure 5.

Figure 7: Occurrence of flooding events, expressed as the number of high tides with water tables >55 cm above mean high tide in April-June at Norderney Riffgat (data NLWKN, Norderney) and Dagebüll, Schleswig-Holstein (data Wasser- und Schifffahrtsamt, Tönning).





lands and Niedersachsen, highest risk of flooding is associated with northwesterly winds, whereas the coasts of Schleswig-Holstein and Denmark are more affected by westerly winds.

2.6.3 Management

Nearly all breeding sites in the Wadden Sea are located in Special Protection Areas (SPA) and are/or will be designated as Special Areas of Conservation (SAC) of the Natura 2000 network of the EU Birds and Habitats Directives (Essink *et al.*, 2005). During the 1990s, several changes in management have occurred throughout the Wadden Sea. These include e.g. changes in salt marsh management, fishery policies, situation of military training sites, regulations for civil aviation and regulations for outdoor recreation (see Koffijberg *et al.*, 2003 and Essink *et al.*, 2005 for a review). Among others, changes in salt marsh management and management in dunes and fishery policies have had a large impact on breeding bird communities, since they directly affect food availability and breeding habitat. Therefore, some remarks on general trends in these aspects will be given here. For salt marshes and dunes, this is mainly based on the recent review for the Quality Status Report 2004 (Bakker *et al.*, 2005; Petersen and Lammerts, 2005). Data on fishery policies have mainly been derived from the review by the CWSS (2002).

Salt Marshes

Denmark

Contrary to other sections in the Wadden Sea, salt marsh management has been rather stable over the past decades. The situation concerning grazing in 1987 has changed in recent years. More than 50% of the mainland salt marshes are intensively grazed, whereas grazing on islands changed only slightly, with 10% grazed very intensely (recent figures about grazing intensity are not available). Since 2000, 'overgrazing' of salt marshes has increased at several locations in the Danish Wadden Sea. As a consequence, an experiment on public land on Mandø and south of the Rømø Dam, with fences separating dike and salt marsh, was carried out in 2004-2005. The results are not yet available. In general, a decline in drainage effort was achieved in the 1990s. Maintenance of coastal protection works was reduced in 2000.

Schleswig-Holstein

The percentage of intensively grazed foreland salt marshes decreased from 80% in the 1980s (Kempf *et al.*, 2003) to 45% in 2001-2002 (Stock *et al.*, 2005). Areas without grazing increased in the same period to 36%; areas with moderate grazing to 19%. From the mid-1980s onwards, drainage effort has been reduced.

Niedersachsen

The size of intensively grazed salt marshes declined from 23% in the 1980s to 11% in 1999. During the same period, areas with no grazing or cutting increased from 53% to 66%. In 2003, 70% of the salt marshes were not grazed, 18% had moderate grazing, 4% intensive grazing and 8% were mown regularly. In the part of the Wadden Sea belonging to Hamburg (*i.e.* Neuwerk), an overall decrease in grazing pressure occurred in the 1990s. Drainage measures have been considerably reduced since the mid-1980s, or even stopped completely (eastern part of the East Frisian Islands).

The Netherlands

The proportion of intensively grazed (mainland) salt marshes decreased from approx. 61% in the 1980s to 28% recently. This coincided with an increase in moderately grazed areas from 17% to 51%. On the islands, salt marshes with no land use increased from 61% to 70% of total size of island-salt marshes. Drainage effort was lowered after 1989 and abandoned in 2001. Coastal protection works were improved in the 1990s but ceased in 2004.

To summarize, we can conclude that apart from Denmark, major parts of the Wadden Sea have experienced a general reduction in agricultural use of the salt marshes. As a result, vegetation succession has proceeded and canopy height has generally increased. However, local variation exists and depends on *e.g.* soil type, altitude, drainage and remaining grazing intensity. Impact on breeding birds might be diverse and is discussed in the species accounts in chapter 4 as well as in chapter 5.3.5.

Dunes

With regard to the management of dunes, a general decrease in maintenance of beaches around the head- and tail-ends of islands has allowed more natural dynamics in the past decade (Petersen and Lammerts, 2005). However, most of the dunes, especially those in the central parts of the islands, are still characterised by mid-successional vegetations dominated by a dense tussock of grasses, stimulated by eutrophication (atmospheric deposition). In this area, hardly any dynamic habitats occur. More open and species-rich dune types with pioneer vegetation further declined in the past decades. Trilateral targets aim to (1) increase the natural dynamics of beaches, primary dunes, beach plains and primary dune valleys in connection with the offshore zone (2) increase the presence of a complete natural vegetation succession and (3) provide favourable conditions for migrating and breeding birds. The latter implies that dynamics in bird populations are considered important in dune management. However, dune areas are only partly covered in the breeding bird monitoring, e.g. with species like Hen Harrier, Eurasian Curlew and Short-eared Owl. Overall, the dune areas in the Wadden Sea are dominated by so-called ‘grey dunes’, covered with dense grasses. This type covers 40% of the Wadden Sea dune areas. In Schleswig-Holstein and Denmark, a considerable proportion of the dunes consists of dune heath (50% and 40% of the total dune area respectively). In the Netherlands and Niedersachsen, these types amount only about 10% and 5% of the dune area, respectively. Meanwhile, coastal protection has been resticted to those parts of the (North Sea) dunes that are considered important for maintaining their coastal defence function.

Fishery Policies

Denmark

Fisheries on wild blue mussels have been restricted since the end of the 1980s (after severe winters and reduced numbers in Common Eider *Somateria mollissima*) and is now allowed in three areas, covering 28,700 ha (42% of the tidal area). Culture lots are not allowed. The number of licenses declined from 40 to 5 and annual quota are set to determine landings. Moreover, half the annual production is set aside for mussel-eating birds and the ecosystem in general (Christensen and Laursen, submitted). In 1991-2000, on average 4,152 metric tonnes were landed. Cockle fisheries are only carried out in three small areas, and landings amounted 7,000 tonnes gross weight in 1990-99. *Spisula*- fishery was carried out by only one vessel in the 1990s.

Schleswig-Holstein

Within the national park boundaries, fishing on seed mussels is allowed in parts of the subtidal area and closed in the intertidal area. Fishing on wild mussels for consumption is not allowed. In

2001, about 2,300 ha of culture lots were used by eight licensees. From these culture lots an average of 20,837 metric tonnes were landed in 1991-2000. Cockle- and *Spisula*-fisheries are not allowed (the latter only outside the Conservation Area).

Niedersachsen

In the National Park only fishing on blue mussels is allowed. Mussels for consumption are collected in the subtidal area. Seed mussels are fished in the subtidal and certain parts of the intertidal area (five licenses). Culture lots are maximally 1,300 ha in size. Average annual landings of mussels amounted 7,332 metric tonnes gross weight in 1991-2000.

The Netherlands

In the 1990s, only seed mussels were fished and used in 3,550 ha of culture lots (maximally 7,200 ha allowed). All culture lots are situated in the western part of the Dutch Wadden Sea, in the subtidal area. A total number of 89 seed fishing vessels was allowed. Wild mussel banks disappeared in the early 1990s as a result of extensive fishing, years of poor spatfall and stormy weather (Ens et al., 2004). In 1991-2000, average annual landings were 37,712 metric tonnes gross weight. Cockle-fisheries were allowed until autumn of 2004 (23-37 licenses for 8-14 vessels) and included an annual average landing of 23,215 metric tonnes gross weight in 1991-2000 (mechanical fisheries). In addition, a small amount of cockles is landed by hand-fishing. *Spisula* fisheries have been carried out in the offshore areas. All shellfish fisheries have been subject to management regulations, which included reservations for shellfish-eating birds in the 1990s. However, this management could not prevent sharp declines in some waterbird species. After an extensive evaluation (EVA-II project), it was decided in 2004 to abandon cockle fisheries and develop a new management plan for sustainable mussel fisheries.

Comparing the situation regarding shellfish fisheries between the Wadden Sea countries, it is clear that in the 1990s by far the highest exploitation was achieved in the Dutch part of the Wadden Sea. This is reflected by the size of the culture lots (67% of the allowed size in the entire Wadden Sea), the number of licenses for e.g. blue mussel fisheries (83% of all licenses issued), the extension of cockle fisheries (77% of average annual landings). Due to the ban on cockle-fisheries in 2004-2005, this situation has changed recently.

General Review of Populations, Distributions and Trends

3.1 Status of Breeding Birds in 2001

Among the 31 bird species that are included in the Joint Monitoring Program for Breeding Birds are 21 species for which the Wadden Sea supports at least 1% of the NW-European population (Table 2). Many of these species (9) are also included in Annex I of the EC Birds Directive. Another four species breed in rather low numbers in the Wadden Sea, but are included in Annex I as well (Ruff *Philomachus pugnax*, Little Gull *Larus minutus*, Mediterranean Gull *Larus melanocephalus* and Short-eared Owl *Asio flammeus*). In an international context, the Wadden Sea is a core breeding area for Eurasian Spoonbill, Avocet, Gull-billed Tern and Sandwich Tern *Sterna sandvicensis*. For each of these species more than 25% of the NW-European population breeds in the Wadden Sea area. (*cf.* Figure 74).

The total survey in 2001 recorded an overall number of 469,000 breeding pairs or territories (Table 2). Nearly 70% of the breeding bird population represents gulls, with Black-headed Gull, Lesser Black-backed Gull *Larus fuscus* and Herring Gull *Larus argentatus* being most abundant species. Another 18% of the population consists of coastal waders, especially Oystercatcher, Avocet,

Species	Annex I EC Birds Directive	% population NW-Europe	Population 1991	Population 1996	Population 2001
Great Cormorant *Phalacrocorax carbo*	-	1-5	274	838	2,337
Eurasian Spoonbill *Platalea leucorodia*	x	>25	217	589	831
Shelduck *Tadorna tadorna*	-	5-25	4,413[1]	4,982	6,480
Common Eider *Somateria mollissima*	-	1-5	8,408	11,534	10,497
Red-breasted Merganser *Mergus serrator*	-	<1	15	41	44
Hen Harrier *Circus cyaneus*	x	<1	124	142	126
Oystercatcher *Haematopus ostralegus*	-	5-25	37,156[1]	46,591	39,927
Avocet *Recurvirostra avosetta*	x	>25	11,844	11,214	10,170
Great Ringed Plover *Charadrius hiaticula*	-	1-5	1,364[2]	1,367	1,093
Kentish Plover *Charadrius alexandrinus*	x	5-25	569[2]	521	340
Northern Lapwing *Vanellus vanellus*	-	1-5	8,753[1]	12,521	11,643
Dunlin *Calidris alpina schinzii*	x	1-5	51	39	25
Ruff *Philomachus pugnax*	x	<1	242	82	33
Common Snipe *Gallinago gallinago*	-	<1	529[1]	646	189
Black-tailed Godwit *Limosa limosa*	-	1-5	2,117[1]	3,004	2,824
Eurasian Curlew *Numenius arquata*	-	<1	782	632	640
Common Redshank *Tringa totanus*	-	5-25	12,081[1]	16,197	14,722
Turnstone *Arenaria interpres*	-	<1	3	2	1
Mediterranean Gull *Larus melanocephalus*	x	<1	2	5	9
Little Gull *Larus minutus*	x	<1	2	2	0
Black-headed Gull *Larus ridibundus*	-	5-25	128,317	133,313	155,355
Common Gull *Larus canus*	-	1-5	6,671	10,481	13,837
Lesser Black-backed Gull *Larus fucus*	-	>25	18,016	38,252	80,372
Herring Gull *Larus argentatus*	-	5-25	89,522	74,551	78,722
Great Black-backed Gull *Larus marinus*	-	<1	6	15	27
Gull-billed Tern *Gelochelidon nilotica*	x	>25	28	86	56
Sandwich Tern *Sterna sandvicensis*	x	>25	16,982	17,285	14,722
Common Tern *Sterna hirundo*	x	5-25	13,677	13,064	14,377
Arctic Tern *Sterna paradisaea*	x	1-5	5,256	9,011	8,464
Little Tern *Sterna albifrons*	x	5-25	654	983	1,121
Short-eared Owl *Asio flammeus*	x	<1	83	114	89

[1] Numbers underestimate since coastal meadows ('*marsken*') behind the seawall on the Danish mainland were not covered during the 1991 survey.
[2] incomplete coverage in Denmark

Table 2: Status of breeding birds in the Wadden Sea during total counts in 1991, 1996 and 2001, expressed as the number of counted breeding pairs or territories. Data from 1991 after Fleet *et al.* (1994); data from 1996 after Rasmussen *et al.* (2000), both with corrections. Also given are status in the EC Birds Directive (Annex I species or not) and the proportion of the NW-European population

Northern Lapwing and Common Redshank. Among the rare breeding birds are Dunlin *Calidris alpina schinzii* and Ruff which have been subject to long-term declines and are currently at the verge of extinction in the Wadden Sea. For both species (but notably Dunlin), the Wadden Sea more or less constitutes the extreme southwestern edge of the breeding range, and it is expected that both species might disappear from the WS entirely in near future if no conservation measures succeed. Also for Red-breasted Merganser *Mergus serrator*, Turnstone *Arenaria interpres*, Mediterranean Gull and Little Gull the Wadden Sea is currently situated at the fringe of their European breeding range, and therefore only scattered and often fluctuating numbers of breeding pairs are observed. Most of these species have a more northernly or easternly distribution; only Mediterrean Gull is a south(east)ern species that has expanded its breeding range to NW-Europe recently (Meininger and Flamant, 1998). The same also applies to Little Egret *Egretta garzetta* (not included in Table 2), which have been breeding in the Dutch Wadden Sea from 1999 onwards (SOVON, 2002) and are still increasing as a result of a northward expansion from the Atlantic coast of France. It is assumed that this species will follow the trend of Eurasian Spoonbill and expand its range further into the Wadden Sea in the near future.

Thus, the geographical location of the Wadden Sea is one explanation for the species-specific distribution patterns within it. Others include regional differences in location of different habitats (especially salt marshes, dunes/beaches and outer sands). In order to present an overall view of distributions, Figure 8 shows the proportions of the Wadden Sea population in 2001 breeding in Denmark, Schleswig-Holstein, Niedersachsen and the Netherlands, respectively. Although these figures are partly explained by the differences in

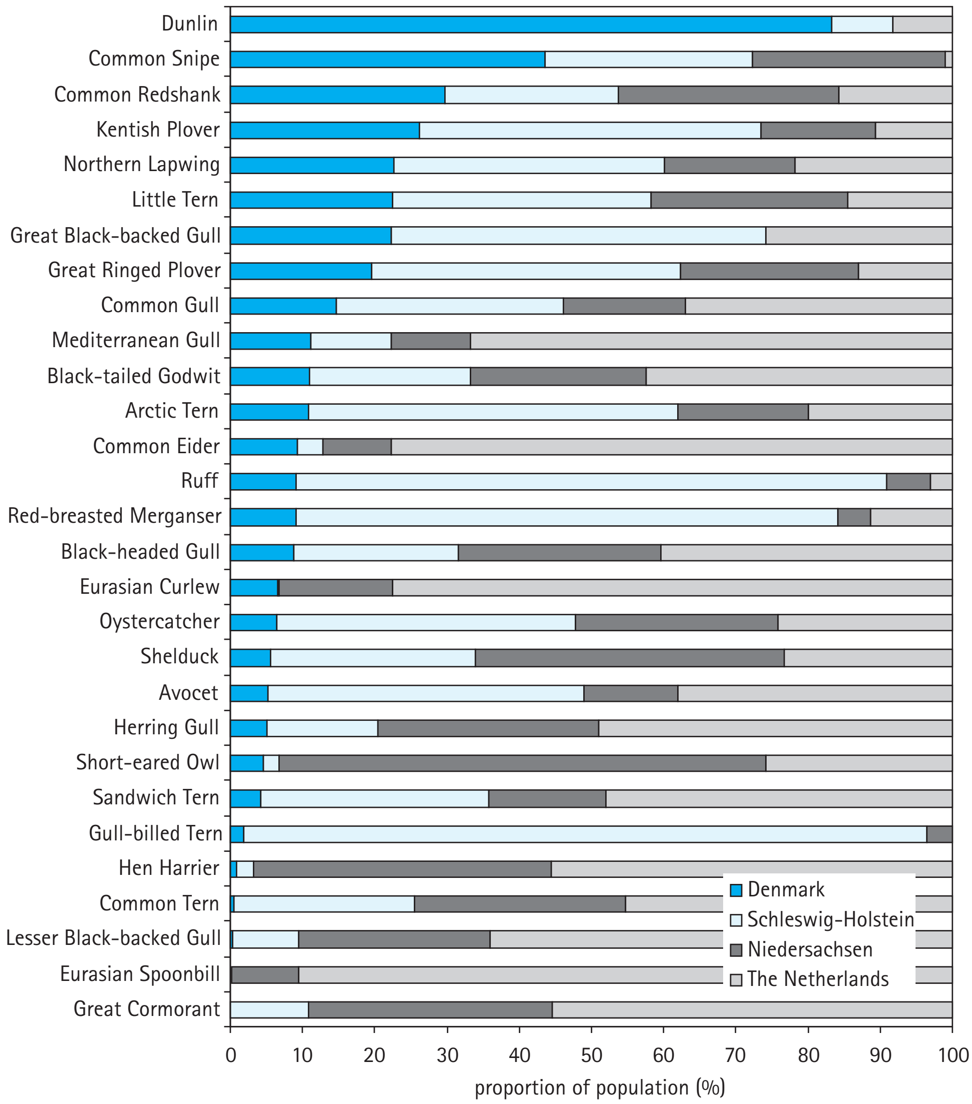


Figure 8: Overall distribution of breeding birds in the Wadden Sea in 2001, expressed as the proportion of the total Wadden Sea population breeding in Denmark, Schleswig-Holstein, Niedersachsen and the Netherlands.

size of the respective parts of the Wadden Sea (*e.g.* the Danish Wadden Sea is rather small compared to the other sections), they also show for which part of the population the respective countries are responsible regarding conservation and management. In the northern section, in Denmark, high numbers of some coastal waders like Common Snipe and Common Redshank as well as Kentish Plover occur. Coastal waders here particularly concentrate in the damp coastal meadows behind the seawall between Tønder and Ribe, which have been included in the surveys from 1996 onwards but which are not included in other countries. Also, a major part of the small and threatened population of Dunlin is mainly confined to the Danish Wadden Sea. Species concentrating in Schleswig-Holstein are Gull-billed Tern (95% of the population), Arctic Tern, Avocet, Oystercatcher, Northern Lapwing, Sandwich Tern and Common Gull *Larus canus*. Other rare species like Ruff, Red-breasted Merganser and Great Black-backed Gull *Larus marinus* also mainly breed in this section of the Wadden Sea. Furthermore, it represents major strongholds for beach-breeding species like Kentish Plover, Great Ringed Plover and Little Tern Sterna *albifrons*. Niedersachsen has a high responsibility for breeding Short-eared Owl, Shelduck *Tadorna tadorna*, Hen Harrier, Great Cormorant, Common Redshank and Herring Gull. Finally, the westernmost part of the Wadden Sea, in the Netherlands, supports core breeding sites for Eurasian Spoonbill (90% of the population), Common Eider, Eurasian Curlew, Mediterranean Gull, Lesser Black-backed Gull, Hen Harrier, Great Cormorant, Herring Gull, Sandwich Tern, Common Tern *Sterna hirundo*, Black-tailed Godwit, Black-headed Gull, Avocet and Common Gull.

Furthermore, the mainland coast of the Wadden Sea and the Wadden Sea islands differ in breeding bird communities. Many species (21 out

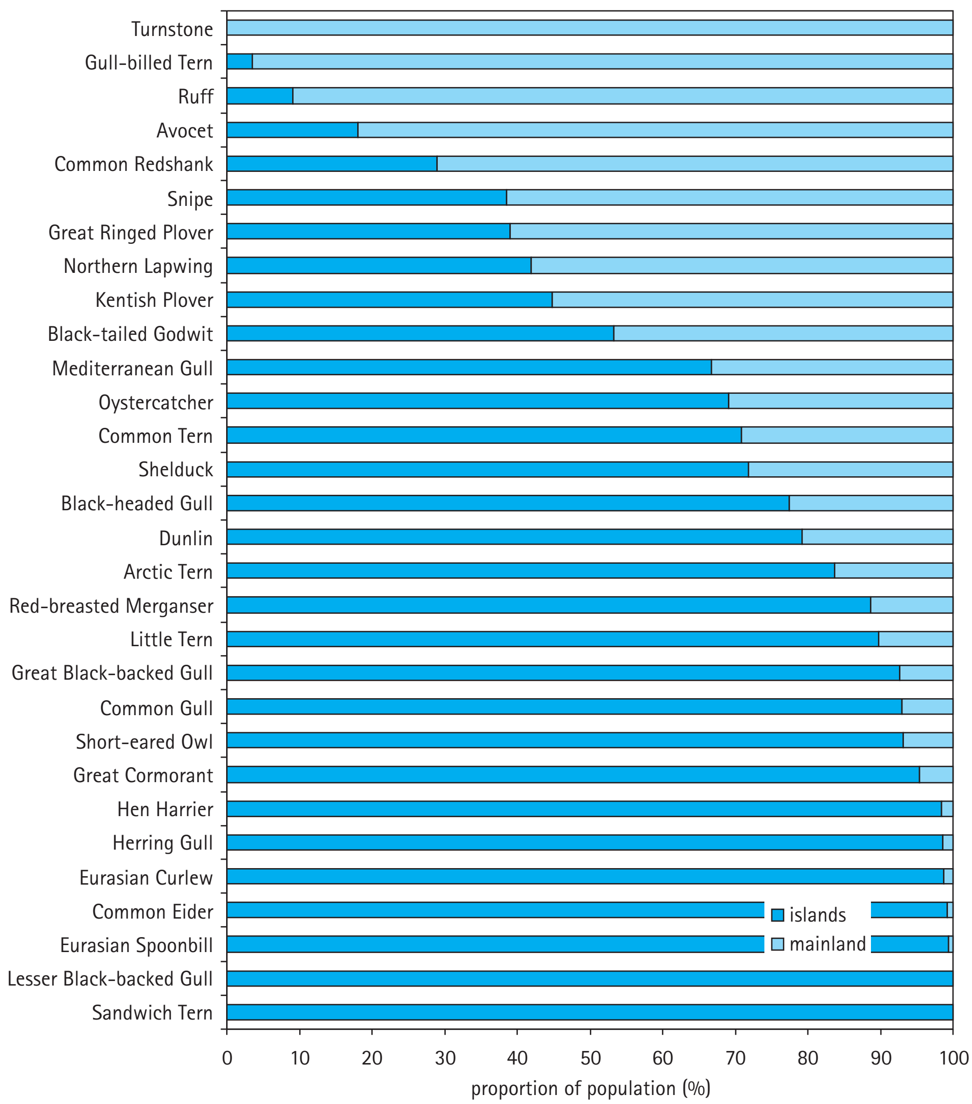


Figure 9: Breeding bird populations in 2001 divided according to islands and mainland.

of 30 species, Little Gull not included) have the highest proportion breeding on the islands (Figure 9). This involves colonial breeding birds like Great Cormorant, Eurasian Spoonbill, gulls and terns as well as dune-breeding species like Hen Harrier, Eurasian Curlew and Short-eared Owl. Typical mainland breeding species are Gull-billed Tern (which in contrast to other terns feeds in terrestrial habitats), Avocet (which preferably breeds on salt marshes, feeding on silty mud flats) and – perhaps surprisingly – Great Ringed Plover and Kentish Plover. Northern Lapwing, and especially Black-tailed Godwit occur in high numbers in the grassland polders on the islands in Schleswig-Holstein and the Netherlands and therefore have large proportions of the population on islands as well as on the mainland coast. These species are also characteristic for the coastal marshes on the mainland coast in Denmark.

3.2 Trends

3.2.1 Overall Trends

Since the Joint Monitoring Program for Breeding Birds has been running now for more than 15 years, a reliable assessment of trends has become possible. As can be judged from the results of the total surveys in 1991, 1996 and 2001 (Table 2), breeding populations in several species show large

Table 3: Summary of trends of breeding birds in the Wadden Sea in 1991-2001. Trends are given for individual countries (DK Denmark; SH Schleswig-Holstein; Nds Niedersachsen; NL The Netherlands) as well as for the trilateral Wadden Sea as a whole. Wadden Sea trends are also given for 1996-2001 to give alerts for recent population changes. Method refers to data from annual total counts (1) or annually covered census areas (2). Trend indications: + increase; = stable and – decrease; symbols in parantheses refer to non-significant trends. Annual rate of increase or decrease >25% indicated as ++ or --. When left blank, numbers were too small to allow trend analysis.

Species	Method	DK	SH	Nds	NL	Wadden Sea 1991-2001	Wadden Sea 1996-2001
Great Cormorant *Phalacrocorax carbo*	1			+	++	+	+
Eurasian Spoonbill *Platalea leucorodia*	1				+	+	+
Shelduck *Tadorna tadorna**	2	+	+	+	(=)	+	+
Common Eider *Somateria mollissima**	2	++	+	+	(=)	+	(=)
Red-breasted Merganser *Mergus serrator*	1					(+)	no data
Hen Harrier *Circus cyaneus*	1			+	-	(=)	-
Oystercatcher *Haematopus ostralegus**	2	=	+	+	-	(=)	-
Avocet *Recurvirostra avosetta**	1	(=)	+	-	-	=	(=)
Great Ringed Plover *Charadrius hiaticula**	2	-	-	-	-	-	-
Kentish Plover *Charadrius alexandrinus**	1	+	-	-	-	-	-
Northern Lapwing *Vanellus vanellus**	2	(=)	=	(=)	-	-	(=)
Dunlin *Calidris alpina schinzii*	1					(-)[1]	(-)[1]
Ruff *Philomachus pugnax*	1					(-)[1]	(-)[1]
Common Snipe *Gallinago gallinago*	1					(-)[1]	(-)[1]
Black-tailed Godwit *Limosa limosa*	2	(=)		-	-	-	(=)
Eurasian Curlew *Numenius arquata*	2			(=)	(=)	(=)	(=)
Common Redshank *Tringa totanus**	2	+	+	-	(=)	(=)	(=)
Turnstone *Arenaria interpres*	1					no data	no data
Mediterranean Gull *Larus melanocephalus*	1					+	+
Little Gull *Larus minutus*	1					no data	no data
Black-headed Gull *Larus ridibundus**	1	+	+	+	-	(=)	+
Common Gull *Larus canus**	1	+	+	+	+	+	+
Lesser Black-backed Gull *Larus fuscus**	1	++	+	++	+	+	+
Herring Gull *Larus argentatus**	1	+	+	-	-	-	(=)
Great Black-backed Gull *Larus marinus*	1	(=)	++			+	+
Gull-billed Tern *Gelochelidon nilotica*	1					(=)	(=)
Sandwich Tern *Sterna sandvicensis**	1	++	-	+	+	=	(=)
Common Tern *Sterna hirundo**	1	-	-	-	(=)	-	+
Arctic Tern *Sterna paradisaea**	1	+	+	+	+	+	-
Little Tern *Sterna albifrons**	1	+	+	+	+	+	+
Short-eared Owl *Asio flammeus*	1			+	-	(=)	(=)
Summary of significant trends (no. species)							
positive + or ++		11[2]	11[2]	9[2]	5[2]	10	10
negative -		2	4	6	6	8	8
stable =		1	1				

[1] trend classification not possible due to lack of data; classification is based on results of the surveys in 1991, 1996 and 2001.
[2] only species considered that breed in all countries, marked with *

Species	Country			
	Denmark	Schleswig-Holstein	Niedersachsen	The Netherlands
Hen Harrier	-	-	significant increase	significant downward trend
Avocet	significant increase	significant increase	significant downward trend	significant downward trend
Kentish Plover	significant increase	significant downward trend	significant downward trend	significant downward trend
Dunlin	significant downward trend	-	-	-
Ruff	significant downward trend	-	-	-
Sandwich Tern	significant increase	significant downward trend	significant increase	significant increase
Common Tern	significant downward trend	significant downward trend	significant downward trend	significant increase
Short-eared Owl	-	-	significant increase	significant downward trend

Table 4: Summary of significant downward trends in Annex I species of the EC Birds Directive in the Wadden Sea 1991-2001. Species and country combinations with "-" indicate low numbers which did not allow trend analysis.

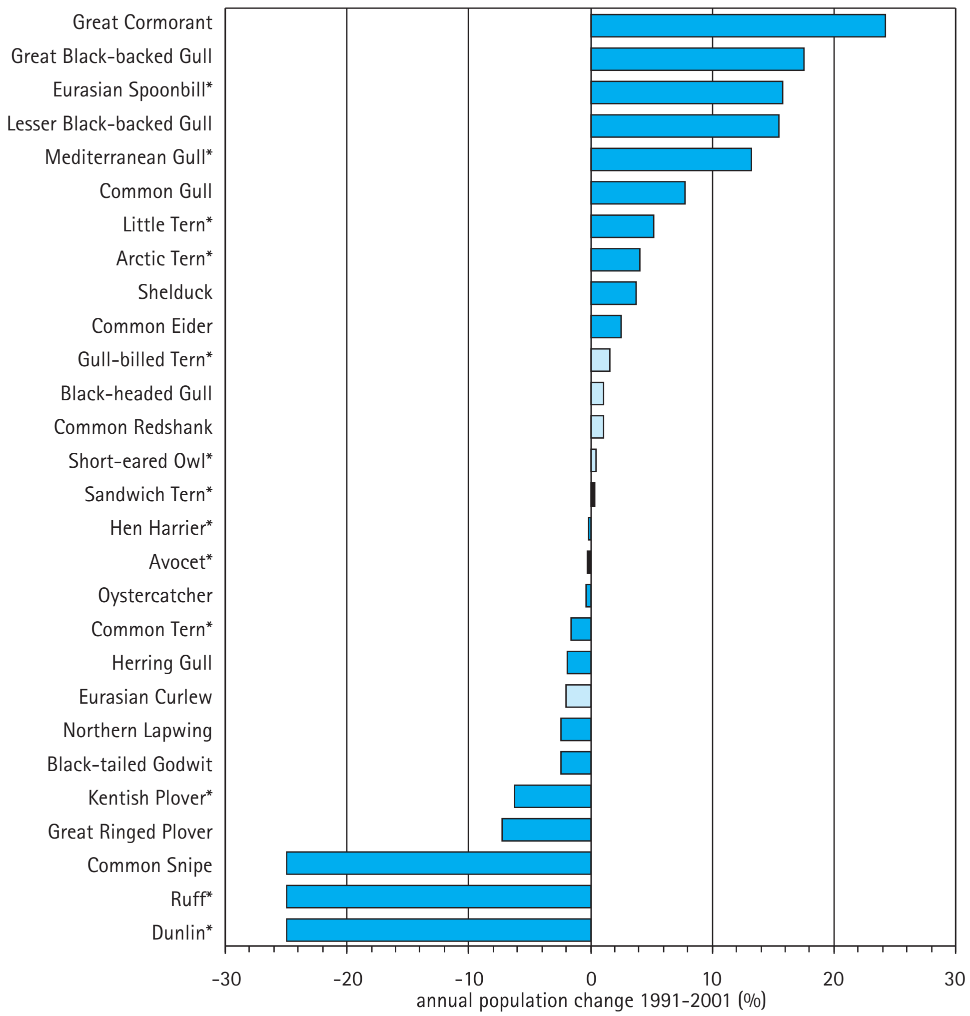


Figure 10: Summary of trends for breeding birds in the Wadden Sea between 1991-2001. The annual rate of increase or decrease is given in %. Non-significant changes are marked in light blue. Black bars indicate species with a significant stable trend and annual changes of nearly zero. For Common Snipe, Ruff and Dunlin, the rates of decline could not be calculated from the census data and have been assumed to be >25% when considering the data from the complete surveys in 1991, 1996 and 2001. Annex I-species of the EC Birds Directive are marked with an asterisk (*).

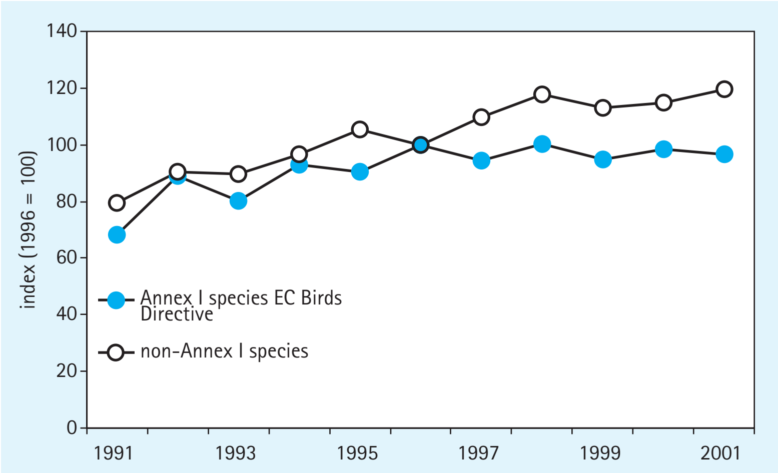


Figure 11: Summary of trends for breeding birds in the Wadden Sea between 1991-2001, separated according to status within the EC Birds Directive (Annex I and non-Annex I) and expressed as the geometric mean of the trends of the individual species.

differences between years, *e.g.* Great Cormorant, Eurasian Spoonbill, Kentish Plover, Common Gull and Arctic Tern. Changes in population size in these species often reflect long-term trends. Overall trends in the Wadden Sea in 1991-2001 show significant population increases in 10 out of 31 species (Table 3). The highest increase rates have been observed in Great Cormorant, Great Black-backed Gull, Eurasian Spoonbill, Lesser Black-backed Gull and Mediterranean Gull (Figure 10). Nearly all of these species have expanded their geographical breeding range in the past decade and have also shown further increases in 2002-2004 (Koffijberg *et al.*, 2005b). For the majority of species upward trends have been consistent over the entire period. Exceptions are Common Eider and Arctic Tern. For Common Eider, an initial population growth in the first half of the 1990s has turned into a decline from 1998 onwards, especially in the core breeding range in the Netherlands. Arctic Terns went up in most parts of the Wadden Sea until 1997-1998, but have experienced declines in all countries ever since. However, they still breed in higher numbers in the Wadden Sea than in the early 1990s.

Significant declines occurred in nine species, among them Great Ringed Plover, Kentish Plover, Northern Lapwing, Black-tailed Godwit, Common Tern and Herring Gull. The most dramatic declines seem to have occurred in three species for which proper trend calculations in the past decade are difficult to assess due to low numbers and scattered breeding (Figure 10). Dunlin, Ruff as well as Common Snipe all have probably declined by more than 50% in the past decades. As mentioned before, the first two species are likely to disappear from the Wadden Sea in near future. For Northern Lapwing, Black-tailed Godwit and Herring Gull, recent numbers suggest that the rate of decline has levelled off and the population now fluctuates around a stable level. In addition, a recovery has recently become apparent for Common Tern, especially in the German Wadden Sea. In the Dutch Wadden Sea, however, Common Tern has decreased since 2001 (van Dijk *et al.*, 2006). Great Ringed Plover and Kentish Plover have continued their decline in 2002-2004 (Koffijberg *et al.*, 2005b). Especially for the latter species this is of major concern, since a large proportion of the NW-European population breeds in the Wadden Sea.

Overall trends in Annex I species of the EC Birds Directive and trends in other (non-Annex I) species ran parallel until 1996. Since 1996, the average trend for Annex I species has stabilized, whereas the trend in other species has been a continuous increase (Figure 11). Regarding individual Annex I species, trends for Hen Harrier, Avocet, Kentish Plover, Dunlin, Ruff, Sandwich Tern, Common Tern and Short-eared Owl all point to an unfavourable conservation status (Table 4). Nearly all these species have continued to decline in 2002-2004 (Koffijberg *et al.*, 2005b, van Dijk *et al.*, 2006).

3.2.2 Regional Trends

Especially for those species showing marked trends, these are often consistent throughout the entire Wadden Sea, *e.g.* Great Ringed Plover (decreasing), Great Cormorant, Common Gull, Lesser Black-backed Gull, Arctic Tern and Little Tern (all increasing in 1991-2001). Trends in these species often reflect an overall European trend of expansion or reduction in breeding populations (*e.g.* Great Cormorant, Lesser Black-backed

Gull; BirdLife International, 2004) or at least population changes at a larger scale. In Little Tern, the population trend should be regarded as a population recovery, supported by a successful protection scheme safeguarding breeding colonies from human disturbance (Flore, 1997; Witte, 1997; Hälterlein, 1998; Potel *et al.*, 1998; Rasmussen *et al.*, 2000). However, there are also obvious differences and sometimes even opposite trends in several species between Denmark, Schleswig-Holstein, Niedersachsen and the Netherlands (Table 3). In some cases these contradictory population changes might point at differences in management regulations or conservation measures.

Although, major achievements in trilateral policies regarding the Wadden Sea have been made since the 6th Trilateral Governmental Conference in Esbjerg in 1991 and the publication of the Wadden Sea Plan in 1997, management policies regarding e.g. protected areas, fisheries and regulation of outdoor recreation are often different among the three countries concerned (see *e.g.* de Jong *et al.*, 1999; Koffijberg *et al.*, 2003; Essink *et al.*, 2005). When considering the 16 species that are abundant in all parts of the Wadden Sea (Table 3), Denmark and Schleswig-Holstein each show upward trends in 11 species and downward trends in only two and four species, respectively (Figure 12). In Schleswig-Holstein this is also the case for Sandwich Tern, a species which has experienced increases in other parts of the Wadden Sea (note however, that numbers in this species usually fluctuate, see Stienen, 2006). In Niedersachsen and the Netherlands, there are more declining species. Avocet, Black-tailed Godwit and Herring Gull all have experienced a significant reduction in population size in this part of the Wadden Sea whereas numbers of at least Avocet and Herring Gull have grown or remained stable (Avocet in Denmark) in Schleswig-Holstein and Denmark. In Niedersachsen, numbers of Common Redshank decreased. In the Netherlands, this species tended to decline after 1998, but in Schleswig-Hol-

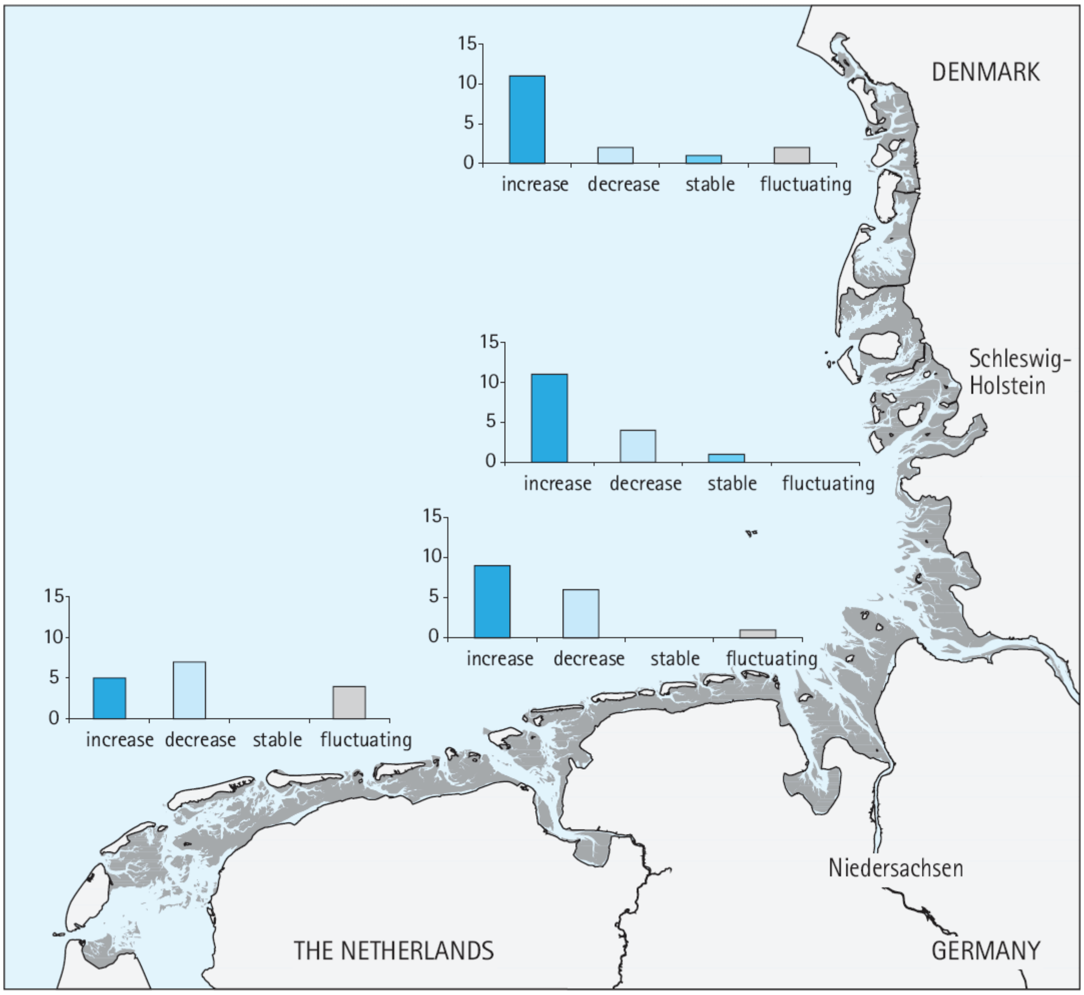


Figure 12: Assessment of regional trends in Denmark, Schleswig-Holstein, Niedersachsen and The Netherlands 1991-2001. The number of species in each trend category is given for 16 species which are abundant throughout the Wadden Sea (see Table 3).

stein and Denmark it has experienced an annual population growth of 5-18%. Specific declines in the Dutch Wadden Sea concern Hen Harrier, Oystercatcher, Black-headed Gull and Short-eared Owl. Both Hen Harrier and Short-eared Owl show opposite trends in Niedersachsen, which, together with the Netherlands, represents the stronghold of these species in the Wadden Sea. Furthermore, Common Eider, which has small populations in Denmark, Schleswig-Holstein and Niedersachsen, increased in the 1990s but has shown a sharp decline in the main core breeding areas in the Dutch Wadden Sea since 1998.

Unravelling the background for this variability in trends is a difficult but challenging task. Often, there is hardly any extra information available beyond the monitoring scheme, regarding *e.g.* changes in mortality and survival, changes in breeding success and recruitment of subadult birds in the breeding populations concerned. Without monitoring of these parameters, it is difficult to make out processes involved in the observed population changes. For some species, species-specific research has been carried out, and its results allow a glimpse at the backgrounds for trends. Downward trends are e.g. linked to human disturbance and lack of habitat dynamics (Kentish Plover and Great Ringed Plover in the entire Wadden Sea), mussel- and cockle-fisheries (Common Eider, Oystercatcher, perhaps Herring Gull in the Netherlands), habitat degradation in the dunes (Hen Harrier and Short-eared Owl in the Netherlands) and increase of predation risk (Avocet and Black-headed Gull in the Netherlands and Niedersachsen). These, and other aspects will be dealt with in the species-accounts in chapter 4 and will be discussed at an aggregated level in chapter 5.2.

4. Species Accounts

Introduction

Data from 31 species have been considered and are presented at species-level in this chapter. Each species-account is divided into three sections: (1) distribution and habitat; (2) population and trends and (3) assessment. The first two sections give a description of the distribution pattern, breeding habitat and a review of population changes. The third section gives some background information on the trends observed (*e.g.* in relation to management or other aspects), or points out current gaps in our knowledge. Data on distribution are visualised in maps in which dots represent the number of breeding pairs or territories for the census regions also used for the last total count in 1996 (Figure 2 in chapter 2.1). In order to allow a direct comparison with the total count in 1996, data for this year have been included in the maps as well. Note that this comparison only shows two years and therefore does not necessarily reflect the long-term trend depicted in the trend graphs. Furthermore, the maps include a graph showing the overall trend in the trilateral Wadden Sea, presented as an index (1996 set at 100) for the period 1991-2001 (data from Table 3). For a few rare species, the index is replaced by a bar graph showing the actual number of breeding pairs. In addition, trends for each country (*i.e.* Denmark, Schleswig-Holstein, Niedersachsen and the Netherlands) are shown separately. Also here, numbers are represented by indices (again 1996 set at 100). For some species, countries with small numbers have been omitted from the graph.

In the text, when mentioned for the first time, names of breeding sites or colonies are accompanied by an abbreviation of the country where they are located: DK Denmark; SH Schleswig-Holstein; Nds Niedersachsen and NL the Netherlands. Neuwerk and Scharhörn, which belong to Hamburg, are considered part of Niedersachsen in this report. The heading of each species account indicates the species' name in the Wadden Sea countries, the status in 1991, 1996 and 2001 as well as its share of the NW-European breeding population (Table 2; Figure 74). In case a species is listed on Annex I of the EC Birds Directive, this is mentioned as well. Due to updates of the breeding bird database, figures for 1991 and 1996 might differ slightly from those published in previous reports by Fleet et al. (1994) and Rasmussen et al. (2000). Coverage is indicated as A >95% coverage, B 75-95% coverage; C <75% coverage, see section 'Assessment' for details.

4.1 Great Cormorant

Phalacrocorax carbo sinensis

NL: Aalscholver D: Kormoran DK: Skarv

Status 1991: 274 pairs
Status 1996: 838 pairs
Status 2001: 2,337 pairs
EC Birds Directive: –
NW-Europe: 2%
Coverage: A

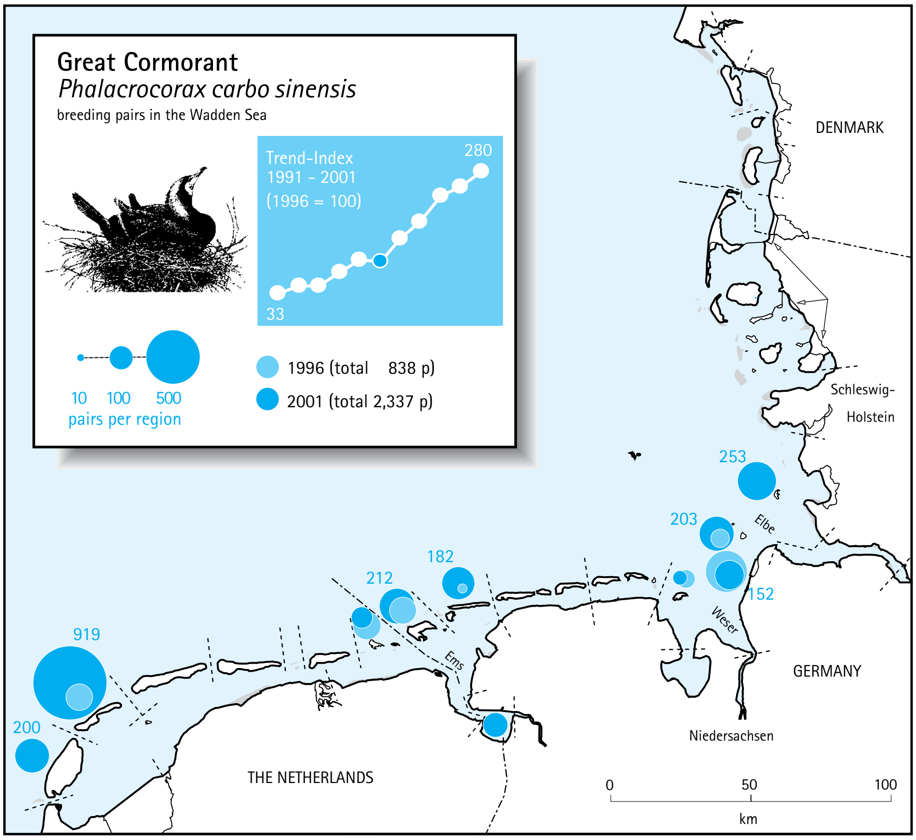
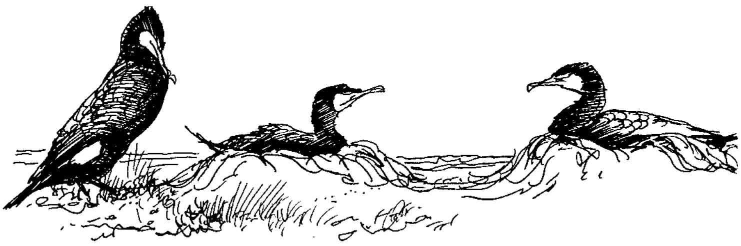


Figure 13: Breeding distribution of Great Cormorant in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Only a small per cent of the North-West European population of Great Cormorants breeds in the Wadden Sea. The total European population was estimated at c. 142,000 pairs in the early 1990s (Hagemeijer and Blair, 1997) and most of the core breeding sites on the European Continent have shown a levelling off in population growth since then (Berndt *et al.*, 2002; Bregnballe *et al.*, 2003; Südbeck and Wendt, 2003; van Dijk *et al.*, 2005). However, sites in the Wadden Sea still show a higher growth rate than inland colonies. In the Wadden Sea, over 50% breeds in the Netherlands. The largest colony here was Kroon's Polders (919 pairs) on the island of Vlieland. Smaller colonies were found in Niedersachsen and Schleswig-Holstein. Since 2003, Great Cormorants have tried to breed on Langli DK. Colonization of the Danish Wadden Sea was expected, since the Danish population had increased in the western part of the country (Bregnballe *et al.*, 2003). However, the colony was destroyed by Danish authorities since a national management plan for the species does not allow further colonies to become established. Breeding attempts were made by 22 and 15 pairs in 2004 and 2005 respectively, directly on the ground. Further breeding attempts in 1994 and 1995 at Jordsand DK failed, probably due to human disturbance (Rasmussen *et al.*, 2000).

Until the 1990s, breeding Great Cormorants in the Wadden Sea mainly preferred artificial



structures such as a former lighthouse (Weser Estuary Nds), a gas pressure measure station (De Hond/Eems estuary NL) and an old ship wreck (Knechtsand and Mellum Nds). More recent settlements are found in natural habitats, like Elder and Willow trees at De Muy/Texel NL and on the ground in Kroon's Polders/Vlieland NL, at Memmert Nds, Lütje Hörn Nds and Trischen SH. All colonies are situated at uninhabited islands or outer sands (and/or have no free public access) and therefore not susceptible to predation by larger mammals or to human disturbance.

Population and Trends

The Great Cormorant established the first breeding colonies in the Wadden Sea area in the 1970s in the estuaries of Rivers Ems and Weser. Schleswig-Holstein followed in 1997 (Trischen). Between 1991 and 2001, the number of colonies increased from 4 to 11. Among breeding birds in the Wadden Sea, Great Cormorant is one of the fastest expanding species, with an annual growth rate of 24% in 1991-2001. The population in 2001 amounted 2,337 pairs. Especially colonies in the Dutch part of the Wadden Sea experienced steep increases, with new settlements at Rottumeroog (1997) and Texel (1999).

Between 2001 and 2004, the population in the Dutch colonies had grown further from 1299 to 1586 pairs (van Dijk *et al.*, 2006). In Niedersachsen, signs of a level off already appeared after 1996 and only a slight increase was reported until 2004 (877 pairs). Trischen in Schleswig-Holstein increased from 40 pairs in 1997 to 253 in 2001 and supported 274 breeding pairs in 2004. New colonies have recently been reported from Föhr and Sylt SH (Koffijberg *et al.*, 2005b). These settlements are part of a shift from breeding inland and along the Baltic coast in Schleswig-Holstein towards the Wadden Sea. Human distribution and disturbance by White-tailed Eagle are assumed to be the main cause for this development (Kieckbusch and Koop, 2005).

Assessment

The steep increase rates in the Wadden Sea are probably initiated by a high reproductive output compared to freshwater colonies inland and might be explained by a better food availability and combination of safe breeding sites and suitable (nearby) feeding sites. In the Dutch Wadden Sea, breeding success and condition of young are much better than those of (large) inland colonies (van Rijn *et al.*, 2003). The Dutch Wadden Sea birds mainly forage at sea, but in some cases (*e.g.* Ems Estuary) also visit inland waters to feed (P. de Boer pers. com.). Moreover, Great Cormorants are opportunistic feeders and easily switch prey preferences according to available fish stocks (Leopold *et al*, 1998). On a longer term, the number of safe breeding colonies might become limited.

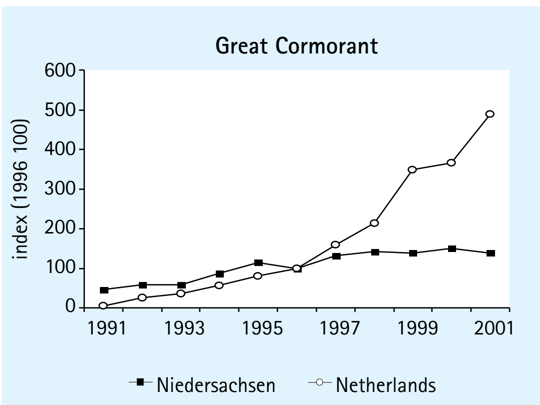


Figure 14: Trends in Great Cormorant 1991-2001, retrieved from annual total counts.

4.2 Eurasian Spoonbill

Platalea leucorodia

NL: Lepelaar D: Löffler DK: Skestork

Status 1991:	217 pairs
Status 1996:	589 pairs
Status 2001:	831 pairs
EC Birds Directive:	Annex I
NW-Europe:	65%
Coverage:	A

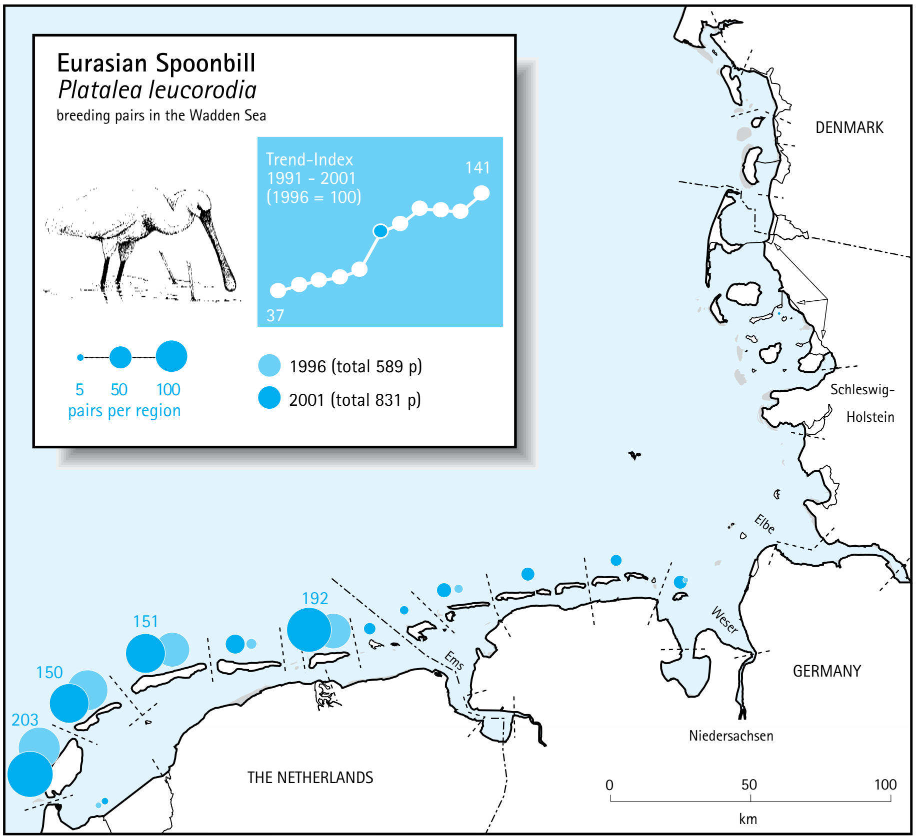


Figure 15: Breeding distribution of Eurasian Spoonbill in the Wadden Sea in 2001 (1996 given for comparison).

Distribution and Habitat

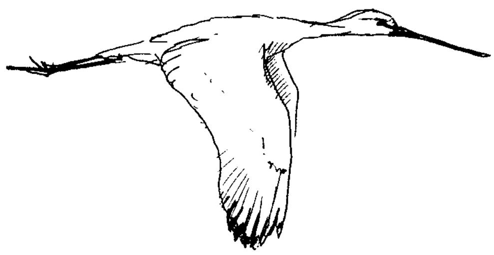
The Wadden Sea represents the northernmost fringe of the European breeding range and supports about 65% of the isolated breeding population in North-western Europe (Mediterranean breeders not included). Spoonbill-colonies are found both in high and low salt marshes, reed beds and low trees at lakes in wet dune slacks. Nearly all settlements are confined to islands and generally have a low risk of mammalian predation. Moreover, a major part of the population breeds within protected areas and does not have public access (in fact, most colonies are guarded). New colonies are often established within colonies of Herring Gull and Lesser Black-backed Gull. Spoonbills commute to gullies on the mud flats to feed on shrimps and small flatfish. Feeding in ditches in polder areas on the larger islands is also observed regularly. Here, Sticklebacks *Gasterosteus aculeatus* are an important food resource. With the increase of breeding populations on the Wadden Sea islands, increasing numbers of Spoonbills are reported feeding on the mainland salt marshes (*e.g.* northern coast of Groningen/Friesland NL), coastal wetlands (*e.g.* Leyhörn/Leybucht Nds and Hauke-Haien-Koog SH) and shallow ditches and canals behind the mainland seawall. Long flights (>10 km) to feeding areas are observed regularly.

Nearly the entire population (99%) was confined to islands; the only exception being the Balgzand area in Noord-Holland NL. Initially, a large proportion of the spoonbill population was breeding in marsh areas in the interior parts of the Netherlands. However, due to predation by Red Fox *Vulpes vulpes* increasing numbers switched to breed on the predator-free Wadden Sea islands (Voslamber 1994). In 1991, four out of the seven Dutch islands were occupied. In 2001, Spoonbill was breeding on all islands. Further expansion was observed in Niedersachsen and Schleswig-Holstein, where first settlements occurred in 1995 (Memmert) and 2000 (Hallig Oland) respectively. So far, no breeding occurred in the Danish Wadden Sea, although breeding Spoonbills have been reported from the Limfjord area (Jutland) from 1996 onwards (Overdijk and Horn, 2005). In 2001, Spoonbill was breeding in 13 regions (of which seven in the Netherlands and five in Niedersachsen), with 90% of the population breeding in the Dutch part of the Wadden Sea.

Population and Trends

Between 1991 and 2001, the Spoonbill population in the Wadden Sea increased by 16% annually.

At the same time, the number of colonies went up from 5 to 16. As already forecasted in the previous report by Rasmussen et al. (2000), recent new settlements were mainly observed in Niedersachsen, where after first breeding at Memmert in 1995, new colonies were established at Mellum (1996), Borkum (1999), Spiekeroog and Norderney (2000). The breeding population in 2001 amounted to 831 pairs. After 2001, further increases were reported (2004: 1100 pairs, Koffijberg *et al.*, 2005b). It is expected that further expansion will occur, especially in Schleswig-Holstein. In Denmark, a lack of predator-free breeding sites might hamper first settlements (Rasmussen *et al.*, 2000). Sightings of colour-ringed birds indicate that the expansion of Spoonbill in the German Wadden



Sea (and Denmark) was initiated by birds from the growing Dutch colonies (Rasmussen *et al.*, 2000; Overdijk and Horn, 2005).

Assessment

Overdijk (2002, 2004) and Overdijk and Horn (2005) have attributed the increase of the Spoonbill population to a combination of improved water quality and comprehensive protection measures along the flyway between NW-Europe and West-Africa in the past decades. Moreover, the expansion in the Wadden Sea was probably accelerated by increased predation pressure on inland colonies in the Netherlands (Voslamber, 1994; Overdijk, 2002). In addition, a tendency toward earlier recruitment of sub-adult birds into the breeding population has been observed. In combination with a higher survival rate, this might be the driving mechanism behind the fast growth rate reported in the past decade (Overdijk, 2004). However, the population is still susceptible to events elsewhere in the flyway. In 1999, lower numbers of Spoonbills returned to the Wadden Sea, probably as a result of prolonged drought at stop-over sites in Spain, which prevented the birds from replenishing their body reserves on their way to the Wadden Sea (Overdijk, 2002). Moreover, a large proportion of the NW-European population winters in only two areas in West-Africa and therefore the species remains vulnerable (Overdijk, 2004).

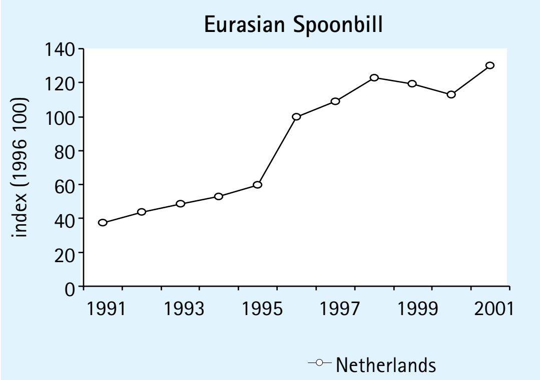


Figure 16: Trends in Eurasian Spoonbill 1991-2001, retrieved from annual total counts.

4.3 Common Shelduck

Tadorna tadorna

01730

NL: Bergeend **D: Brandgans** **DK: Gravand**

Status 1991: 4,413 "pairs"
Status 1996: 4,982 "pairs"
Status 2001: 6,480 "pairs"
EC Birds Directive: –
NW-Europe: 16%
Coverage: B

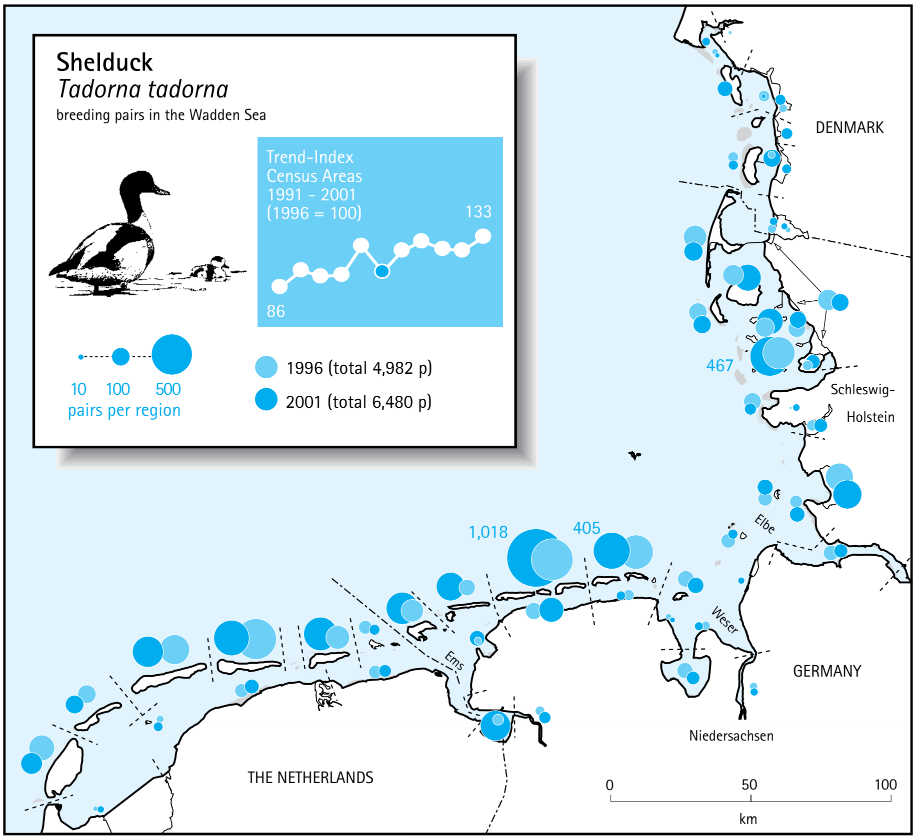


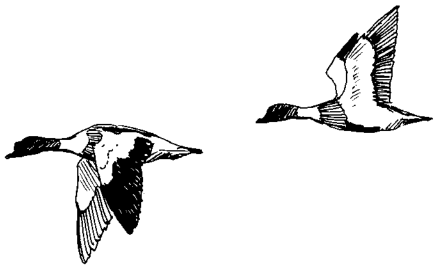
Figure 17: Breeding distribution of Shelduck in the Wadden Sea in 2001 (1996 given for comparison).

Distribution and Habitat

Although breeding Shelduck are highly dependent on rabbit burrows, they are also found breeding under debris washed ashore, in low and dense scrub or in (farm) buildings. Deserted farm buildings sometimes even support several breeding pairs. Due to the preference for rabbit holes, large numbers breed in the dune areas, or on the fringe of dunes and salt marshes on the islands. Breeding and feeding areas might be well separated, and often just-fledged broods move considerable distances to reach chick-rearing areas. Feeding Shelduck are mostly found at silty mudflats along the mainland coast. Others rear their broods in brackish ditches or canals directly behind the seawall. The largest numbers of Shelduck are found in the Netherlands, Niedersachsen and Schleswig-Holstein (94% of the population in 2001). Island-breeding sites are clearly preferred and support 72% of the population. Core breeding areas were Terschelling, Ameland and Schiermonnikoog NL, the East Frisian islands Nds and Pellworm SH. A similar distribution pattern was found in 1996.

Population and Trends

According to the overall numbers recorded during the total surveys in 1991, 1996 and 2001 the breeding population of Shelduck increased. For 2001, the population was estimated at 6,480 pairs. Trend estimates for the census areas indicate an annual increase rate of 4% between



1991 and 2001. Similar increases occurred in Schleswig-Holstein and Niedersachsen, whereas the Dutch population remained rather stable. Only Denmark reported a sharp increase (18%) which, however, is mainly due to better coverage (see below). Therefore, the overall population size as well as population changes presented here must be treated with some caution, and the overall Wadden Sea population is probably stable or only slightly increasing. This would coincide with a stable trend reported for NW-Europe (BirdLife International, 2004).

Assessment

Shelduck is a notoriously difficult species to count due to the occurrence of large numbers of non-breeders, the large home range of breeding pairs and the large distances pairs with offspring move (Hälterlein *et al.*, 1995; Südbeck *et al.*, 2005). Therefore, population size might be less accurate than in other species. Trends, however, have been collected by the same methods and should give a realistic trend estimate, at least for Schleswig-Holstein, Niedersachsen and the Netherlands. In Denmark, coverage was incomplete in the first years of the monitoring project (between 1991 and 1996). This will be the main reason for the sharp increase derived from the numbers in Danish census area.

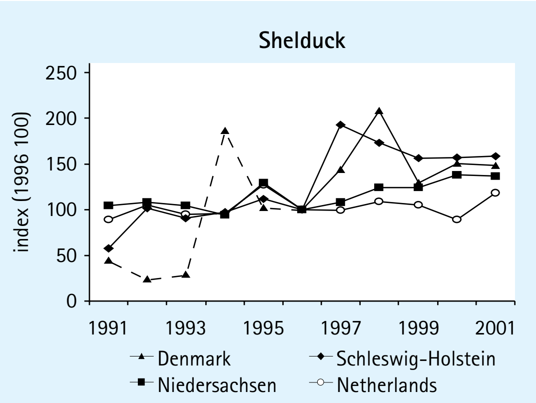


Figure 18: Trends in Shelduck 1991–2001, retrieved from annual counts in census areas. Dashed line indicates incomplete coverage.

4.4 Common Eider

Somateria mollissima

NL: Eider **D: Eiderente** **DK: Ederfugl**

Status 1991:	8,408 pairs
Status 1996:	11,534 pairs
Status 2001:	10,497 pairs
EC Birds Directive:	–
NW-Europe:	1%
Coverage:	B

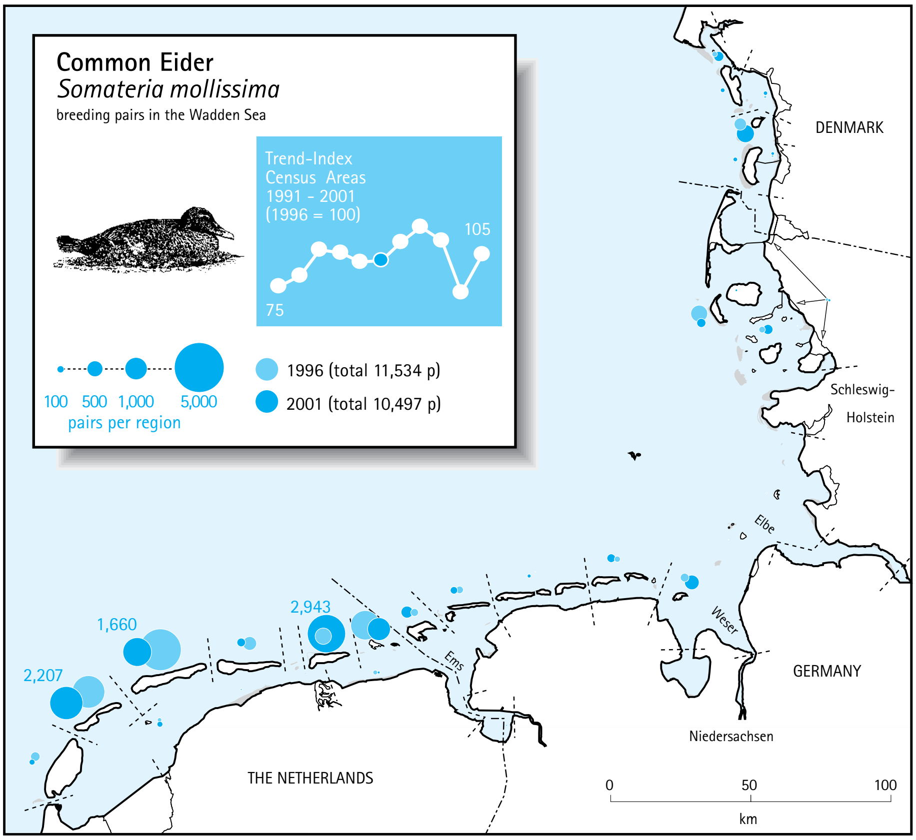


Figure 19: Breeding distribution of Common Eider in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

The majority of Eider breeding in the Wadden Sea (78%) is found in the Dutch section. Here, five islands, Vlieland, Terschelling, Schiermonnikoog and Rottumeroog and Rottumerplaat support 96% of the Dutch Wadden Sea population. In Niedersachsen, Schleswig-Holstein and Denmark, scattered breeding occurs. Important breeding sites in this part of the Wadden Sea are Mellum Nds, Amrum SH and Mandø DK. Nearly all Eider in the Wadden Sea (99%) breed on the islands. Some of these birds breed in colonies. Mainland breeding pairs often represent single breeders. The species breeds in all kinds of vegetated areas, mostly close to open water. Nests are often hidden under thick scrub in coastal dunes, but might also be found in more exposed situations, *e.g.* on salt marshes. Broods move considerable distances to chick-rearing areas and many of the families observed along the mainland coasts often originate from breeding sites at the islands.

Population and Trends

About 10,500 pairs of Eider were recorded in the Wadden Sea in 2001, slightly less than in 1996. On a longer term, the population has increased in the second half of the 20th century. Between 1991-2001, Common Eider breeding in the census areas still experienced a significant increase. However, this only accounts for the small populations in Niedersachsen and Denmark. In Schleswig-Holstein, numbers in the census areas point to an increase, but, in fact, the total population declined from 808 pairs in 1991 to 382 pairs in 2001, mainly due to reduction of the population at Amrum (not covered with census areas). For Niedersachsen and Denmark, the upward trends in census areas are confirmed by the total counts. The core breeding sites in the Netherlands showed fluctuating numbers from 1991-2001, mainly as a result of a slight increase until 1997 and a sharp decline in the late 1990s. Between 1999 and 2000, the population in census areas suffered losses of about 50% and until now it has only partly recovered (van Dijk *et al.*, 2005; Willems *et al.*, 2005). Results from total counts in the Dutch Wadden Sea are more or less in line with the data retrieved from the census areas and show a reduction in population size of about 20% between 1996 and 2001. Recent trends in the western part of the Dutch Wadden Sea still point to declines, whereas in the eastern part numbers have increased since 2000 (Willems *et al.*, 2005).

Assessment

Trends of breeding Eider in the Wadden Sea are dominated by the developments in the large Dutch population. The downward trend observed here in the late 1990s was preceded by mass-starvation among wintering Eiders in 1999/2000, when an estimated 21,000 Eider died in the Dutch Wadden Sea and 10,000 in the German Wadden Sea (Camphuysen, 2001; Fleet 2001; Camphuysen *et al.*, 2002). Ring-recoveries show that many starving birds belonged to the local breeding population, despite the fact that local birds are outnumbered by Baltic birds in winter. Breeding bird surveys in 2000 pointed to a low number of females starting to breed (indicating poor condition), late laying-dates and, finally, a low reproductive output (Dijksen and Koks, 2001; Oosterhuis and van Dijk, 2002; Desholm *et al.*, 2002). Mechanical shellfish-fisheries are assumed to play a major role in the mass-mortality and reduced breeding population, although their impact has been under intense debate, since it could not be proven whether birds died of food-shortage or starved due to parasite contamination in crabs (Wolff, 2001). In a comprehensive evaluation, Ens and Kats (2004) concluded that food-shortage, triggered by lower availability of the for Eider highly profitable sublittoral mussel stocks, was the main explanation for the observed mass-starvation, and parasites only played a secondary role. The latter is confirmed by data from Desholm *et al.* (2002). Meanwhile, cockle fisheries in the Dutch Wadden Sea were stopped in 2004, and a new management plan is purposed to develop sustainable mussel-fisheries (see also chapter 4.2.7). Further monitoring will show if populations will recover.

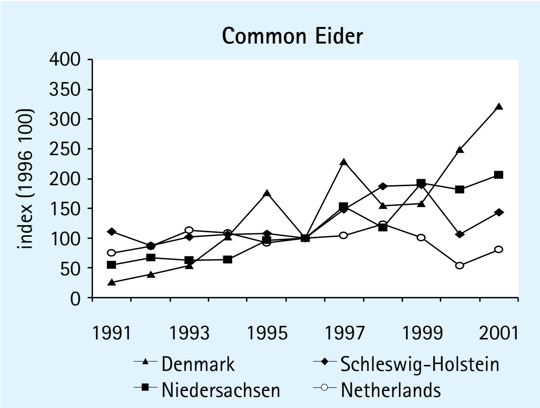
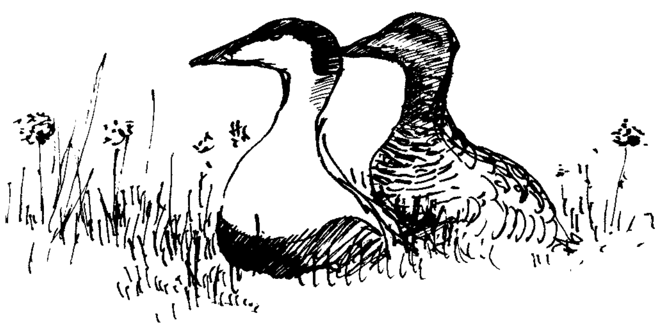


Figure 20: Trends in Common Eider 1991-2001, retrieved from annual counts in census areas.



4.5 Red-breasted Merganser

Mergus serrator

NL: Middelste Zaagbek D: Mittelsäger DK: Toppet Skallesluger

Status 1991: 15 pairs
Status 1996: 41 pairs
Status 2001: 44 pairs
EC Birds Directive: –
NW-Europe: < 1%
Coverage: A

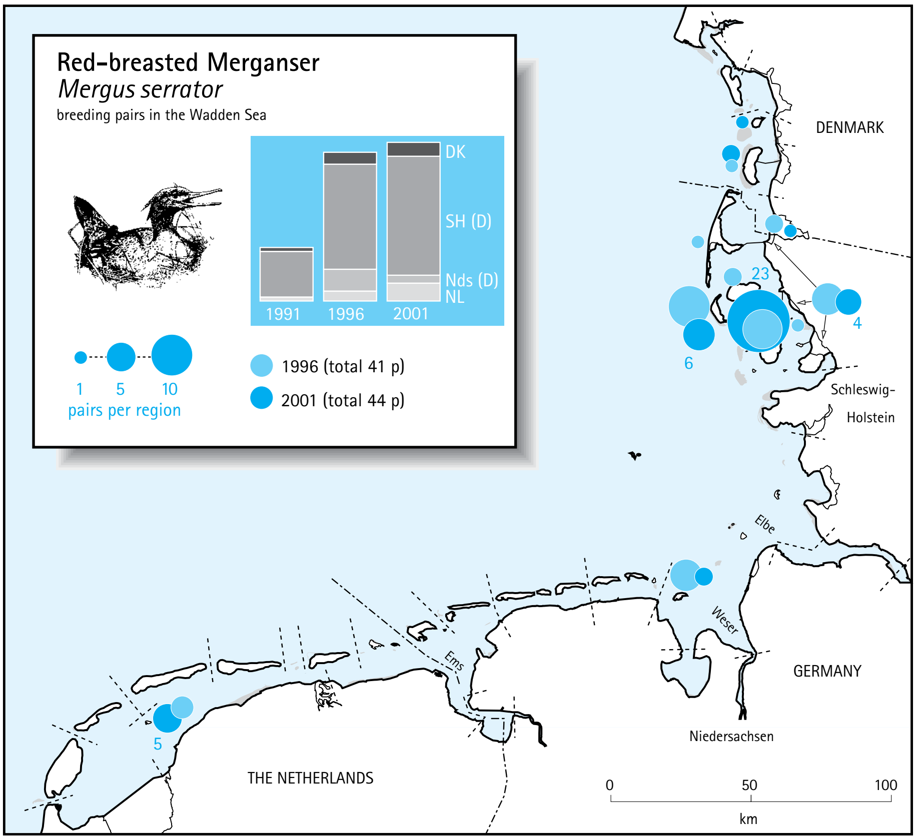


Figure 21: Breeding distribution of Red-breasted Merganser in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Breeding sites for Red-breasted Merganser in the Wadden Sea are among the southernmost recorded in Europe. The population is rather small (see below) and in 2001 75% of the population was confined to Schleswig-Holstein. Originally, Red-breasted Merganser had its stronghold on the island of Amrum, but since 1998 the largest numbers have been breeding on the Halligen. Breeding in Niedersachsen and the Netherlands was observed at only two sites (the islands of Mellum and Griend, respectively, both traditional breeding sites). In Denmark, breeding pairs were observed from the islands of Mandø and Rømø and the saltwater lagoon of Margrethe Kog. The latter is the only mainland settlement, together with coastal wetlands in Schleswig-Holstein. Breeding habitat often comprises dune vegetation on the islands. In Schleswig-Holstein also salt marshes (Halligen) are inhabited, as long as tall vegetation is available (Hälterlein, 1998).

Population and Trends

From 1991 to 2001, the population of Red-breasted Merganser increased nearly threefold, from 15 to 44 pairs. Data from Schleswig-Holstein suggest a continuous population growth (Hälterlein *et al.*, 2000; see Figure 22).

The initial increase in the early 1990s follows a long-term increase of the flyway population and a southward expansion of the European breeding

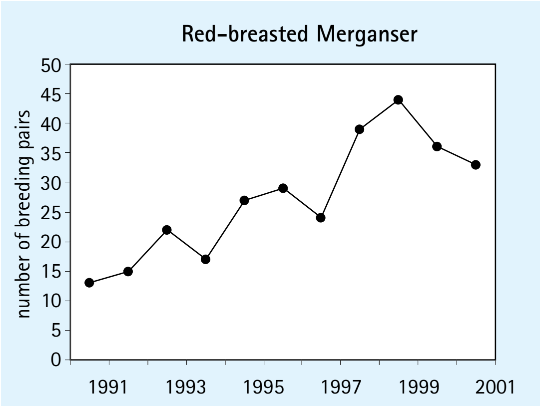


Figure 22: Trends in Red-breasted Merganser 1991-2001 in the Wadden Sea in Schleswig-Holstein, retrieved from total counts.

range. In Schleswig-Holstein first breeding was observed in 1963 on Amrum, but especially in the late 1980s an increase occurred (Hälterlein, 1998). In the Dutch part of the Wadden Sea, scattered breeders were found from 1916 onwards, mainly on Texel, Schiermonnikoog and Rottumeroog (review in Bijlsma *et al.*, 2001). Regular breeding has been observed here since 1988, mainly on Griend. Within the Netherlands, however, the breeding population is outnumbered by the small population in the Delta area, SW-Netherlands which has shown an increase as well.

Assessment

Red-breasted Merganser is rather difficult to count. Hence, the breeding population might be slightly under-estimated since often only pairs with offspring are taken into account as breeding pairs and young often appear late in the season when survey work for other species has been reduced.

Moreover, data from the Danish Wadden Sea in 1991 were incomplete. Nevertheless, the upward trend shown here will represent a reliable trend and is in line with increases observed elsewhere in Western Europe (BirdLife International, 2004).

4.6 Hen Harrier

Circus cyaneus

NL: Blauwe Kiekendief D: Kornweihe DK: Blå Kærhøg

Status 1991: 124 pairs
Status 1996: 142 pairs
Status 2001: 126 pairs
EC Birds Directive: Annex I
NW-Europe: 1%
Coverage: B

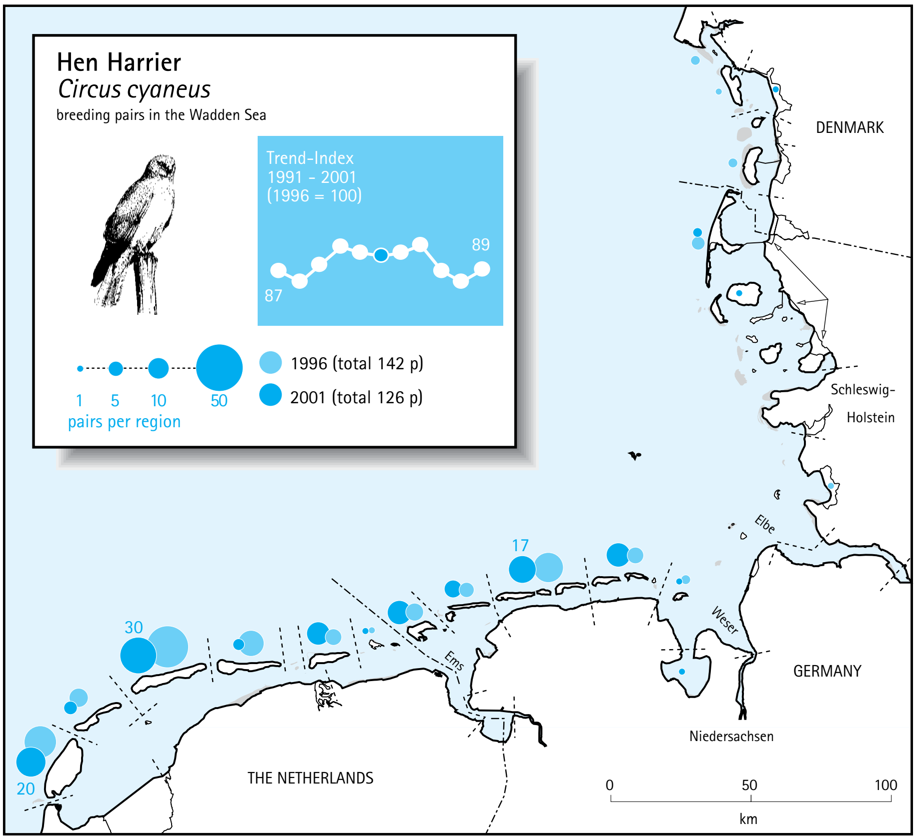


Figure 23. Breeding distribution of Hen Harrier in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Only a small part of the NW-European population of Hen Harriers breeds in the Wadden Sea area. Within the Wadden Sea, more than 90% breeds on the islands in Niedersachsen and the Netherlands, with largest numbers on Norderney, Langeoog (NI), Texel and Terschelling (NL), respectively. Breeding in Denmark and Schleswig-Holstein has occurred regularly in low numbers. The species preferably breeds in dune areas, often in wet dune valleys and in reed beds. Adjacent polder areas or villages are searched for prey, as are areas along the mainland coast, salt marshes and dunes. Commuting from islands to the mainland coast fur hunting has been observed frequently for the East Frisian islands, which are rather close to the mainland coast. Furthermore, it has been reported for Texel and Rottumeroog/plaat. Other Dutch islands are probably too far from the coast.

Population and Trends

Hen Harrier are covered with annual total counts. In 2001, 126 pairs were counted, which is similar to 124 pairs in 1991. A (non-significant) stable trend was assessed for the entire Wadden Sea. However, trends for Niedersachsen and the Netherlands differ very much. The population on the Dutch islands has experienced a significant decline, with a continuous downward trend since 1994. Major losses were observed at Ameland

and Terschelling, whereas numbers at Texel and Schiermonnikoog remained rather stable. In Niedersachsen, on the other hand, numbers more than doubled between 1991 and 1997 (from 22 to 55 pairs), but levelled off afterwards. Since 2001, both countries have shown downward trends (Koffijberg *et al.*, 2005b). Breeding in Denmark and Schleswig-Holstein was first observed in 1991 and 1996, respectively, and even 10 pairs were found in both countries in 1996. Annual breeding, however, has only been recorded in Schleswig-Holstein, mainly on Sylt (since 1989). In Denmark, Hen Harrier did not breed annually since 2001. The reasons are thought to be predation and human disturbance.

Assessment

Coverage for Hen Harrier was good over the years, but the estimated breeding population might be slightly higher since males are often polygamous and pairs may be difficult to separate. A long-term study on Schiermonnikoog showed that declining Hen Harrier numbers were coinciding with smaller clutches and a lower breeding success (van der Wal *et al.*, 1999). Competition with increasing numbers of Marsh Harriers *Circus aeruginosus* and deteriorating prey detectability due to vegetation succession were assumed to be the main causes for this process. Recent studies on Texel, Terschelling and Ameland, however, suggest a more complex situation (De Boer and Klaassen, in prep.; Dijksen, in prep.). First results point towards a decline in prey densities, especially numbers of pheasants *Phasianus colchicus* (due to abandoned feeding and releases for hunting purposes) and rabbits *Oryctolagus cuniculus* (due to myxomatosis and VHS-disease). Both are important prey in the initial chick-rearing period. Further (ringing) studies will focus on the exchange of breeding pairs between the islands, which seems to be hardly occurring. Regarding the increases on the East Frisian islands, it is recommended to start similar studies there, since a comparison of both countries could reveal more background information and eventually help to establish management measures. One explanation for the different trends could also be that Hen Harrier in Niedersachsen have better access to feeding sites along the mainland coast since islands here are much closer to the mainland than in the Netherlands. In this context it is striking that Hen Harrier on Texel, which are mainland-visitors too, perform better than populations on the other islands.

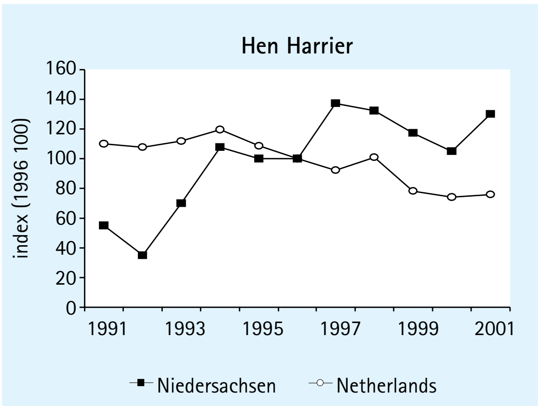


Figure 24: Trends in Hen Harrier 1991-2001, retrieved from annual total counts.

4.7 Oystercatcher

Haematopus ostralegus

NL: Scholekster D: Austernfischer DK: Strandskade

Status 1991: 37,156 pairs
Status 1996: 46,591 pairs
Status 2001: 39,927 pairs
EC Birds Directive: –
NW-Europe: 12%
Coverage: B

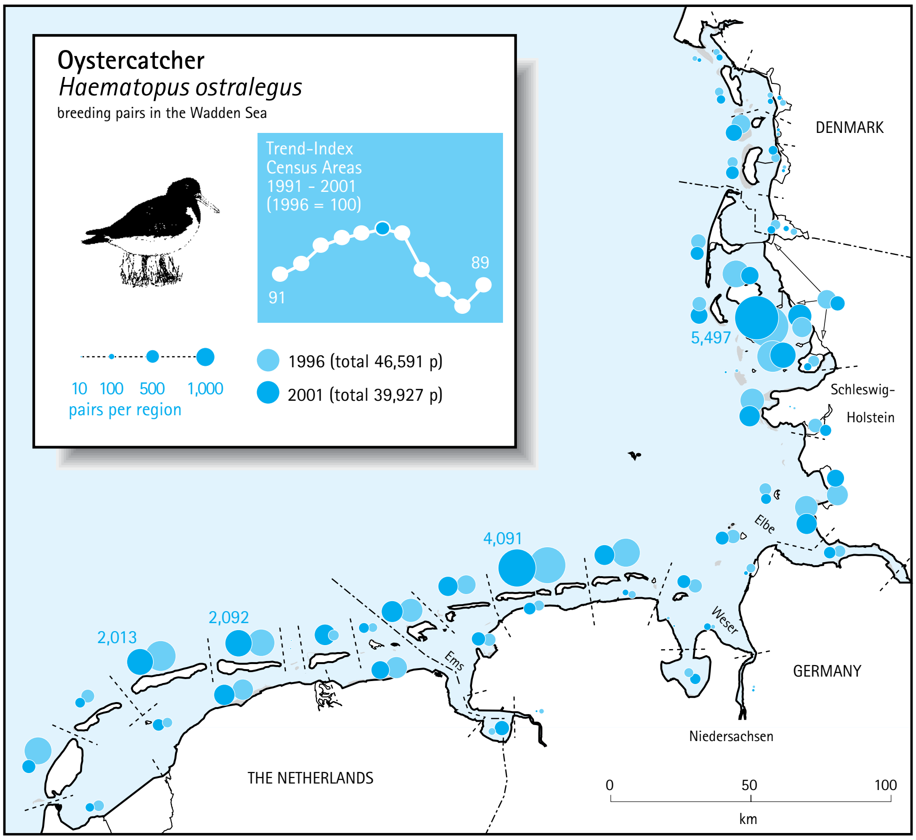


Figure 25: Breeding distribution of Oystercatcher in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Oystercatcher is one of the most abundant breeding birds in the Wadden Sea and an important part of the NW-European population (12%) is found in the area. It breeds in various habitats, ranging from beaches and dunes to salt marshes and coastal grasslands or arable fields behind the seawall. Highest densities are usually found on island salt marshes (especially little Hallig-Islands in Schleswig-Holstein), lowest densities in dunes, outer sands and on arable fields behind the seawall. Densities in salt marshes within census areas in 2001 were about 1.5 times higher than in dunes/beaches and coastal grasslands (Figure 26). As shown by Ens (1992) pairs breeding in close vicinity to the intertidal mud flats (i.e. on the fringe of salt marshes) have highest reproduction rates since these birds have best access to their food resources. Overall, 69% of the 2001-population was breeding on islands. This figure varies little among the countries. Islands with large populations are especially Terschelling and Ameland NL, Norderney and Langeoog Nds and the Halligen SH.

Population and Trends

Over the past decades, Oystercatcher has experienced a long-term increase in the Wadden Sea (and elsewhere in the breeding range). The population size in 1991-1996 (37,000-46,500 pairs) probably represents the maximum population size for the Wadden Sea as a whole. The trend for the entire Wadden Sea 1991-2001, as derived from the census areas, is not significant, however. Populations in Schleswig-Holstein and Niedersachsen were still increasing in the 1990s, whereas Dutch populations experienced a significant decline. Downward trends started in suboptimal habitats like dunes/beaches and coastal grassland, and were less obvious in salt marshes (Figure 28; Willems *et al.*, 2005). Densities per habitat in the census areas (in all countries) support this: in beaches/dunes and coastal grasslands densities in 2001 were on average 30% lower than in 1996 (Figure 26).

After 1996, the decline in the Netherlands is also reflected in an overall significant decrease in the entire Wadden Sea. Data from census areas collected in 2002-2004 showed that populations in Niedersachsen, Schleswig-Holstein and Denmark also decreased recently (Thorup, 2004a; Koffijberg *et al.*, 2005b). Dutch and Schleswig-Holstein populations declined at an annual rate of 5% between 1996-2004; data from Denmark suggest a similar rate of decline. Since 2002 at least in the Netherlands numbers have tended to stabilize, however, without signs of a recovery to former population levels (van Dijk *et al.*, 2005).

Assessment

The decline pointed out above was initiated by the cold winter of 1995/96. Between 1995 and 1996 numbers of Oystercatcher breeding in the Dutch Wadden Sea declined by more than 20% as a result of mass-mortality during the cold spell in winter (Koks and Hustings, 1998). However, the population did not recover as following previous severe winters, vacant territories were not re-occupied and reproduction was poor in following years (Bruinzeel and van de Pol, 2003). The main cause for this development were low food stocks due to the removal of blue mussel beds by shellfish-fisheries in the early 1990s in combination with a series of years of poor spatfall and stormy weather (Ens *et al.*, 2004). Oystercatchers switched to cockles as an alternative food source but then suffered competition from mechanical cockle fisheries in the late 1990s (Rappoldt *et al.*, 2003; Verhulst *et al.*, 2004). Since shellfish fisheries have their highest intensity in the Dutch Wadden Sea (CWSS, 2002), this also explains the downward trend observed here and the (initial) opposite trends in other parts of the Wadden Sea. To what extent recent declines in

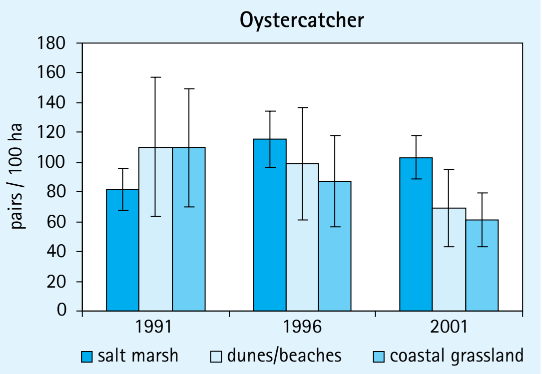


Figure 26: Densities (pairs/100 ha, ±SE) of Oystercatcher according to habitats in the Wadden Sea in 1991, 1996 and 2001. Data derived from census areas > 15 ha.

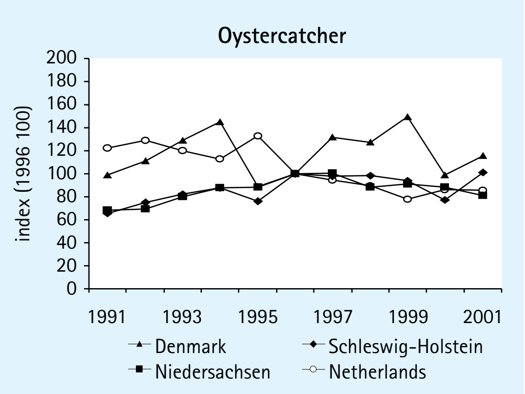


Figure 27: Trends in Oystercatcher 1991-2001, retrieved from annual counts in census areas.

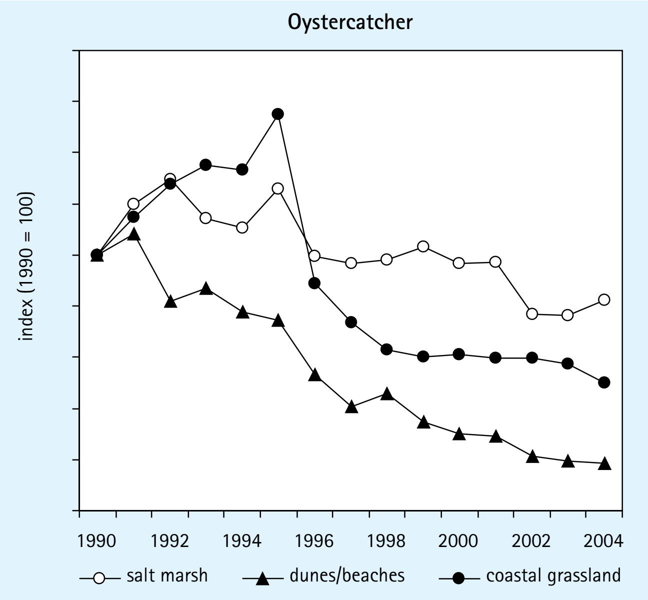
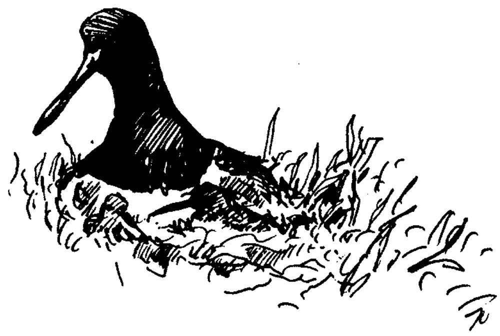


Figure 28: Trends in Oystercatcher according to habitat 1990-2004, retrieved from annual counts in census areas in the Dutch part of the Wadden Sea.

Niedersachsen, Schleswig-Holstein and Denmark are linked to the deterioration of food stocks in the Dutch Wadden Sea is not clear and should be investigated further. Impact from factors other than shellfish fisheries (e.g. management of salt marshes and predation) are not yet clear and should also be assessed.

Numbers of non-breeders in the Dutch Wadden Sea have undergone declines as well, starting already in the early 1990s (Leopold *et al.*, 2004; van Roomen *et al.*, 2005; Blew *et al.* 2005). The decline of breeding and non-breeding Oystercatchers in the Dutch Wadden Sea also coincides with downward trends and a contraction of the breeding range in agricultural areas in the interior of the Netherlands (SOVON, 2002; Teunissen, 2003; van Dijk *et al.*, 2005). This development is mainly thought to be caused by intensified agricultural practise (especially early mowing) and loss of grassland habitat (Hulscher and Verhulst, 2003; Teunissen, 2003), but it is not clear yet if also deteriorating conditions for wintering birds in the Wadden Sea have played a role as well (Hulscher and Verhulst, 2003). It is striking that in inland parts of Schleswig-Holstein and Niedersachsen, local increases were still reported in the 1990s (Melter *et al.*, 1998; Berndt *et al.*, 2002). As proposed by Reneerkens et al. (2005), the interplay between wintering conditions in the Wadden Sea and breeding conditions at inland breeding sites should be investigated.



4.8 Avocet

Recurvirostra avosetta

NL: Kluut **D: Säbelschnäbler** **DK: Klyde**

Status 1991:	11,844 pairs
Status 1996:	11,214 pairs
Status 2001:	10,170 pairs
EC Birds Directive:	Annex I
NW-Europe:	43%
Coverage:	A

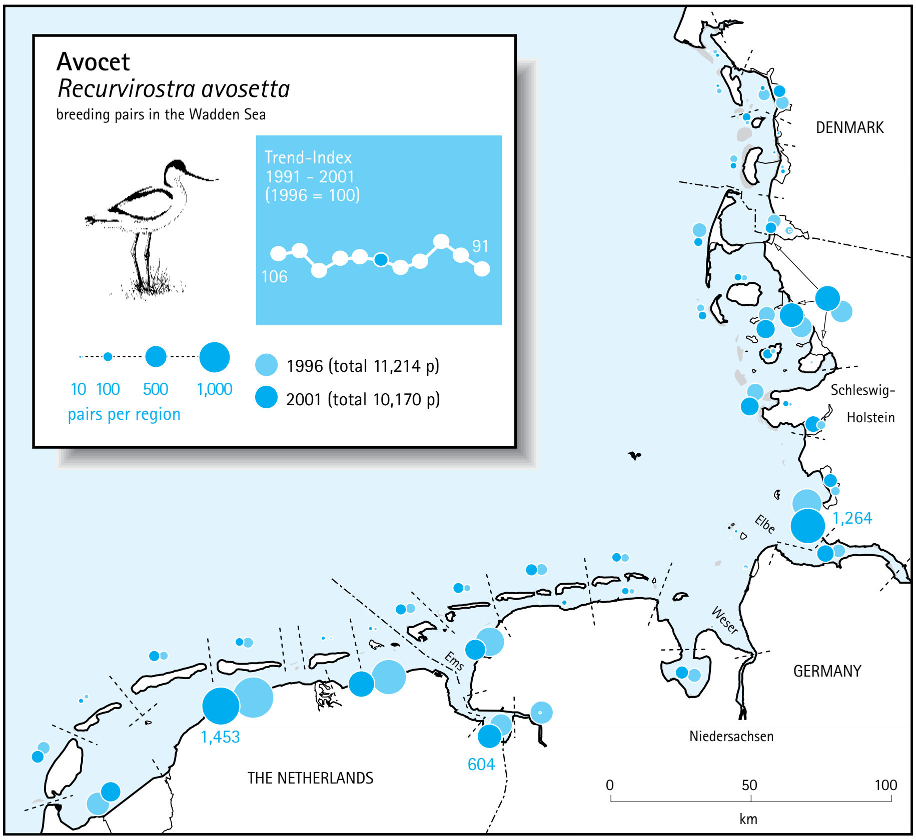


Figure 29: Breeding distribution of Avocet in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Avocet is one of the prime species of the Wadden Sea, with nearly half of the NW-European population concentrated in the area. The species preferably breeds in sparsely vegetated areas. Highest numbers are usually found in salt marshes along the mainland coast. Large numbers also breed in coastal wetlands, like recent embankments (*e.g.* Margrethe Kog DK, Beltringharder Koog SH, Leyhörn Nds or 'de-banked' areas (Polder Breebaart/Dollard NL). All these sites are characterised by vegetation of early succession stages. Locally, small numbers also breed on arable fields, especially in crops which have sparse vegetation in May, like sugar beet, carrot and spring-sown cereals. Along the northern mainland coast in Groningen NL, this usually comprises 10-15% of the breeding population (K. Koffijberg, unpublished), in Schleswig-Holstein about 6% in some years (Berndt *et al.*, 2002). In Denmark, arable fields are only infrequently used (Thorup, 2005). Most birds breeding behind the seawall switch with their chicks to the mud flats to feed immediately after hatching (migration up to 5 km; Hötker and Kölsch, 1993). Since Avocet are especially confined to silty mud flats for feeding, highest numbers (8,322 pairs, 82% of total population) are found along the mainland coasts. The distribution pattern was similar to previous total censuses, with three regions supporting >1,000 pairs: Dithmarschen SH, northern Groningen and northern Friesland NL. Other concentrations are found in the so-called 'Naturschutzköge' (i.e. coastal wetlands) in Schleswig-Holstein and in Leybucht Nds and Dollard NL/Nds. Coastal wetlands in Schleswig-Holstein supported about 30% of the local population in 1990-92 (Berndt et al., 2002). Also here, the species is subject to vegetation succession and will only remain if short vegetation will sustain (Hälterlein, 1998). By 2001, the proportion of Schleswig-Holstein birds breeding in coastal wetlands had gone down to 20%.

Population and Trends

The breeding population in 2001 (10,170 pairs) did not differ much from previous counts. In line with the NW-European population (BirdLife International 2004; Hötker and West, 2005), the overall breeding population of Avocet in the Wadden Sea can be classified as stable. However, trends differ among countries. Whilst Denmark and Schleswig-Holstein showed significantly increasing populations in 1991-2001 (Denmark reports a decline after 1999), trends in Niedersachsen and the Netherlands pointed at significant declines in the same period. In Niedersachsen, the breeding population steadily decreased from 2,869 pairs in 1996 to 1,320 in 2001 (-54%). Especially populations in the German part of the Dollart and the Leybucht area suffered major losses. In the Netherlands, numbers along the mainland salt marsh coast of Friesland and Groningen declined from 2,882 to 2,471 pairs (-15%). Until 2003, this trend continued, with 1,270 pairs left in 2003 (van Dijk *et al.*, 2005). Large parts of the salt marshes by that time had been abandoned by breeding Avocets. On the other hand, the Dutch part of the Dollard recently supported higher numbers (probably receiving birds from the German side; Oltmanns and Koffijberg, unpublished). This trend continued after 2001 and can be mainly attributed to a large colony in Polder Breebaart, on the western edge of the Dollard. Here, a connection between inland polder and Dollard was created in 2001, allowing tidal influence behind the seawall. Hence, favourable breeding opportunities for Avocet were established. In 2003, the colony had grown to 824 pairs, but in 2005 it declined sharply (see below).

Assessment

Although overall numbers of Avocet were stable during 1991-2001, Avocet populations usually tend to fluctuate according to habitat availability. Hence, numbers and distribution in e.g. Schleswig-Holstein expanded after the embankments along the mainland coast in 1970s and 1980s (Hälterlein, 1998). A similar trend appeared in Polder Breebaart NL after 1991 (see previous section). Often, birds abandon such areas after some time: as vegetation succession proceeds, breeding habitat deteriorates and risk of predation increases. Moreover, breeding success in such areas is often low, especially when pairs and their offspring do not move to mud flats nearby (Meininger *et al.*, 2003; Helms and Segebade in Hälterlein, 1998; Hötker and Segebade, 2000). In Schleswig-Holstein, weather conditions in June were of prime importance to the reproductive output finally achieved by Avocet (Hötker and Segebade, 2000). This also implicates that Avocet is probably one of the species susceptible to increased precipitation and storminess during the breeding season, as suggested in several scenarios in studies on climate change and sea level rise (Oost *et al.*, 2005; Hötker and West, 2005). This

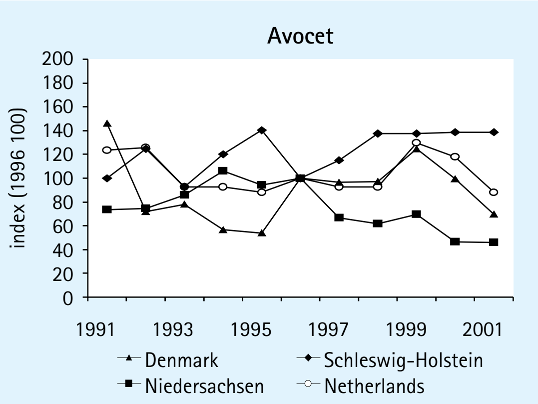


Figure 30: Trends in Avocet 1991-2001, retrieved from annual total counts.

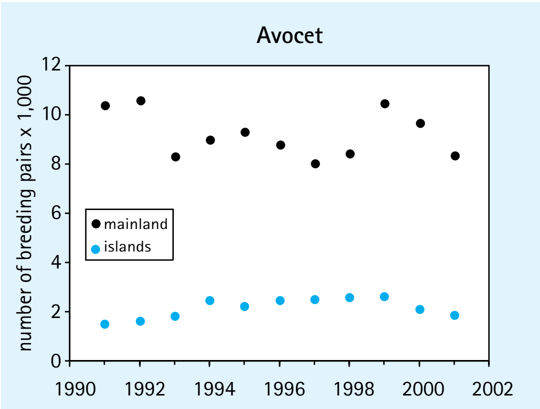
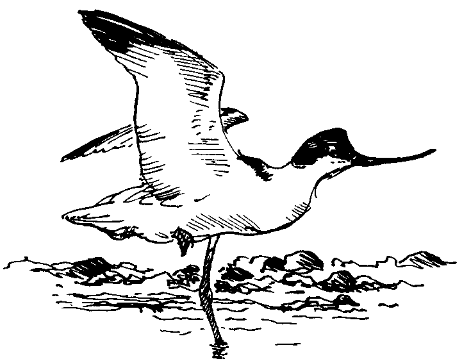


Figure 31: Trends in Avocet on island-breeding sites and mainland-breeding sites. Both trends are not significant.

will not only affect chick-survival but also poses a higher risk of flooding of the often exposed breeding sites at the lower salt marshes.

Recent declines at the mainland salt marshes, especially in the Netherlands (Koopman, 2003; Klaassen-Bos, 2005) and Niedersachsen (Leybucht; Vaas and Melter, 2005) as well as in the Tønder Marsh in Denmark (Clausen *et al.*, 2005) seem to be linked to low reproductive output due to increased predation pressure, mainly by red foxes. As a result, some Avocet seem to have moved to the predator-free islands (but the trend is not significant, compare Black-headed Gull) (Figure 31). Vaas and Melter (2005) reported a hatching probability of only 1% in a study on breeding success in the Leybucht area. Nest were mainly (75%) predated by night, and tracks suggested red fox being the main predator. A similar study in the Dollard, also in 2005, revealed a hatching success of 1.5 and 26% respectively at two study sites. Also here, predation was the most important factor causing nest losses, probably for a major part also by red fox (Klaassen-Bos, 2005). However, the study in the Dollard also underlined the importance of available food stocks, especially mudshrimp *Corophium sp.* The recent decline and complete breeding failure in Polder Breebaart coincided with a sharp reduction in *Corophium* density. Engelmoer (in Willems *et al.*, 2005) observed a similar pattern along the mainland coast of Friesland NL, as a result of the cessation of drainage works. Another factor causing declines might be the discharge of fresh water (causing typical brackish feeding habitat). Both along the coast of Groningen and in the Leybucht area, a decline in breeding Avocet became apparent after sluices were given up and the discharge of fresh water stopped (Koffijberg, Oltmanns, unpublished). Therefore, investigations on the decline in Avocet should not only focus on changes in predation risk, but also take into account available food stocks. In addition, habitat changes (also with respect to predator facilitation, see Langgemach and Bellebaum, 2005) should be reviewed as well.



4.9 Great Ringed Plover

Charadrius hiaticula

NL: Bontbekplevier D: Sandregenpfeifer DK: Stor Præstekrave

Status 1991:	1364 pairs
Status 1996:	1367 pairs
Status 2001:	1093 pairs
EC Birds Directive:	Annex I
NW-Europe:	4%
Coverage:	A

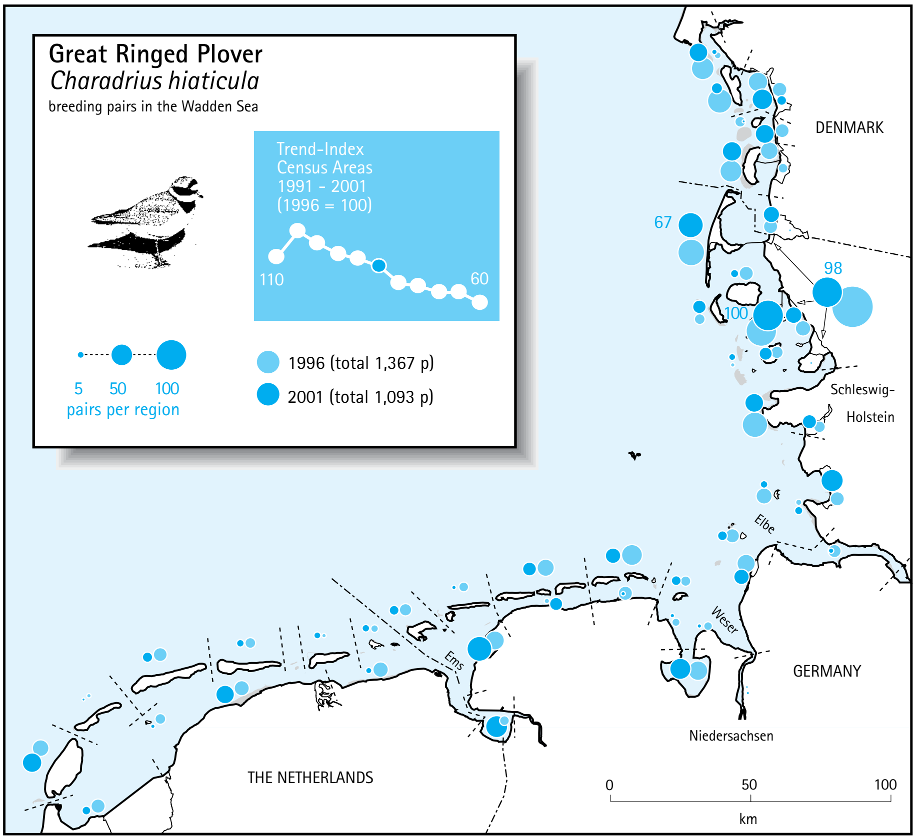


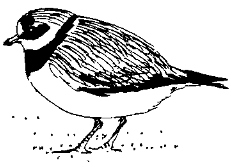
Figure 32: Breeding distribution of Great Ringed Plover in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Great Ringed Plovers usually inhabit sites with low or sparse vegetation cover. Preferred are beaches, sand flats or dynamic low dunes with young succession stages. In addition, embankments (especially initial stages) and sparsely vegetated sites and harbours and industrial areas (*e.g.* parking lots) are used for breeding. In the beginning of the 1990s, such 'artificial' habitat comprised 43% of breeding Great Ringed Plovers in Schleswig-Holstein (Hälterlein, 1998). Regularly, grazed salt marshes and even arable fields behind the seawall are supporting few breeding pairs. Distribution in the Wadden Sea has its core breeding sites mainly in Schleswig-Holstein and Denmark, which support 62% of the Wadden Sea population. Islands as well as mainland breeding sites are common (in 2001, 39% and 61% of the population respectively). In Denmark, highest numbers were found at the mainland salt marshes and Rømø. In Schleswig-Holstein, the Halligen and coastal wetlands in North Friesland were preferred sites whereas in Niedersachsen highest numbers occur in sheltered bays like Jadebusen, Leybucht and Ems-Dollart. In the Netherlands, only a few sites supported > 10 pairs (Texel, Terschelling and Friesland). This pattern is very similar to previous counts. In a European context, the Wadden Sea population is rather small (4%).

Population and Trends

Since the start of the monitoring scheme in the Wadden Sea, Great Ringed Plovers have steadily



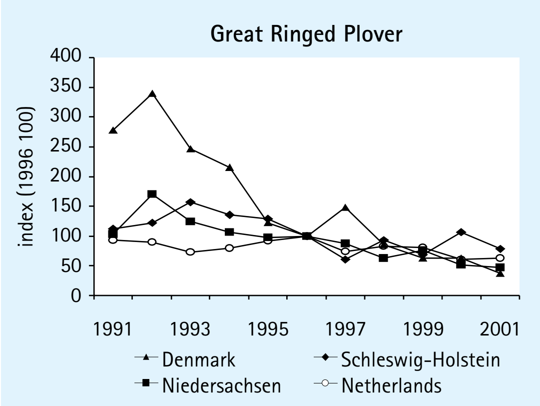


Figure 33: Trends in Great Ringed Plover 1991-2001, retrieved from annual counts in census areas.

declined. Numbers from the counts in 1991 and 1996, however, were highly similar, whereas in 2001 a reduction of about 20% had occurred. The apparently stable numbers between 1991-1996 are mainly due to incomplete coverage in Denmark (O. Thorup). The overall trend 1991-2003 indicates significant declines in all countries. Apart from Denmark (which was covered incompletely in 1991-1996), trends are highly synchronised among the Wadden Sea countries. When comparing distribution in 1996 and 2001, the species experienced the largest decreases on the islands (e.g. Terschelling NL, islands in Nds and Fanø DK) and other beach-based breeding sites (*e.g.* Westerhever SH). On the other hand, in the northern part of the Wadden Sea (*e.g.* Sylt SH and Rømø DK) populations on islands showed highly similar size in 1996 and 2001. Several breeding sites along the mainland coast, like Friesland NL, Dollart-Ems NL/Nds, Leybucht Nds and Meldorfer Bucht SH showed increases in the same period. Declines have continued since 2001 (Koffijberg *et al.*, 2005b).

Assessment

The observed decline of Great Ringed Plovers coincides with an overall decline in coastal populations in Europe (BirdLife International, 2004; Thorup, 2006), which indicates that negative factors might also be operating at population-level and causing an overall population reduction. Moreover, declines in Great Ringed Plover numbers in the Wadden Sea often have been attributed to increased human disturbance. This might also explain the relatively large decline on the islands (which are popular beach-resorts) compared to other (mainland) sites. Several studies have shown that human disturbance reduces opportunities to settle territories and reduces feeding opportunities for chicks (Tulp, 1998; Schulz, 1998). Protective measures so far have been especially successful for Little Tern (see chapter 4.30) but more difficult to implement for beach-breeding plovers, since these breed dispersed over several sites, also depend on feeding in the Figure vicinity of the nest site and do not concentrate in distinct colonies like Little Tern (*cf.* Kentish Plover). Furthermore, numbers have been affected largely by dynamics in reconstruction works. Mud-deposits, embankments (coastal wetlands in SH) often attract large numbers in the first years after creation, when sparse vegetation patterns offers suitable breeding habitat. However, as succession progresses and predation risk increases, numbers often decline in a few years (*e.g.* Hälterlein, 1998). This pattern probably also explains recent increases at some mainland sites, *e.g.* Leybucht and Ems-Dollart in Niedersachsen. In both areas, dike-reconstruction works offered attractive breeding habitat around 2001. The species thus benefits probably from (natural or even artificial) habitat dynamics. Since new embankments and similar developments will not occur, in the future Great Ringed Plovers will have to rely entirely on natural habitat dynamics, only found at some beaches and outer sands (sometimes also at fringe of salt marshes). Here, they often breed exposed and are increasingly susceptible to flooding as a result of predicted sea level rise.

4.10 Kentish Plover

Charadrius alexandrinus

NL: Strandplevier D: Seeregenpfeifer DK: Hvidbrysted Præstekrave

Status 1991: 569 pairs
Status 1996: 521 pairs
Status 2001: 340 pairs
EC Birds Directive: Annex I
NW-Europe: 15%
Coverage: A

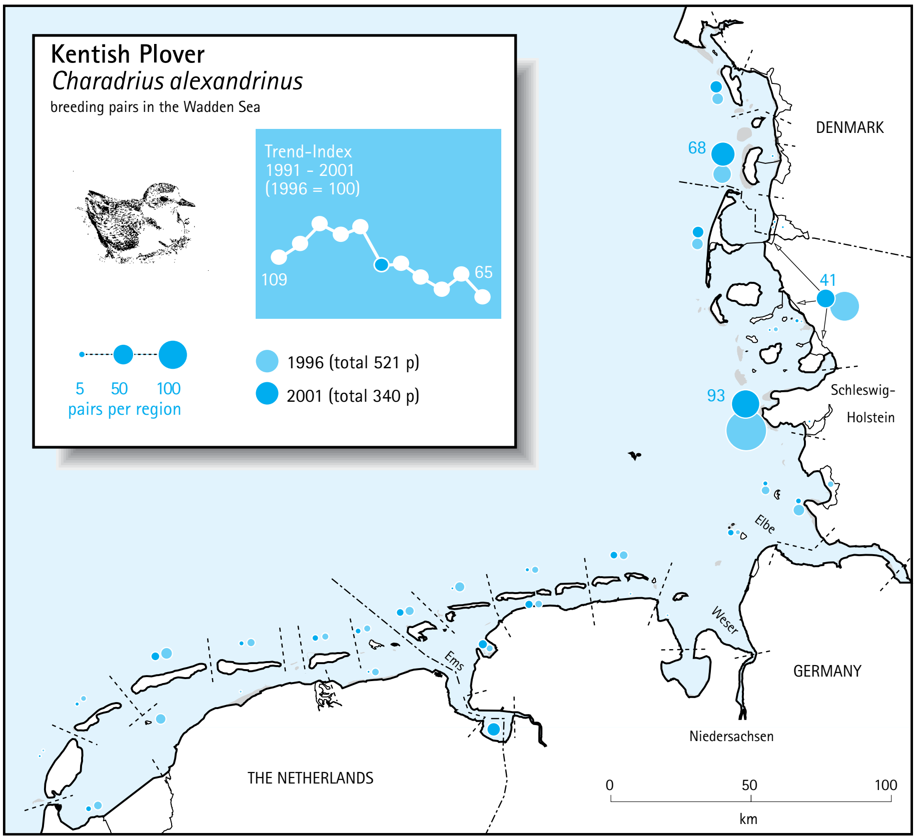


Figure 34: Breeding distribution of Kentish Plover in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Kentish Plover is confined to sandy habitats (more than Greater Ringed Plover), like beaches, primary dunes and shell banks, both along mainland coasts as well as islands (in 2001, 55 and 45% of the population, respectively). Coastal wetlands are inhabited as well, especially in Schleswig-Holstein, where nowadays wet meadows intensively grazed by geese in spring also provide asuitable breeding habitat. The population in the Wadden Sea is of prime importance since it represents a major proportion of the NW-European population. A large part of the Wadden Sea population in 2001 (47%) occurred in the Schleswig-Holstein part of the Wadden Sea. Two sections (coastal wetlands in North Friesland and salt marshes/beaches in Eiderstedt) support even 40% (134 pairs) of the entire Wadden Sea population. Further strongholds are found in the Danish part of the Wadden Sea (26%), notably at Rømø (68 pairs). All other sites only hold small numbers. The large share of the NW-European population and the fact that the population is mainly confined to only a few regions makes the species one of the most vulnerable and threatened breeding birds in the Wadden Sea.

Population and Trends

Data from Kentish Plover were collected by annual total counts. Similar to Great Ringed Plover, the overall trend for 1991-2001 is a significant decline. The exception is Denmark, where populations were even (significantly) increasing during this period (but see below). The largest declines in the other parts of the Wadden Sea occurred in the second half of the 1990s and were observed at most breeding sites. This development represents the final stage of a long-term decline which already started in the first half of the 20th century (Meininger and Arts, 1997; Flore, 1998; Potel *et al.*, 1998). Declines after 2001 continued, and in 2004 only 218 pairs were left, *i.e.* a decline of 36% compared to 2001 (Koffijberg *et al.*, 2005b). In this period, some smaller breeding sites were abandoned.

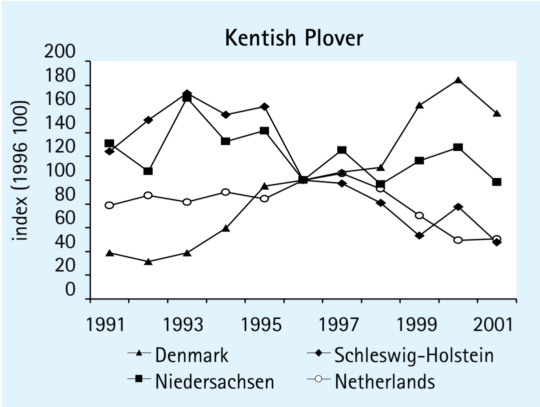


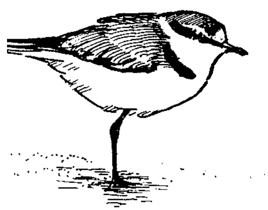
Figure 35: Trends in Kentish Plover 1991–2001, retrieved from annual total counts.

Assessment

The decline in the Wadden Sea coincides with a moderate decline in the European breeding population (BirdLife International, 2004). In the Wadden Sea, several factors have contributed to the downward trend. On a longer term, the species has suffered from the lack of natural dynamics in coastal habitats due to coastal protection works. Due to the specific habitat requirements, Kentish Plover hardly find 'natural' habitats anymore. Hälterlein (1998) estimated that from the west coast in Schleswig-Holstein only 0.5% of the area in the 1990s represented natural breeding habitat. Embankments in Schleswig-Holstein in the 1970s and 1980s temporarily halted the decline in Kentish Plover numbers, as they were attracted by the early succession stages of vegetation and low predation pressure in these areas for the first years (Hälterlein, 1998). In 1990-92, 45% of all Kentish Plovers occurred in such habitats; in 2001 only 25%. Vegetation succession meanwhile has eliminated many man-made habitats as breeding site. Another important constraint, becoming more important as Kentish Plover no longer can rely on man-made habitats, is represented by human disturbance in breeding habitats on beaches (cf. Great Ringed Plover and Little Tern). Both settlement of territories and breeding success are negatively affected by beach visitors, which increasingly crowd the beaches at many sites in the Wadden Sea and for a longer time period in a year. Studies in Schleswig-Holstein and the Netherlands have shown that birds often abandon clutches or fail to raise offspring (Schulz and Stock, 1992; Schulz, 1998; Tulp, 1998). Protection from disturbance has been given attention to at many breeding sites (*e.g.* Potel *et al.*, 1998; Kersten, 2004) and was given priority in the Wadden Sea Plan (Krol, 2005). So far it has not had the same impact as for Little Tern. As Kentish Plovers breed scattered, protection is more difficult than in a colony-breeding species like Little Tern. Where both breed closely associated, protective measures have proven to be successful, like on Rømø DK (Rasmussen *et al.*, 2000).

The increase of Kentish Plover in Denmark is considered mainly a result the creation of a large short-grazed, sandy salt marsh with plenty of pools, inland at Rømø, and also due to protection measures at the beach. Moreover, it was made possible by immigration from areas becoming less favourable nearby across the border with Schleswig-Holstein (Rasmussen *et al.*, 2000; Thorup, 2004b). The increase is much smaller, however, than shown in Figure 35, since coverage at Rømø in 1991-1995 was far from complete (Rasmussen *et al.*, 2000). However, this does not affect trends after 1996 and does not influence the increase observed in this period.

To halt further declines, urgent conservation action and research on this species is necessary on the scale of the entire Wadden Sea.



4.11 Northern Lapwing

Vanellus vanellus

NL: Kievit D: Kiebitz DK: Vibe

Status 1991: 8,753 pairs
Status 1996: 12,521 pairs
Status 2001: 11,643 pairs
EC Birds Directive: –
NW-Europe: 1%
Coverage: B

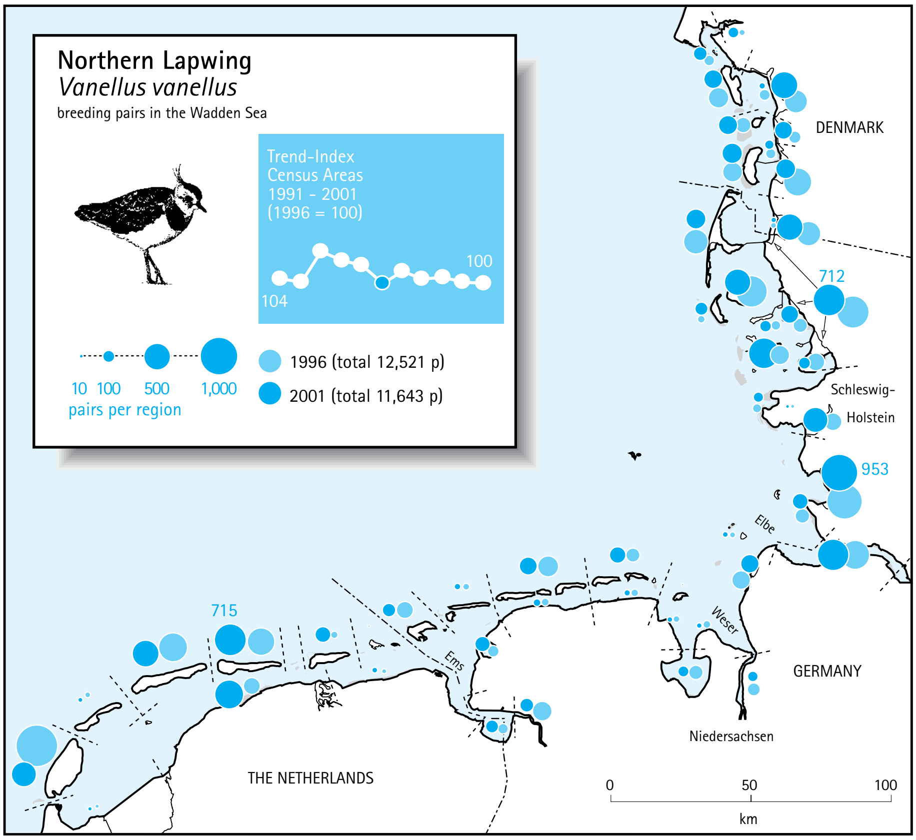


Figure 36: Breeding distribution of Northern Lapwing in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Northern Lapwing is widely distributed in the Wadden Sea. Highest numbers (38% of the population in 2001) were found in Schleswig-Holstein. Contrary to most other coastal waders, the species prefers short vegetation as breeding habitat and tolerates quite intensive agricultural practices (Beintema *et al.* 1995). Highest densities usually inhabit coastal grasslands and arable fields behind the seawall, e.g. in polders in Denmark and on the Dutch Wadden Sea islands. Data from census areas in 2001 point at densities of 34,9 pairs/100 ha in coastal grasslands (Figure 37). In Schleswig-Holstein, nearly 50% of the population in the 1990s concentrated in coastal wetlands (Hälterlein, 1998). Densities found here represent the highest in that region (Berndt *et al.*, 2002). Overall, lower densities are found at salt marshes (see also Figure 37). Occurrence here is often linked to some agricultural use like livestock grazing or hay-making, which both provide short swards (Thyen, 2000; Hälterlein *et al.* 2003; Oltmanns, 2003). Tall vegetation, established after e.g. longer abandonment of livestock-grazing is generally avoided.

Population and Trends

The population figures for 1996 and 2001 refer to a nearly complete census and possibly represent a rather accurate population size for the Wadden Sea as a whole (in 1991, the population was under-estimated due to incomplete coverage in Denmark, see chapter 2.4.1). Trends from census areas indicate a significant decline since 1991.

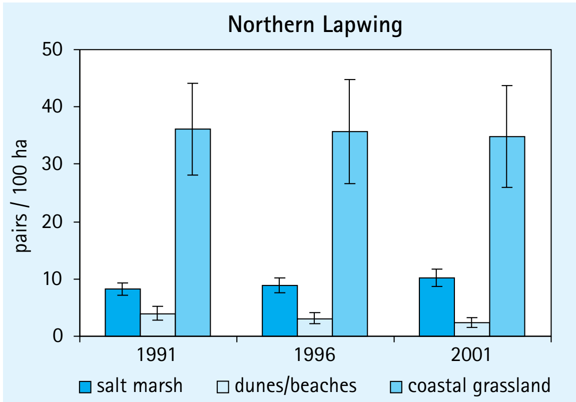


Figure 37: Densities (pairs/100 ha, ±SE) of Northern Lapwing according to habitats in the Wadden Sea in 1991, 1996 and 2001. Data derived from census areas > 15 ha.

This downward trend is dominated by the situation in the Netherlands, where the population declined annually by 3% from 1991 onwards. In Denmark and Niedersachsen, no significant trends could be detected, whereas in Schleswig-Holstein the population remained stable over the years. Since 1996, the overall trend has stabilized (though not significantly).

Assessment

Although Northern Lapwing can cope with a higher agricultural use of fields than other species, it has experienced declines in many regions in the past decade (*e.g.* Beintema and Müskens, 1987; Nehls, 1996; Rasmussen, 1999; Melter, 2004; van Dijk *et al.*, 2005). With ongoing increase of agricultural pressure, clutches often fail and survival of chicks is low. It is not entirely clear which factors caused the decline in the Wadden Sea. Previous statements that the Wadden Sea could be a refuge for coastal waders which suffer losses in the agricultural areas in the interior of the Wadden Sea countries (see Rasmussen *et al.*, 2000) are not supported by the trends observed in the 1990s, even if populations in some parts of the Wadden Sea (in Germany and Denmark) perform better than those in inland breeding areas. The fact that especially Dutch populations seem to be affected might be related to the high numbers breeding in inland polders. Here, birds are to some extent exposed to similar increases in intensity of agricultural practice (especially earlier mowing) as in farmland on the mainland. Moreover, lower intensity or abandonment of livestock grazing in many Dutch mainland salt marshes since the 1990s might have led to reduction of breeding sites. Further analysis of data from the census areas in combination with vegetation data from these sites could yield background information to test this hypothesis.

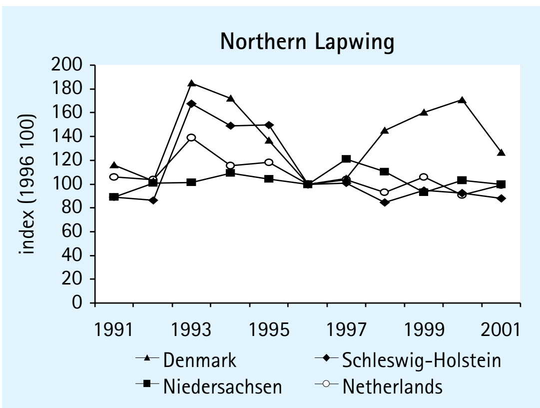


Figure 38: Trends in Northern Lapwing 1991-2001, retrieved from annual counts in census areas.

4.12 Dunlin

Calidris alpina schinzii

NL: Bonte Strandloper D: Alpenstrandläufer DK: Almindelig Ryle

Status 1991: 51 pairs
Status 1996: 39 pairs
Status 2001: 25 pairs
EC Birds Directive: Annex I
NW-Europe: 2%
Coverage: B

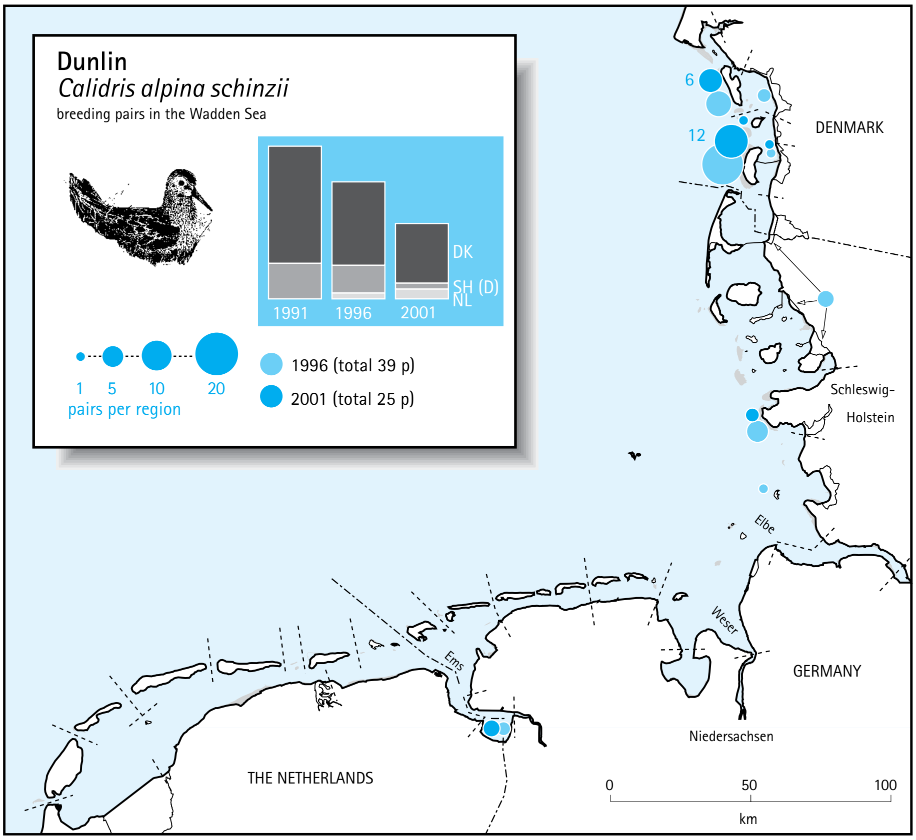


Figure 39: Breeding distribution of Dunlin in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Dunlin breeding in the Wadden Sea represent the southernmost population of the subspecies *schinzii* of the Baltic breeding range. The preferred breeding habitat is upper salt marsh on sandy soils. Breeding sites are often characterised by mosaic-like patterns of tall and short vegetation, small ponds and a moderate grazing regime. Since the species reaches its southern distribution limit in the Wadden Sea, a large proportion (80%) of the small population is concentrated in the northern Wadden Sea in Denmark, mainly Rømø. Elsewhere, breeding meanwhile has become scattered. In 2001 outside Denmark only two other breeding sites were occupied: at St. Peter on the Eiderstedt Peninsula in Schleswig-Holstein and in the Dollard area in the Netherlands. Both are traditional breeding sites, but St. Peter has undergone a sharp decline in the past decade, whereas Dollard has always been a more irregular breeding site. Incidental breeding between 1997-2001 was observed at Griend NL (1998), Terschelling NL (1999, 2 pairs), Trischen SH (1997-99, 1-2), Katinger Watt SH (1998-99, 2), Hauke-Haien Koog (1999), Ribe-Darum salt marshes DK (1998-99) and Ho Bugt DK (1997). This shows that the species might settle in various areas.

Population and Trends

With a population of only 25 pairs, Dunlin is among the rarest breeding birds in the Wadden

Sea and among the species with the highest rate of decline. Despite the lack of good annual census data in 1991-2001, and perhaps a small under-estimate due to the secretive behaviour of breeding birds, figures derived from the total counts between 1991 and 2001 clearly show an ongoing decline and reduction of the breeding range towards its stronghold in Denmark. Compared to the nine breeding sites used in the Wadden Sea 1996, only six were left in 2001. This development coincides with an overall decline in the *schinzii* populations in the Baltic, which is isolated from much larger populations on the British Isles and Iceland (Thorup 2004c; 2006). After 1996, numbers in the core breeding areas tend to be stable. Between 1997-2001, numbers at Rømø ranged from 15-21 (average 17 pairs); Fanø 4-6 (average 6). In 2002-2004, Dunlin no longer bred annually at Fanø, while there were still 12-16 pairs at Rømø (Thorup 2004a). Around St. Peter, the only stronghold in Schleswig-Holstein, the population amounted to 2-5 pairs (average 3). In the 1960s, this site still supported 80 pairs (Hälterlein, 1998).

Assessment

The current population is a relict from a much larger population in former centuries (see Rasmussen et al., 2000 for review and Thorup, 2003 for details in Denmark). Since the total population of the Baltic Dunlin is now very small and is declining everywhere (Thorup 2004c; 2006) and the species is concentrated at only a few breeding sites in the Wadden Sea, Dunlin has become extremely vulnerable. Although breeding numbers currently tend to be fairly stable, suitable management of the remaining breeding sites will be essential to conserve the species as a breeding bird for the Wadden Sea. In Denmark, a management status report (Thorup, 2003) and a national action plan (Asbirk and Pitter, 2005) has been elaborated covering Dunlin, Ruff and Black-tailed Godwit. Favourable management measures for Dunlin are high surface water table, no or moderate grazing early in the season (before 5 June stocking rate at maximum 1 young cattle/0.5 cow per hectare), grazing after 5 June with 1-2 cattle or horses, and no application of fertiliser. Additional mowing or hay-making is most favourable but must not take place before most Dunlin chicks have fledged (15 July, Thorup, 2003).

4.13 Ruff

Philomachus pugnax

NL: Kemphaan D: Kampfläufer DK: Brushane

Status 1991: 242 females
Status 1996: 82 females
Status 2001: 33 females
EC Birds Directive: Annex I
NW-Europe: < 1%
Coverage: B

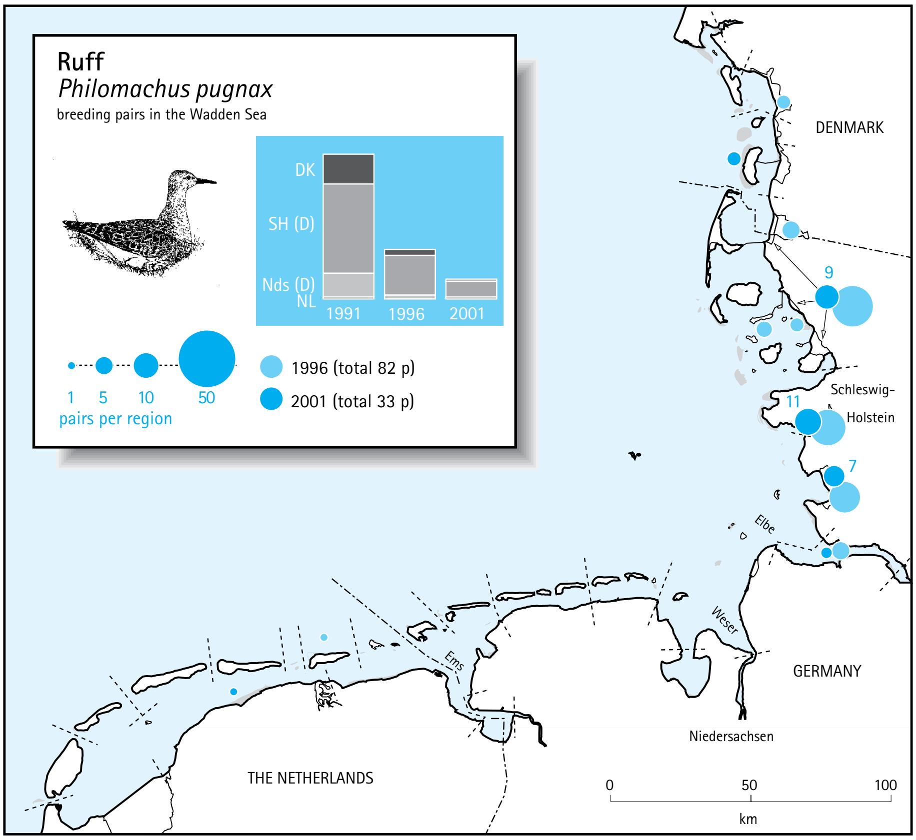


Figure 40: Breeding distribution of Ruff in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Ruff is not a typical coastal wader and the Wadden Sea holds only a very small fraction of the total population. Among meadow birds, the species has the lowest tolerance towards agricultural activities, drainage etc. (Beintema *et al.*, 1995). Hence, populations in the interior parts of the Wadden Sea countries have experienced large declines in the past century and the species has become extinct in many areas. Coastal breeding sites therefore have increased in importance. Here, Ruff prefer fairly wet fresh-brackish sites with damp, shortly vegetated grasslands. Breeding is concentrated in Schleswig-Holstein (82% of the population in 2001). The most important breeding sites are the Eider estuary near Tönning and coastal wetlands (like Rickelbüller Koog and Meldorfer Speicherkoog). Outside these areas, only a few pairs were found and breeding in more than one year was only observed along the mainland coast of Friesland NL (2-3 females), along the mainland coast in North Friesland SH (1-2), on the Halligen SH (3-4), at Rømø DK and at Mandø DK.

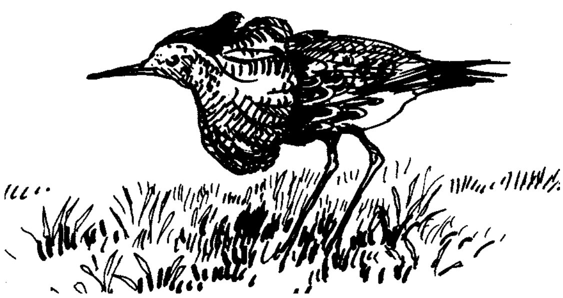
Population and Trends

Ruff numbers have severely decreased in the past decades. Compared to 1991, only 14% of the population (33 pairs) remained in 2001. In the Niedersachsen part of the Wadden Sea, the species disappeared between 1996-2001, whereas in the Danish Wadden Sea Ruff had deserted nearly all breeding sites by 2001 (but maintained itself with 2-5 females in 2002-2004; Thorup, 2004a).

In part of the Tøndermarsken area DK, which was not part of the survey area during the 1991 census, the population declined from 85 to 0 females between 1986-1997. Due to the low numbers, it is not possible to calculate trend indices. However, the data series from the total counts suggest that Ruff currently balances at the verge of extinction as a breeding bird in the Wadden Sea. In the core breeding sites in Schleswig-Holstein, the population was able to retain 1996-numbers for some years, but then sharply declined between 1999-2000 (from 64 to 25 females).

Assessment

The numbers presented above are probably subject to some under-estimate, since Ruff are notoriously difficult to count and considerable field effort should be made to assess the breeding status of the species. Nevertheless, the downward trend observed in all parts of the Wadden Sea is realistic and also coincides with ongoing declines in inland breeding areas and in the Arctic (Zöckler, 2002). The decline is mainly attributed to drainage, application of fertiliser, earlier grazing and higher stocking rates of grazers (see Rasmussen *et al.*, 2000, Thorup, 2003). Zöckler (2002) also mentions global warming as a cause for the observed declines. In the core breeding sites in Schleswig-Holstein breeding populations have been subject to succession in the embanked areas, where major part of the population has occurred after 1980 (Hälterlein, 1998). Here, peak numbers of Ruff occurred in the initial years after embankment, but generally decreased after vegetation succession proceeded. The decline and, finally, desertion of breeders in Tøndermarsken DK took place after reintroduction of surface drainage, conversion of natural grassland with wet depressions into levelled cultivated grass fields and increased grazing pressure (Thorup 2003). Habitat restoration, like a ban on drainage and retaining wet meadows, have locally proven to be successful (see Rasmussen *et al.*, 2000). Without specific measures, the population in the Wadden Sea will probably decrease further and might disappear in near future.



4.14 Common Snipe

Gallinago gallinago

NL: Watersnip D: Bekassine DK: Dobbeltbekkasin

Status 1991: 529 pairs
Status 1996: 646 pairs
Status 2001: 189 pairs
EC Birds Directive: -
NW-Europe: < 1%
Coverage: B

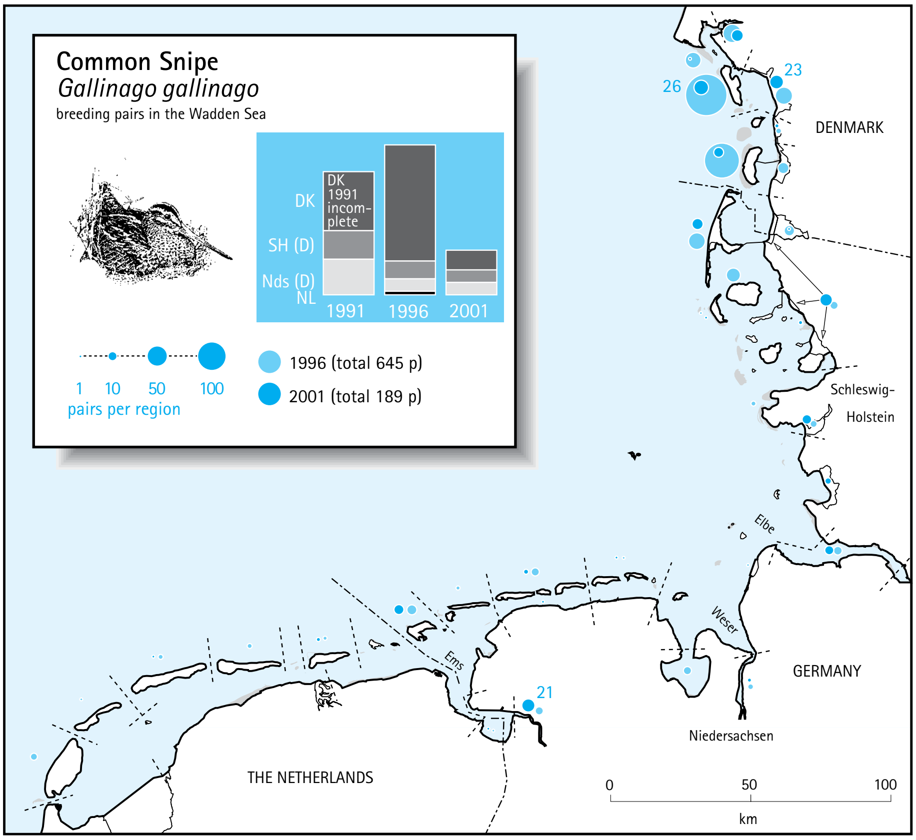


Figure 41: Breeding distribution of Common Snipe in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Common Snipe is not a typical coastal breeding bird, but coastal breeding sites have grown somewhat in importance as many inland breeding sites have been deserted in all Wadden Sea countries. On a global scale, Wadden Sea populations represent only a small proportion of the total population since large numbers occur in northern and north-eastern Europe (including Russia). Breeding numbers in the Wadden Sea also increase from west to north, with 44% of all pairs found in Denmark in 2001. The species occurs in freshwater habitats, preferably permanent (damp or wet) grassland with high coverage of tall vegetation and low or no farming intensity. Major populations inhabit coastal wetlands and permanent grassland areas behind the seawall. Besides, the species is also found in wet dune slacks, which support good numbers on the Danish islands Rømø and Fanø. Both islands represent the largest populations within Denmark (Grell, 1998).

Population and Trends

According to numbers recorded during total counts, Common Snipe has experienced a major decline in the Wadden Sea. However, proper trend analysis is hampered by gaps in coverage, most important being poor data quality from the core breeding sites in Denmark. The largest numbers of breeders are found in dune slacks and inland grassland at Fanø and Rømø. Other important breeding sites are alluvial meadows and abandoned grassland along Varde Å and Ribe Å. In the Tøndermarsken area, Ydre Koge and Margrethe Kog there has been a dramatic decline with 60 pairs in 1979, 11 pairs in 1991, two pairs in 1996 and one pair in 2001 (Gram *et al.*, 1990; Rasmussen, 2003). These data suggest an overall marked decline in the Danish Wadden Sea.

Assessment

The main causes contributing to the negative trend are loss of natural habitats (*e.g.* small wetlands) and increased farming practices, like reduction in amount of permanent grassland, drainage, intensive grazing and high fertilizer input. On Fanø DK, the species is also threatened by drainage of wet dune slacks and expansion of areas used for summer cottages.

4.15 Black-tailed Godwit

Limosa limosa

NL: Grutto D: Uferschnepfe DK: Stor Kobbersneppe

Status 1991: 2,117 pairs
Status 1996: 3,004 pairs
Status 2001: 2,824 pairs
EC Birds Directive: -
NW-Europe: 4%
Coverage: A

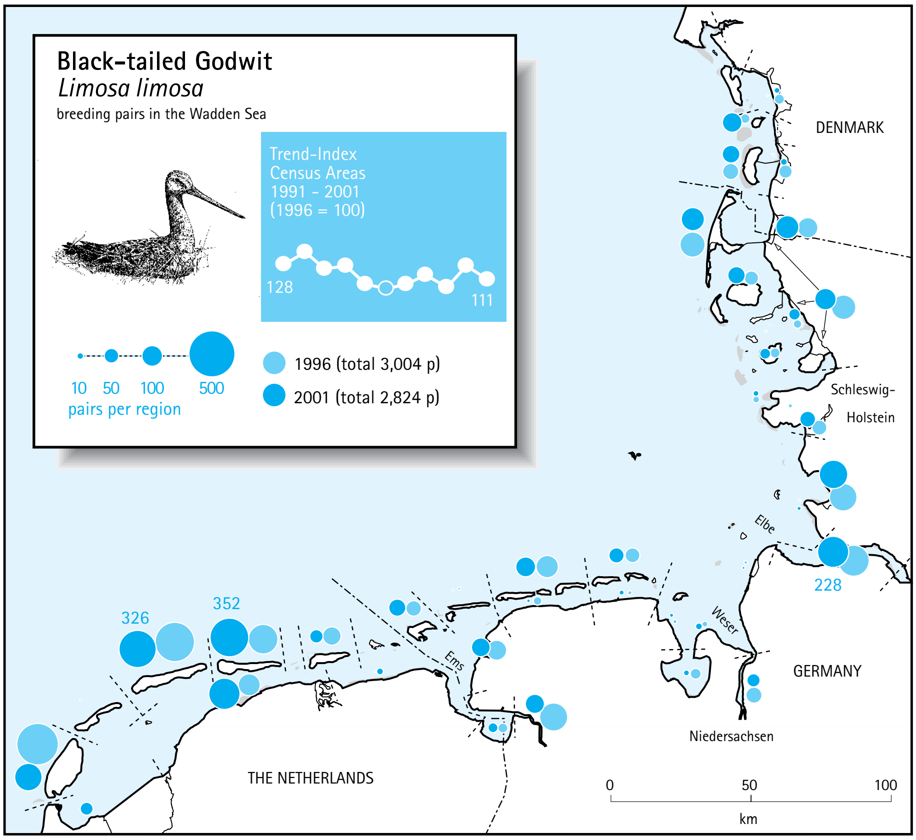


Figure 42: Breeding distribution of Black-tailed Godwit in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Black-tailed Godwit is distributed throughout the entire Wadden Sea, with declining numbers from west to north. The largest part of the population (in 2001: 42%) is situated in the Dutch Wadden Sea. Lowest numbers occur in Denmark. This distribution is in line with that found in the interior parts of the Wadden Sea countries. About 70% of the NW-European population is concentrated in the Netherlands. The species prefers damp grassland habitat, found *e.g.* on coastal grasslands behind the seawall, coastal wetlands, summer-polders and regionally (Schleswig-Holstein) also at the upper parts of the salt marshes. Since tall vegetation is generally avoided during the initial stage of the breeding cycle, the species depends on a certain level of agricultural activity and it benefits from (late) hay-cutting and light to moderate grazing regimes (Beintema *et al.*, 1995; Oltmanns, 2003). Core breeding areas are the large grassland polders on some Dutch islands, e.g. Terschelling and Ameland. Other sites with good populations are the mainland coast of Friesland NL, the Elbe estuary Nds and Meldorfer Speicherkoog SH.

Population and Trends

A comparison of populations retrieved from the three total counts is difficult due to gaps in coverage in Denmark (coastal grasslands not counted in 1991) and the Netherlands (coastal grasslands on Texel, Terschelling and Ameland only partly covered in 1991). Data from 1996 and 2001 both

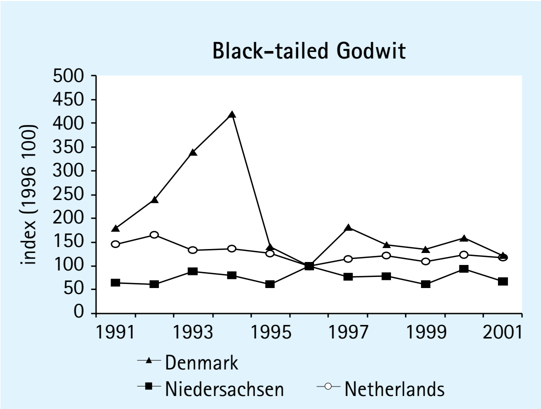
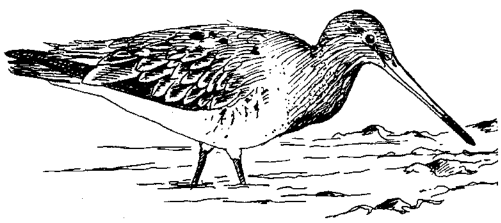


Figure 43: Trends in Black-tailed Godwit 1991-2001, retrieved from annual counts in census areas.

represent reliable counts and indicate a moderate decline from 3,000 to 2,800 pairs (- 6%). Data from the census areas implicate a slight but significant decline between 1991 and 2001 as well. Data recorded after 1996 suggest stabilisation. The pronounced pattern shown by census areas in Denmark is probably influenced by low total numbers breeding in the census areas. Overall, numbers in the Danish Wadden Sea already showed declines in the 1980s and early 1990s, e.g. a decline of 25% on Rømø and Mandø between 1991-1996 and a decrease of 60% in the Tøndermarsken between 1983 and 1996 (Rasmussen *et al.,* 2000). Between 1996 and 2001 there was a decline of 72% in mainland polders in Ballummarsken, Ribemarsken and Vilslev Enge, while a 59% increase took place in Tøndermarsken, Rømø and Mandø (Rasmussen, 2003, Thorup, 2003). For Schleswig-Holstein, numbers breeding in census areas were too small to calculate trends. Census data here suggest at least stable numbers. Several salt marsh areas were re-colonized here in the 1990s, after livestock grazing had been abandoned (Eskildsen *et al.*, 2000; Hälterlein *et al.*, 2003).

Assessment

Black-tailed Godwit does not show the pronounced downward trends observed in other coastal grassland-breeding waders like in Ruff and Common Snipe and to some extent also Northern Lapwing. In Niedersachsen, even increases were reported in some coastal areas in the 1990s, whereas trends in inland breeding areas are generally negative due to increased intensity of agricultural practice (Melter, 2004). In the Netherlands, inland populations annually decreased by 3% between 1990-2003 (even larger declines before 1990; Teunissen, 2005). In Denmark, the total population peaked around 1980 and has declined by 24% since then (Thorup, 2004c). Compared to these downward trends, the (relatively small) breeding populations in the Wadden Sea seem to perform rather well. Assessment of reproductive output is recommended to review the role of the Wadden Sea as a refuge for the species.



4.16 Eurasian Curlew

Numenius arquata

NL: Wulp **D: Grosser Brachvogel** **DK: Stor Regnspove**

Status 1991:	782 pairs
Status 1996:	632 pairs
Status 2001:	640 pair
EC Birds Directive:	–
NW-Europe:	< 1%
Coverage:	A

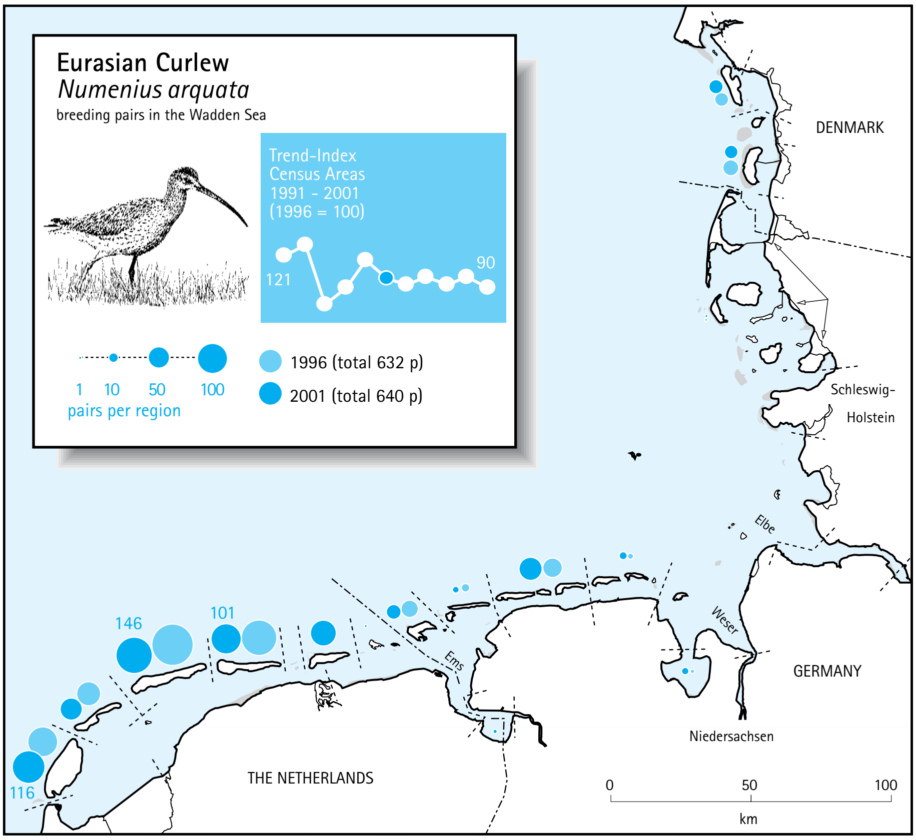


Figure 44: Breeding distribution of Eurasian Curlew in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Eurasian Curlew is a typical dune-breeding species in the Wadden Sea. Hence, 99% breeds on the islands. Highest densities occur in wet dune valleys, dune heath (including *Empetrum nigrum* vegetation). Often, nearby pastures are used for feeding. The largest numbers of Curlew are found at the Dutch islands of Texel, Terschelling and Ameland, which support more than 50% of the entire Wadden Sea population. These islands all have the preferred combination of dune heath (breeding habitat) and pastures (feeding habitat) at close range. Smaller numbers also occur on the East Frisian islands Nds. In Schleswig-Holstein, the species is nearly absent (1 pair at Amrum, recently 4 in 2004) whereas in the Danish Wadden Sea the islands of Rømø and Fanø have breeding Curlew.

Population and Trends

The result from the total count in 2001 (640 pairs) was similar to 1996 (632 pairs). Trend calculations from the census areas (which, of course, merely reflect the trend in the Dutch Wadden Sea) do not provide significant trends. Earlier data (before 1996) indicated a decline, but apparently the negative trend has levelled off recently. This is also shown by the data from the total counts, which depicted a 20% decline between 1991-1996, but stable numbers afterwards (see above). Comparing trends in the Netherlands and Niedersachsen, the small population in Niedersachsen appears to increase. This increase has been attributed to improved habitat conditions in the dunes (Rasmussen *et al.*, 2000). Furthermore, the species might benefit from less disturbance as a result of lower management activities in the dunes.

Assessment

Eurasian Curlew do not show pronounced trends. The initial declines in the first half of the 1990s have been attributed to vegetation succession and recreational pressure (Koks and Hustings, 1998). Population trends in interior parts of the Wadden Sea countries point at different developments. In Denmark, there has been a slight increase in recent decades, in particular due to the establishment of a large population on the island of Saltholm (Grell, 1998, Thorup, 2004b). In Niedersachsen, data from inland breeding sites suggest a 15% decrease in the past decade (though locally also increases; Melter, 2004), whereas in the Netherlands the population more than doubled between the 1970s and late 1990s (SOVON, 2002). However, this coincided with a habitat switch, from dunes (mainly the coastal dunes in Noord- and Zuid-Holland) and heathland areas to agricultural grassland. Here the species faces the same problems as other grassland-breeding waders. Hence, future trends might not be promising if intensification and changes in grassland management proceed.

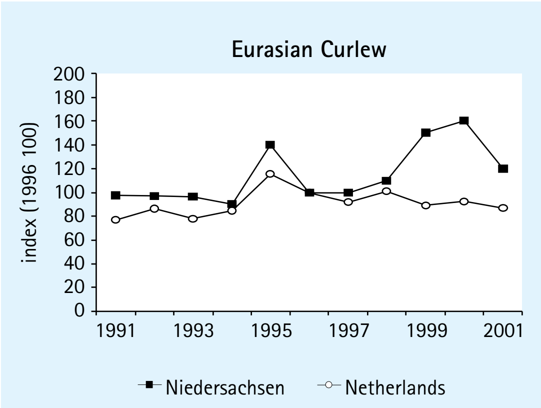
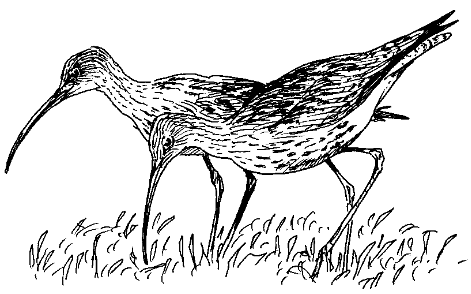


Figure 45: Trends in Eurasian Curlew 1991-2001, retrieved from annual counts in census areas.



4.17 Common Redshank

Tringa totanus

NL: Tureluur D: Rotschenkel DK: Rødben

Status 1991:	12,081 pairs
Status 1996:	16,197 pairs
Status 2001:	14,722 pairs
EC Birds Directive:	-
NW-Europe:	11%
Coverage:	B

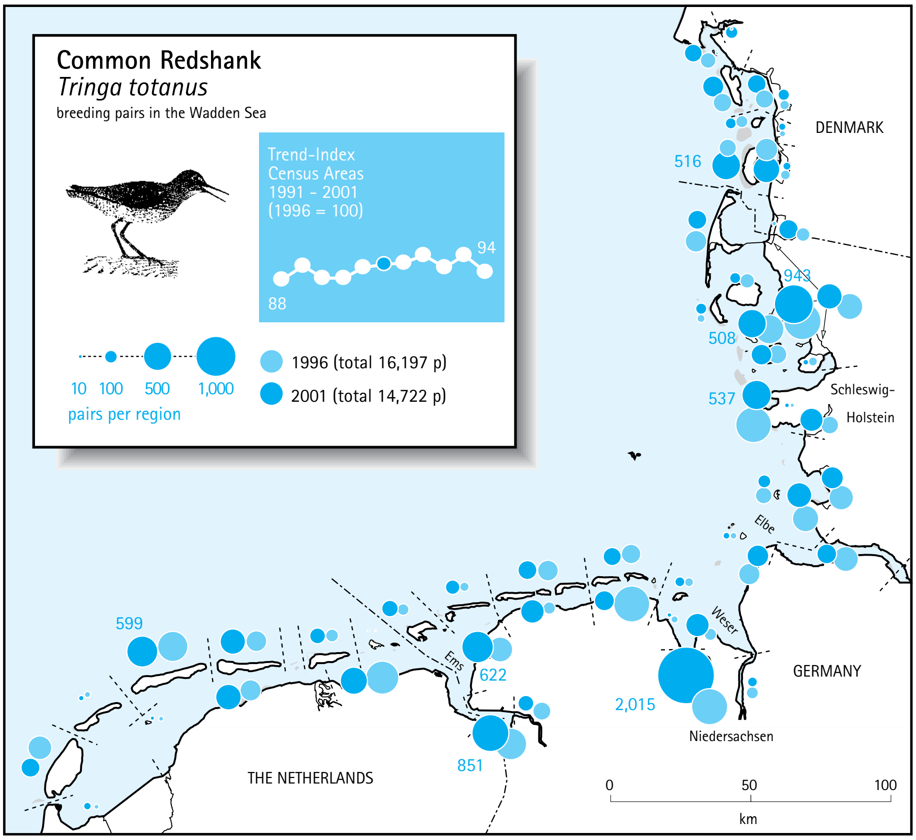


Figure 46: Breeding distribution of Common Redshank in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Common Redshank preferably breed in salt marsh areas with high vegetation (*e.g.* stands of *Elymus, Aster and Atriplex*) or a high density of tussocks (Thyen, 2000; Esselink *et al.*, 2000; Thyen and Exo, 2005: Thyen, 2005). Vegetation coverage is important since the species' nest is concealed in vegetation. High densities are often found in areas where numerous ditches, gullies or other fringes between salt marsh and mud flats exist, and thus nest sites and feeding opportunities occur at close range. Data from the census areas in 2001 indicate densities of 49,6 pairs/100 ha in salt marshes (Figure 47). Coastal grassland and especially dunes/beaches support lower densities. The distribution shows a preference for mainland sites, where 70% of the population occurred. Large numbers were especially found in sheltered bays, *e.g.* Jadebusen Nds (2,015 pairs in 2001), Leybucht Nds (622 pairs) and Dollard NL/Nds (total of 851 pairs). Mainland salt marshes in the Dutch provinces Friesland and Groningen, Ostfriesland Nds, Dithmarschen SH and Nordfriesland SH support high numbers as well. Among the islands, larger numbers of Common Redshank were found at Terschelling and Ameland NL and Rømø DK. In an international context, the Wadden Sea is a core breeding area for the species.

Population and Trends

Data provided by the total counts do not show pronounced differences in the size of the breeding population, ranging from 12,000 (1991) to 15,000

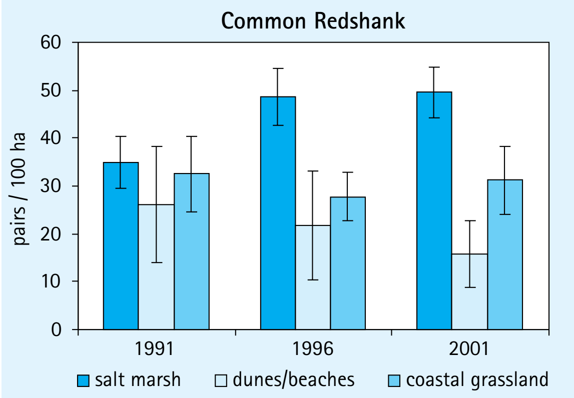


Figure 47: Densities (pairs/100 ha, ±SE) of Common Redshank according to habitat in the Wadden Sea in 1991, 1996 and 2001. Data derived from census areas > 15 ha.

pairs (2001). However, assessing population size in Common Redshank is rather difficult. Detailed studies in the Netherlands (Dallinga, 1993) and Denmark (Rasmussen and Thorup, 1996) have shown that by conventional methods of mapping territories or counting individuals, a large underestimate occurs. Therefore, actual population size could be much larger, at least for salt marsh areas with high densities. Data from the census areas, which generally have been collected according to the same standards and provide reliable trend data, support the little changes in the total numbers in 1991, 1996 and 2001 and give a stable but no significant trend. More pronounced trends were found in individual countries, for Schleswig-Holstein a slight, but significant increase (merely a relocation towards salt marsh areas) and for Niedersachsen a significant decrease by 4% annually from 1991 to 2001. Trends in Niedersachsen, however, show large variation between areas, and the downward trend observed in some census areas might not be true for the entire coast in this section of the Wadden Sea. The significant growth of the Danish numbers is affected by changes in census methods and therefore does not represent a realistic trend between 1991 and 1995 (see Rasmussen *et al.*, 2000). According to Thorup (2004a), a fluctuating and overall stable trend was recorded in the Danish Wadden Sea from 1995 to 2004. Recent data from the Dutch Wadden Sea indicate an ongoing stable trend since 2001 (van Dijk *et al.*, 2006).

Assessment

There seem to be little overall changes in the Wadden Sea. It is likely that the total population is larger than our data suggest, but the difference is difficult to judge from the available data. Rasmussen and Thorup (1998) suggested for the Danish Wadden Sea a population of 5,000 pairs in the mid 1990s, *i.e.* more than three times as high as the population retrieved by the applied census methods in the Danish Wadden Sea by that time. This difference will, however, not be representative for other parts of the Wadden Sea. Regarding the overall stable trend, it is striking that data from census areas in Niedersachsen suggest a significant decrease. Locally, some core breeding areas in this part of the Wadden Sea have reported a large increase between 1996 and 2001 (*e.g.* Jadebusen) and national trend analyses also do not support a decline (Hälterlein *et al.*, 2000; Melter, 2004).

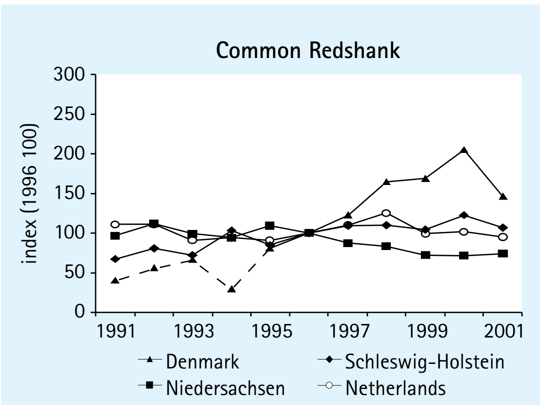
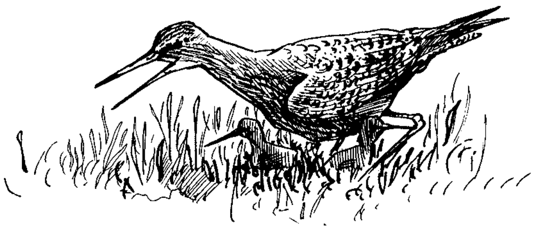


Figure 48: Trends in Common Redshank 1991-2001, retrieved from annual counts in census areas. Dashed line indicates incomplete coverage in Denmark.

The overall stable numbers are probably the result of many local developments and, perhaps, exchanges between populations from 'source' populations at the islands to 'sink' populations on the mainland coast (Thyen *et al.*, 2005; see below). In Schleswig-Holstein many sites in the mainland salt marshes experienced an upward trend in the 1990s, as livestock grazing was abandoned at numerous sites and vegetation became more suitable for breeding Redshank (Hälterlein, 1998). Many studies have confirmed the hypothesis that ungrazed salt marshes are preferred over intensively grazed salt marshes (see Norris *et al.*, 1997; Thyen and Exo, 2003). On the other hand, populations in some of the coastal wetlands in this part of the Wadden Sea declined. Downward trends have also been reported from the Dollard area in the Netherlands. Esselink *et al.* (2000) have hypothesized that a prolonged stay in spring of Barnacle Geese *Branta leucopsis* in the Dollard retards vegetation growth and therefore provides less cover for breeding Redshank in the optimal breeding period. As shown by Thyen and Exo (2005) clutches starting later in the season have lower success rates and smaller reproductive output. Furthermore, data from Thyen *et al.*, (2005) suggest that population dynamics might be a result of source-sink relations. Populations with low breeding success, *e.g.* along the mainland coast, are hypothesized to be supported by the output of highly successful breeding birds on the islands. Studies are recommended in other regions to test this hypothesis on a larger scale and get more insight into population dynamics of Common Redshank.

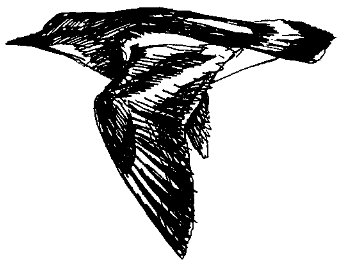


4.18 Turnstone

Arenaria interpres

NL: Steenloper D: Steinwälzer DK: Stenvender

Status 1991:	3 pairs
Status 1996:	2 pairs
Status 2001:	1 pair
EC Birds Directive:	-
NW-Europe:	< 1%
Coverage:	A/B



Turnstone reaches its southern distribution limit in the Wadden Sea. Historically, Denmark and Schleswig-Holstein supported a breeding population in the 19th century. Since 1982, breeding has occurred more or less regularly, mainly in Denmark and Schleswig-Holstein (Struwe, 1983; Berndt *et al.*, 2002). Exposed beaches and primary dunes are the preferred breeding habitat, and in Denmark breeding might be associated with colonies of Black-headed Gull (Grell, 1998). The only breeding pair of Turnstone in 2001 was found at Hamburger Hallig (mainland salt marsh SH). Here, breeding was also observed in 2000. Regular breeding in 1997-2001 was also observed on Trischen SH (1997-99, 1 pair) and on the Hallig-Islands Südfall and Langeness (1997-2000, 0-3). In addition, there is one record of two pairs from Mandø DK in 1998. Breeding Turnstone are difficult to count since large numbers of migratory birds are present until late spring and non-breeders can be observed over the whole summer. Hence, perhaps a few more breeding pairs occur in the area. In the Dutch Wadden Sea, a breeding attempt was reported in 1995 (Koks, 1998a). This is the only attempt in the western Wadden Sea recorded so far.

4.19 Mediterranean Gull

Larus melanocephalus

NL: Zwartkopmeeuw D: Schwarzkopfmöwe DK: Sorthovedet Måge

Status 1991: 2 pairs
Status 1996: 5 pairs
Status 2001: 9 pairs
EC Birds Directive: Annex I
NW-Europe: < 1%
Coverage: B

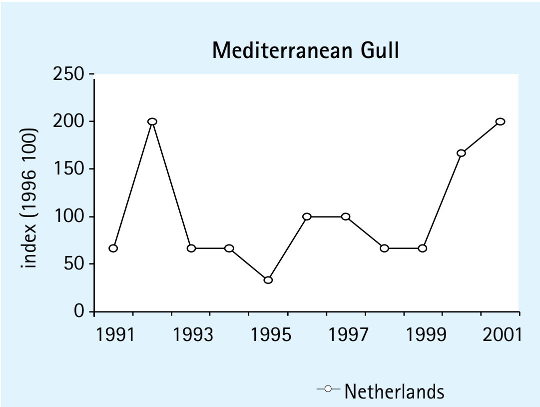
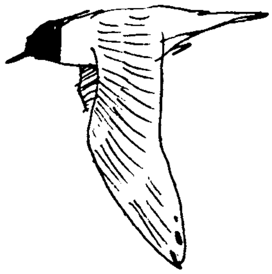


Figure 49: Trends in Mediterranean Gull 1991-2001, retrieved from annual total counts.



Distribution and Habitat

The total population of 190,000-370,000 pairs of Mediterranean Gull is mainly located in the Black Sea area (Meininger and Flamant, 1998). Despite a continuous expansion of its breeding range in NW-Europe since the 1950s, the species is still a rare breeding bird in the Wadden Sea. Often, pairs are found in mixed colonies with Black-headed Gull (salt marshes) or Common Gull (dunes).

Population and Trends

Even if the species is still rare, Mediterranean Gull has established a small breeding population in the Wadden Sea. Between 1991-2001, the number of breeding pairs went up from two to nine to ten. In 1991, breeding was confined to the Dutch Wadden Sea (after successful colonization in 1986). In line with the northward expansion, Niedersachsen was colonized in 1994 (Elbe, five pairs), followed by Schleswig-Holstein (Trischen, one pair) and Denmark (Sneum klæggrav, one pair) in 1996. Recently, the population in the Wadden Sea further increased to 16 pairs in 2004 (Koffijberg *et al.*, 2005b).

Assessment

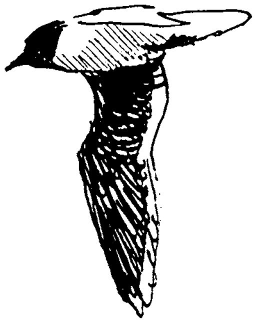
Compared to the fast expanding colonies in e.g. the Dutch Delta area and NW-Belgium (Meininger and Flamant, 1998) and also a growing colony on a small island in the Elbe near Stade, just outside the Wadden Sea (Boschert, 2002, 2005), the growth rate of the Wadden Sea population is rather small. Often, clutches fail, perhaps since some of the breeding birds represent inexperienced subadults (observations by the authors). Moreover, suitable feeding areas might be a limitation in many regions in the Wadden Sea. Core breeding sites, like those in the Dutch Delta area, are usually characterised by a combination of suitable breeding sites and large grassland areas for feeding. Many potential breeding sites in the Wadden Sea are surrounded by arable fields.

4.20 Little Gull

Larus minutus

NL: Dwergmeeuw D: Zwergmöwe DK: Dværgmåge

Status 1991: 2 pairs
Status 1996: 2 pairs
Status 2001: 0 pairs
EC Birds Directive: Annex I
NW-Europe: < 1%
Coverage: A



The Wadden Sea represents the western fringe of the breeding range for Little Gull, whose population of 22,000-34,000 pairs is mainly found in north-eastern Europe. In the Dutch Wadden Sea, a regular colony occupied the Lauwersmeer area between 1973 and 1988 (Veen, 1980; Koks, 1998b). Furthermore, the species regularly bred in coastal wetlands in Schleswig-Holstein and Denmark in the 1980s (see Rasmussen *et al.*, 2000). Although Little Gull migrates through the Wadden Sea and occasional displaying birds also have been observed, only incidental breeding has been recorded in 1991-2001 (in 9 out of 11 years). These mainly include scattered breeding pairs on sparsely vegetated sites on the salt marshes along the mainland coast of Friesland (Paesumerlânnen, 0-2 pairs) and Groningen (Westpolder, 0-3 pairs) NL. Both areas are situated close to the former colonies in the Lauwersmeer area. In 1992, a single pair was recorded in Rickelsbüller Koog SH. During the 2001 survey (and also after 2001) no breeding pairs were found. Since the Wadden Sea is located at the limit of the species breeding range and a range expansion is currently not observed, it will possibly remain an incidental breeding bird in future years.

4.21 Black-headed Gull

Larus ridibundus

NL: Kokmeeuw D: Lachmöwe DK: Hættemåge

Status 1991: 128,317 pairs
Status 1996: 133,313 pairs
Status 2001: 155,355 pairs
EC Birds Directive: –
NW-Europe: 16%
Coverage: A

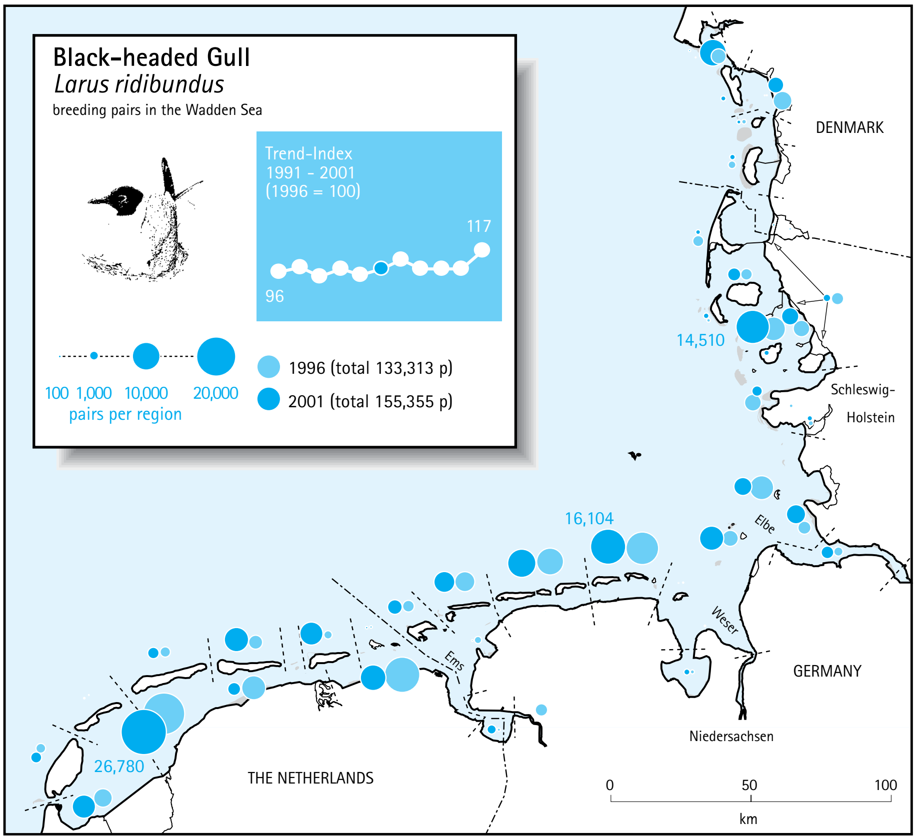


Figure 50: Breeding distribution of Black-headed Gull in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Black-headed Gull represents the most abundant breeding bird in the Wadden Sea and about 16% of the NW-European population is found in the area. The largest breeding sites are located in the western Wadden Sea, e.g. Griend NL (2001: 26,780 pairs), Norderney, Baltrum and Langeoog Nds (10,398) and Spiekeroog/Wangerooge/Minsener Oog Nds (16,104 pairs). Overall, the Dutch and Niedersachsen part of the Wadden Sea support 68% of the population. In Schleswig-Holstein, a large proportion of the population (49%) is found at the Halligen. The Danish Wadden Sea supports less than 10% of the Wadden Sea population, with the main breeding colonies situated at Langli. Many colonies are established in salt marshes. In addition, many coastal wetlands are occupied. In 2001, 77% of the population was breeding on islands. In the past decade, the number of island-breeding Black-headed Gulls has increased significantly (see below).

Population and Trends

Annual counts of Black-headed Gull have not revealed any significant trend for the Wadden Sea as a whole. Between 1991 and 2001, the population fluctuated around an average of 134,000 pairs and many individual colonies confirm this trend. Due to incomplete coverage, in the period1991-1995 numbers have probably been under-estimated, especially in Denmark (see Rasmussen *et al.*, 2000). The population in 2001 is the highest recorded so far and confirms a tendency for increasing numbers after 1996. Despite the fluctuating populations, trends differ

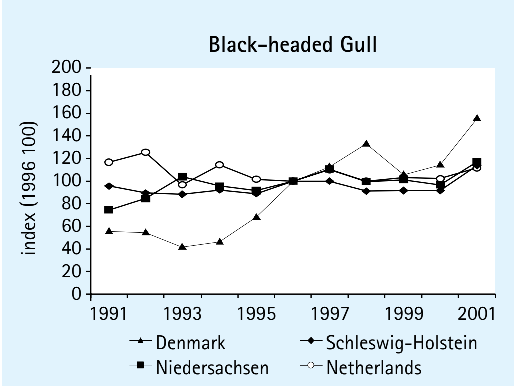


Figure 51: Trends in Black-headed Gull 1991-2001, retrieved from annual total counts.

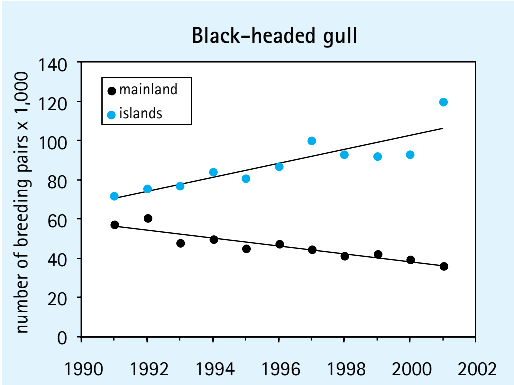
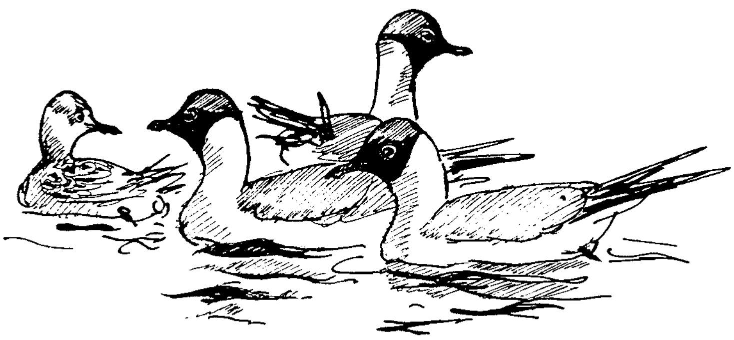


Figure 52: Trends in Black-headed Gull on island-breeding sites and mainland-breeding sites. Both regression lines are significant (mainland R^2 0.857, $P < 0.001$; islands R^2 0.763, $P < 0.001$).

considerably between countries, with significant increases in Niedersachsen and Schleswig-Holstein and a significant decline in the Netherlands. Here, major losses have been reported on the mainland salt marshes in Friesland and Groningen, where the population decreased from 25,000 pairs in 2001 to 12,000 in 2001 (-52%). This trend has continued after 2001 (van Dijk *et al.*, 2005) and meanwhile many salt marshes have been abandoned by Black-headed Gull. Hence, trends for mainland and island colonies are much different (Figure 52) and a clear switch from the mainland to the islands is observed, especially in the Netherlands and Niedersachsen. Large increases on islands also have been observed at the Halligen SH (the population nearly doubled between 1991 and 2001) and Langli DK (from 56 to 9300 pairs in 10 years; but recently declining; Thorup, 2005). On the other hand, the colony at Trischen SH went down after peak numbers in the mid-1990s. Since numbers along the nearby mainland salt marshes in Dithmarschen increased, probably a reverse switch from the island to the mainland coast occurred.

Assessment

Apart from the Dutch Wadden Sea, Black-headed Gull numbers in the Wadden Sea are doing rather well when compared to the declines reported in many north-eastern European countries, the majority of inland colonies and *e.g.* the Baltic coast (Hagemeijer and Blair, 1997; van Dijk, 1998; Garthe *et al.*, 2000; Bellebaum, 2002). Often, reproduction is much better in coastal colonies, suggesting that food availability in marine habitats is superior to that in inland areas (Stienen *et al.,* 1998; Thyen *et al.,* 1998). The hypothesis of Engelmoer (2001), attributing the decline along the mainland coast of Friesland NL to deteriorating mudshrimp *Corophium volutator* stocks, contradicts these findings, but would deserve further study. Thyen *et al.* (1998, 2000) showed that predation by red foxes *Vulpes vulpes* was an important factor contributing to poor breeding results of Black-headed Gull. Koopman (2003) and Oltmanns (2003) have drawn similar conclusions from their work on the mainland coast of Friesland NL and in the Leybucht Nds, respectively. At many other mainland sites, predation is likely to have caused the declines observed, but specific research on this aspect is still lacking. Often, colonies in mainland salt marshes do settle by the start of the breeding season, but nests are deserted in short time and colonies often displace between the field surveys. As already stated by Rasmussen et al. (2000) red foxes have increased in nearly the entire Wadden Sea region. The high risk of predation on mainland breeding sites also explains the switch to island breeding sites, which suffer much less predation since larger mammalian predators do not occur here. However, it is questionable whether Black-headed Gull numbers will remain stable when breeding is more concentrated at fewer sites.



4.22 Common Gull

Larus canus

NL: Stormmeeuw D: Sturmmöwe DK: Stormmåge

Status 1991: 6,671 pairs
Status 1996: 10,481 pairs
Status 2001: 13,837 pairs
EC Birds Directive: –
NW-Europe: 3%
Coverage: A

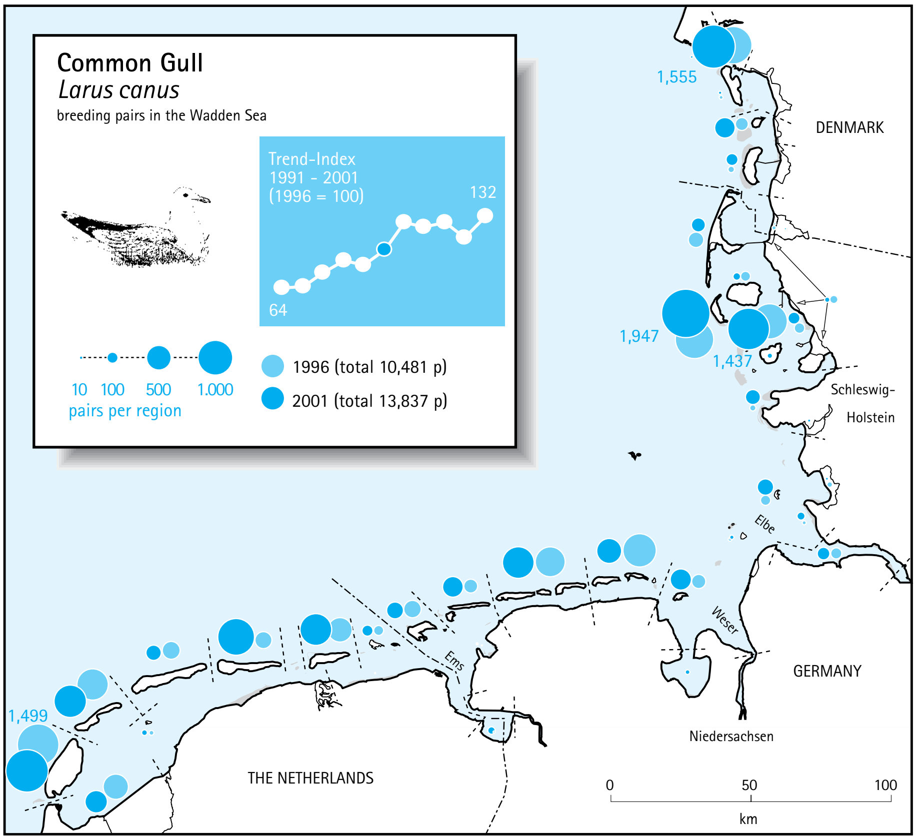


Figure 53: Breeding distribution of Common Gull in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Only a small proportion of the NW-European population of Common Gull breeds in the Wadden Sea. The species is rather evenly distributed in the area, but predominantly breeds on the islands (2001: 93% of the population). Along the mainland coast often only incidental breeders are found, occasionally also larger colonies (Balgzand NL). Like in 1996, only a few areas account for a large proportion (54%) of the Wadden Sea population. These are Texel NL, Ameland NL, Halligen SH, Amrum SH and Langli DK. Apart from Ameland, these areas have been core breeding sites for the entire 1991-2001 period. Ameland experienced a threefold increase between 2000 and 2001 (from 339 to 1,119 pairs). Common Gull colonies are mostly located in dunes.

Population and Trends

Common Gull experienced a significant increase throughout the Wadden Sea during the period from 1991 to 2001, even if individual colonies often show fluctuating numbers and areas with large colonies seem to become saturated. The largest increase rates occurred in the early 1990s and were most pronounced in Niedersachsen, Schleswig-Holstein and Denmark. The Dutch colonies, which supported 46% of the population in 1991, showed lower growth rates (in 2001 they accounted for 36% of the total population).

In 2001, 13,800 pairs were counted in the Wadden Sea, twice as many as in 1991. Data from 1997-2001 suggest a tendency to stabilize. In Niedersachsen, numbers temporarily went down after 1999, especially in the colonies of the East Frisian islands between Norderney and Minsener Oog. Data from the Netherlands after 2001 suggest a stable trend (van Dijk *et al.*, 2006).

Assessment

The increase of Common Gull is part of a long term trend of growing numbers in the Wadden Sea countries. For Schleswig-Holstein, it has been hypothesised that the increase might be partly a result of displacements from the Baltic coast (Kubetzki, 1987; Garthe *et al.*, 2000). In the Netherlands, the Wadden Sea colonies might have received disturbed birds from the large colonies along the North Sea coast in Noord- and Zuid-Holland, which were raided by red foxes in the late 1980s and 1990s (Keijl and Arts, 1998). Data from the Netherlands suggest that, recently, reproduction has been poor in some colonies.

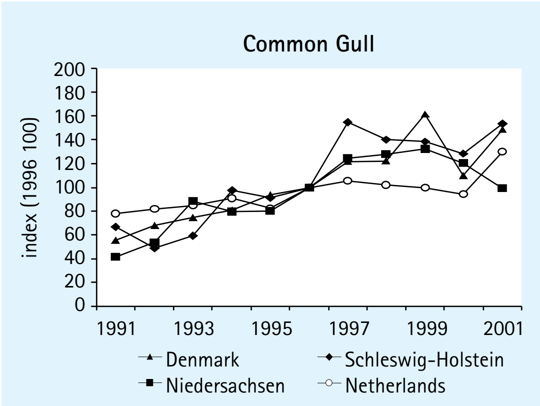
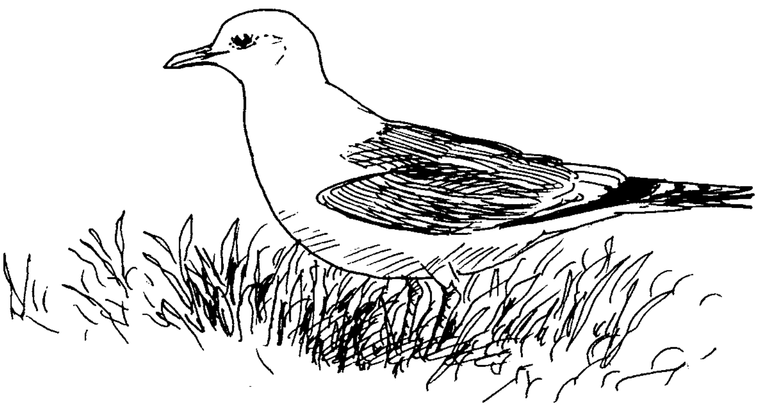


Figure 54: Trends in Common Gull 1991-2001, retrieved from annual total counts.



4.23 Lesser Black-backed Gull

Larus fuscus

NL: Kleine Mantelmeeuw D: Heringsmöwe DK: Sildemåge

Status 1991: 18,016 pairs
Status 1996: 38,252 pairs
Status 2001: 80,372 pairs
EC Birds Directive: –
NW-Europe: 26%
Coverage: A

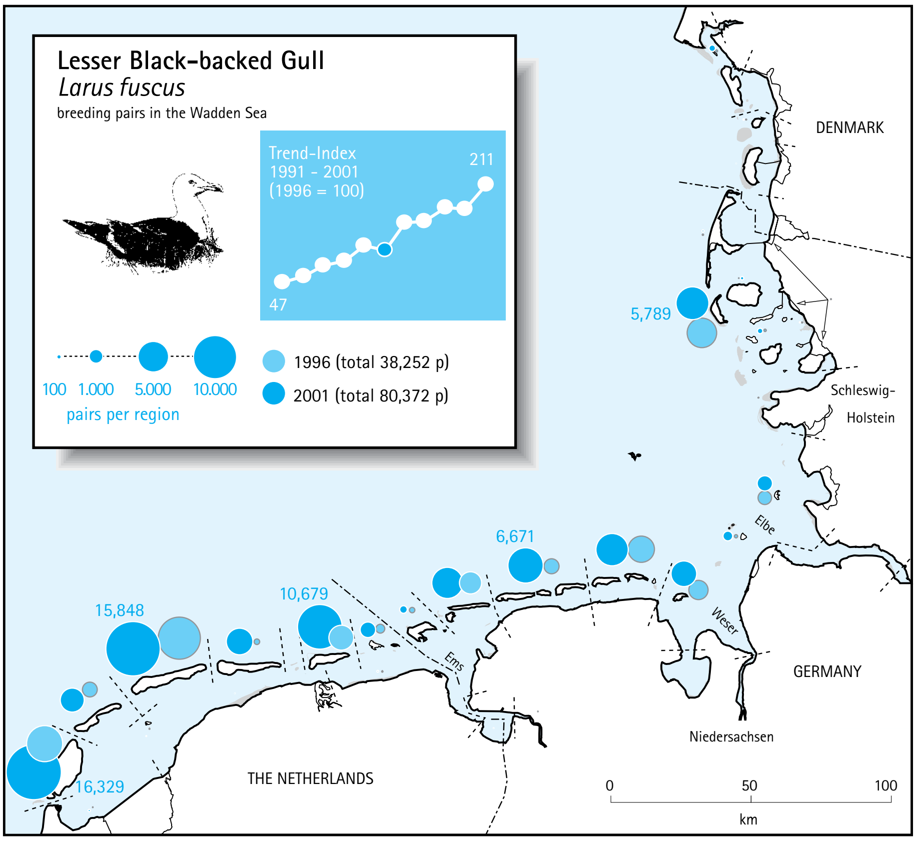


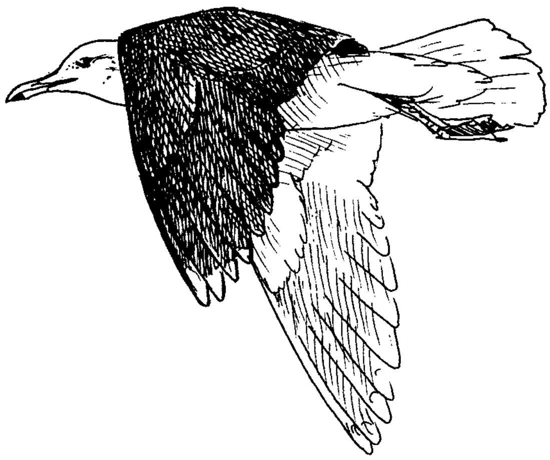
Figure 55: Breeding distribution of Lesser Black-backed Gull in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Within NW-Europe, the Wadden Sea is an important breeding area for Lesser Black-backed Gull, with slightly more than 25% of the total population breeding in the area. Numbers in the Wadden Sea decline from west to east. The Dutch part accounts for 64% of the population; the Danish section for less than 1%. Similar to the survey in 1996, the largest breeding sites in 2001 were Texel NL (16,329 pairs) and Terschelling NL (15,845 pairs). In addition, Schiermonnikoog now also held >10,000 pairs. Large colonies were also found on the East Frisian islands in Niedersachsen, which were probably supported by the growing population in the Dutch Wadden Sea (Garthe *et al.*, 2000). In the northern Wadden Sea the only important settlement is Amrum (2001: 5,789 pairs). In Denmark, nearly all Lesser Black-backed Gull were found at Langli, where it started to breed in 1990. The species mainly breeds in dunes, often in mixed colonies with Herring Gull, and therefore hardly occurs along the mainland coast. Sometimes small numbers also inhabit higher salt marshes and anthrophogenic habitats (*e.g.* islands or industrial estates).

Population and Trends

Lesser Black-backed Gull experienced spectacular growth in the Wadden Sea. Between 1991 and 2001, the population size retrieved from annual counts increased nearly fivefold to more than 80,000 pairs in 2001. The highest increase rates were recorded in Niedersachsen (27% annually



between 1991 and 2001) and in the small Danish population (53% annual increase, mainly Langli). The upward trend was reported from nearly all colonies, although especially in 2001 declines were observed in the larger colonies on the islands in Niedersachsen and on Trischen and Amrum SH. Data from 2001-2004 from the large colonies in the Dutch Wadden Sea suggest that population growth has levelled off, and several colonies have become saturated (van Dijk *et al.*, 2006).

Assessment

The increase of Lesser Black-backed Gull is in line with upward trends recorded in large parts of Europe (BirdLife International, 2004). As already stated in the previous report by Rasmussen et al. (2000), the growing numbers are mainly the result of improved food stocks (especially discards) and, perhaps, also improved feeding conditions in the wintering areas. Recently, numbers in the largest colonies seem to stabilize, or even decline, and reproduction has been poor due to food shortage (Buckacinski *et al.*, 1998; Spaans 1998a). This coincides with growing numbers of Lesser Black-backed Gull feeding on pastures in coastal areas in the Wadden Sea, which was first observed in the Netherlands and Niedersachsen (*i.e.* where the greatest numbers breed) and was recently also seen in Schleswig-Holstein and Denmark (observations by the authors). From 2005 onwards, research on feeding ecology of Herring Gull and Lesser Black-backed Gull will be carried out in the Dutch Wadden Sea colonies (Camphuysen *et al.*, in press).

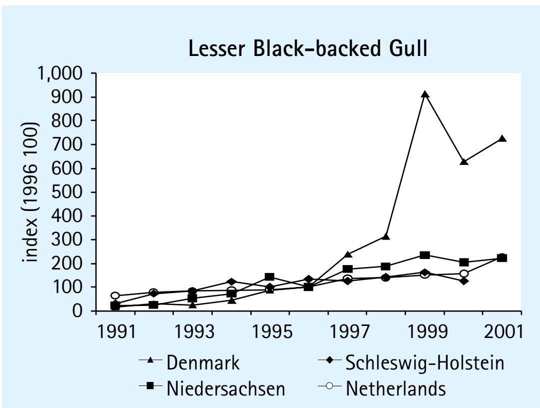


Figure 56: Trends in Lesser Black-backed Gull 1991-2001, retrieved from annual total counts.

4.24 Herring Gull

Larus argentatus

NL: Zilvermeeuw D: Silbermöwe DK: Slovmåge

Status 1991: 89,522 pairs
Status 1996: 74,551 pairs
Status 2001: 78,722 pairs
EC Birds Directive: -
NW-Europe: 11%
Coverage: A

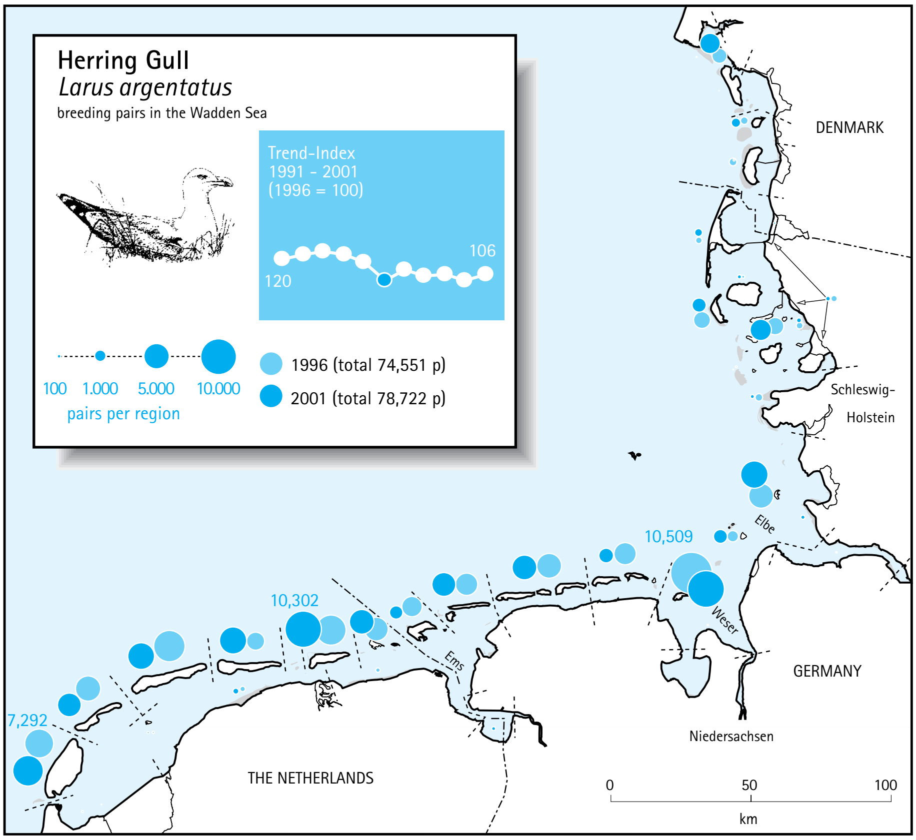


Figure 57: Breeding distribution of Herring Gull in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

The Wadden Sea supports about 11% of the NW-European population of Herring Gull. Its core breeding range within the Wadden Sea is located in the Netherlands and Niedersachsen, with 49% and 31% of the population, respectively (2001). In the northern Wadden Sea Herring Gull numbers are much lower. The species predominantly breeds in dunes or higher salt marshes (like Halligen SH). Nearly all birds (99%) are found on the islands. As in previous surveys, the largest colonies were on Mellum Nds and Schiermonnikoog NL. In Schleswig-Holstein the highest numbers breed on Trischen and the Halligen, whereas in Denmark the most important colonies are found at Langli.

Population and Trends

Annual counts of all Herring Gull colonies have shown a significant decline since 1991, which seems to have levelled off after 1996. However, this negative trend is confined to the core breeding sites in the Netherlands and Lower Saxony, where Herring Gull numbers peaked in the 1980s (Spaans, 1998b), but annual declines of 3-4% have been recorded in the 1990s. Smaller populations in Schleswig-Holstein and Denmark went up during the same period with a similar rate. The overall trend, however, does not account for large differences between individual colonies. These often show varying trends, even when at close range within the same region. Sharp declines from 1991 to 2001 were *e.g.* reported from Vlieland NL, Terschelling NL, Juist and Memmert Nds, whereas other colonies in these regions, like Schiermonnikoog NL and Neuwerk-Scharhörn HH/Nds experienced growing numbers and many other colonies remained stable. Compared to 1991, the total Wadden Sea population declined by 13%, to 78,700 pairs in 2001. Data from the Netherlands in 2002-2004 suggest a stabilization of the declines reported previously (van Dijk *et al.*, 2006).

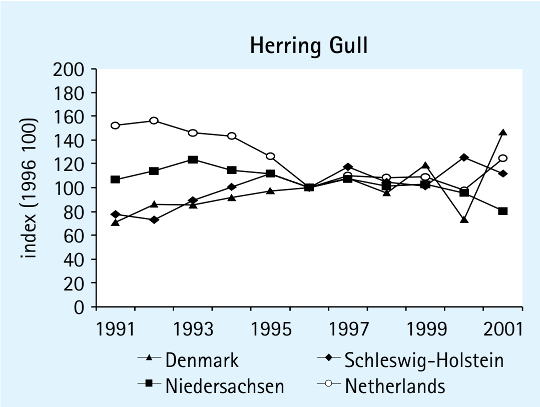
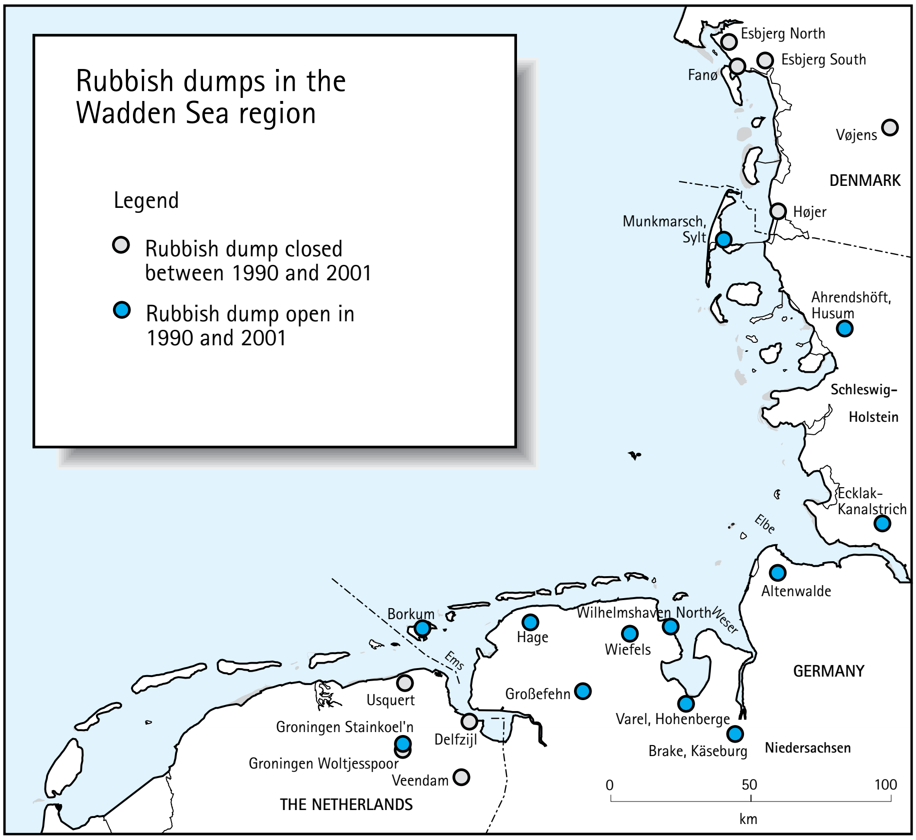


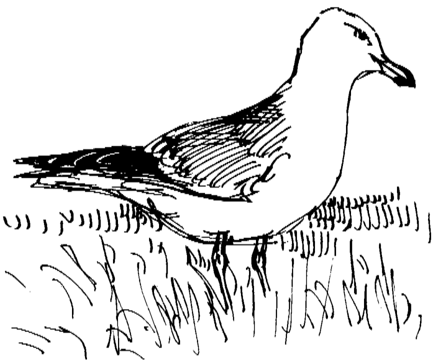
Figure 58: Trends in Herring Gull 1991-2001, retrieved from annual total counts.

Assessment

Trends retrieved from the annual total counts indicate a maximum level of breeding pairs in the Wadden Sea in the early 1990s. This peak can be regarded as the final stage of a population recovery from human persecution and contamination with organochlorides in the 1950s and 1960s (Hälterlein, 1998; Spaans, 1998b). Several causes have been put forward to explain the current decline in Herring Gull, which is mainly a result of poor reproduction rates (Koks and Hustings, 1998; Spaans, 1998b). Often, competition with the increasing numbers of Lesser Black-backed Gull has been put forward as an important constraint to Herring Gulls *(e.g.* Noordhuis and Spaans, 1992), although not in all colonies (Garthe *et al.*, 2000). Furthermore, decreased fishery effort in coastal waters might have reduced food availability (Camphuysen, 1995), whereas the disappearance of blue mussel beds in the Dutch Wadden Sea might have affected numbers in the Netherlands negatively in the 1990s (Leopold *et al.*, 2004; see also Common Eider and Oystercatcher). Furthermore, artificial food resources like rubbish dumps (also important to some of the breeding colonies) have become increasingly rare, since many rubbish dumps near the Wadden Sea were closed in the 1990s (Figure 59).

Figure 59: Availability of rubbish dumps near the Wadden Sea around 1990 and 2000. All rubbish dumps in Niedersachsen and Schleswig-Holstein were closed in 2005 (data mainly from local country councils).





4.25 Great Black-backed Gull

Larus marinus

NL: Grote Mantelmeeuw D: Mantelmöwe DK: Svartbag

Status 1991: 6 pairs
Status 1996: 15 pairs
Status 2001: 27 pairs
EC Birds Directive: -
NW-Europe: < 1%
Coverage: A

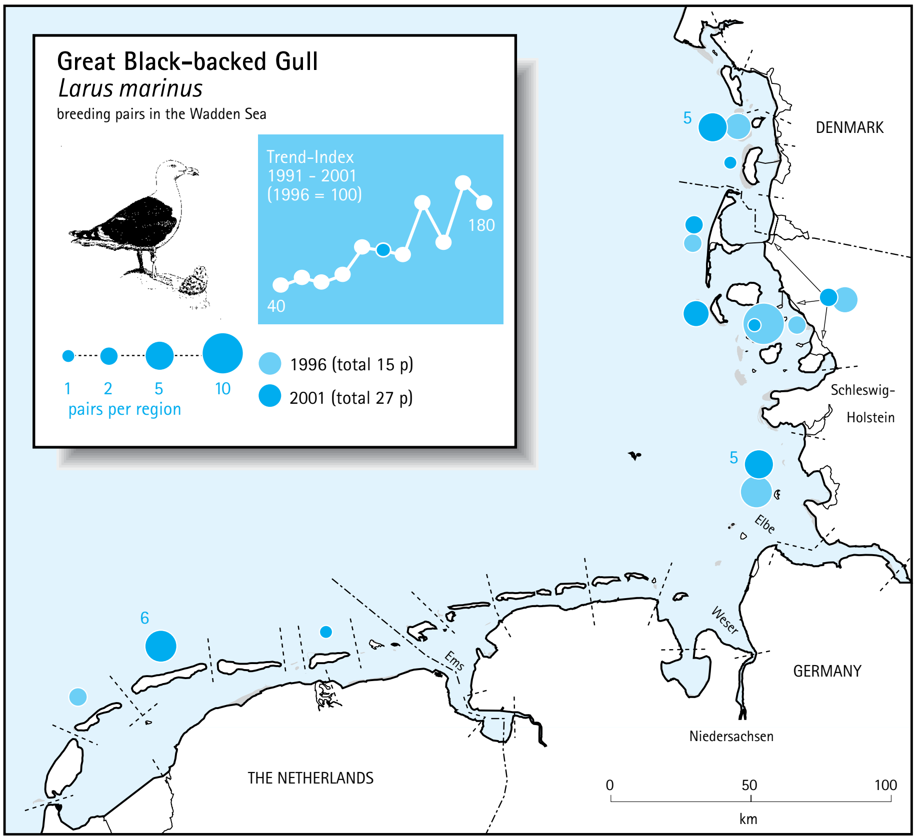


Figure 60: Breeding distribution of Great Black-backed Gull in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Great Black-backed Gull is currently expanding its breeding range to the southwest and has colonized the Wadden Sea in the early 1970s (Denmark; Dybbro, 1976) and 1985 (Niedersachsen; Behm-Berkelmann and Heckenroth, 1991). However, these were cases of incidental breeding pairs, but regular breeding has been observed in Schleswig-Holstein and Denmark from 1988 onwards (see Rasmussen *et al.*, 2000). Still, the majority of the population (75%) is found in these two countries. Often, pairs associate with Herring Gull and Lesser Black-backed Gull at breeding sites in dunes. In the Dutch Wadden Sea, man-made habitat is also used for breeding (at the island De Hond in the estuary of the river Ems; Koks 1995). Nearly the entire population (93%) breeds on islands. Core breeding sites in 2001 were Terschelling NL (6 pairs), Mandø DK (5 pairs), Trischen SH (5 pairs) and Amrum SH (5 pairs).

Population and Trend

Great Black-backed Gull is among the fastest growing species in the Wadden Sea. Between 1991 and 2000, the population increased steadily from 6 to 32 pairs. In 2001, 27 pairs were found.

After successful colonization of the northern Wadden Sea in the late 1980s (see above), Niedersachsen followed in 1995 and the Dutch Wadden Sea in 1994.

Assessment

Regarding the overall population growth, a further increase has to be expected in the years to come.

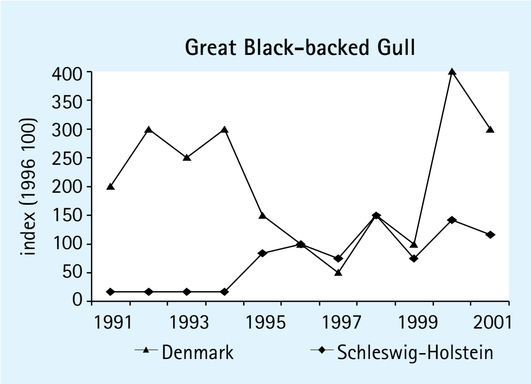
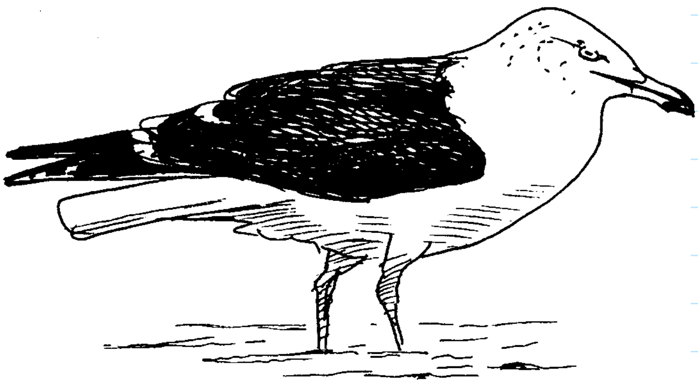


Figure 61: Trends in Great Black-backed Gull 1991-2001, retrieved from annual total counts.



4.26 Gull-billed Tern

Gelochelidon nilotica

NL: Lachstern **D: Lachseeschwalbe** **DK: Sandterne**

Status 1991:	28 pairs
Status 1996:	86 pairs
Status 2001:	56 pairs
EC Birds Directive:	Annex I
NW-Europe:	100%
Coverage:	A

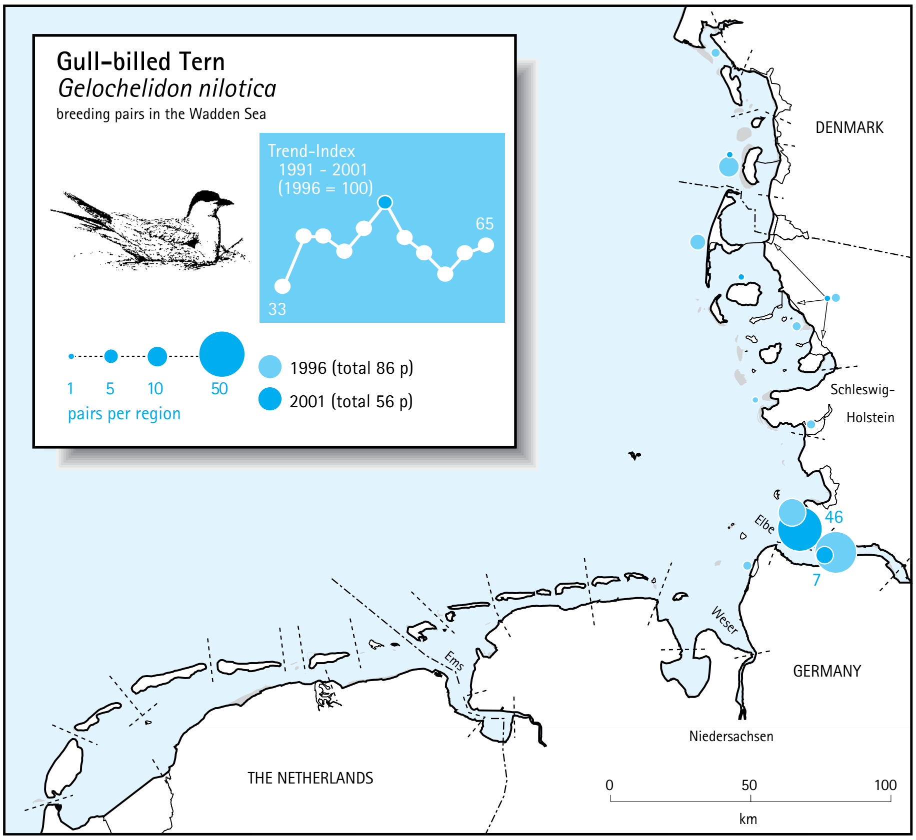


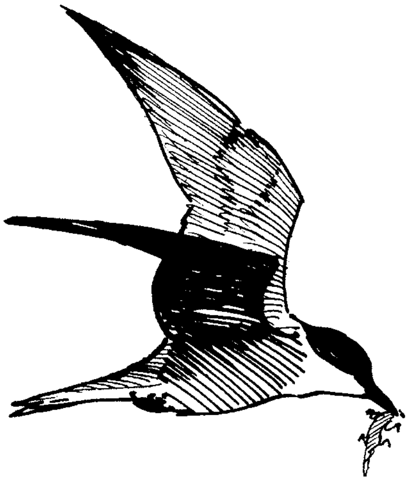
Figure 62: Breeding distribution of Gull-billed Tern in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

The Wadden Sea represents the only breeding area for Gull-billed Terns in NW-Europe. Initially, core breeding sites were mainly located in Denmark (Wadden Sea and further sites in Jutland; Møller, 1975), but since the 1970s the distribution has shifted towards Schleswig-Holstein. Colonies of Gull-Billed Terns are mainly found on the mainland coast where they breed in association with Black-headed Gull, Common- or Arctic Tern. The birds feed outside the Wadden Sea, mainly in terrestrial habitats where they search for small mammals, lizards and insects. Feeding sites may be located up to 40 km from the breeding colony (Berndt *et al.*, 2002). Between 1996 and 2001, a further contraction in breeding range occurred. Danish breeding colonies and scattered settlements in the northern part of Schleswig-Holstein were deserted (except for 1 pair at Rømø DK). In 2001 the only remaining large breeding sites were located in the Elbe estuary, mainly in Schleswig-Holstein.

Population and Trend

During the period from 1991 to 2001, the Wadden Sea population fluctuated between 28 and 86 pairs. The total survey in 1996 coincided with a peak year (86 pairs). After 1996 the number of pairs decreased to 36 in 1999, but increased again to 56 pairs in 2001. The overall trend is therefore not significant and fluctuating. In 2004, the population had declined to 25 pairs (Koffijberg *et al.*, 2005b). In the Danish Wadden Sea in



2002-2004 isolated pairs were found at Mandø, Fanø and Langli, none of which were successful (Thorup, 2004a).

Assessment

Since the population of Gull-billed Terns in the Wadden Sea is confined to only a few sites, the species is highly vulnerable. Breeding success is sometimes poor (Rasmussen *et al.*, 2000). Backgrounds for the long term decline in the second half of the 20th century still have not been clarified but have been assumed to be linked to changes in feeding opportunities, habitat loss, predation and deteriorating conditions in wintering areas (Biber, 1994). Predation seems to be an important factor in recent switches in breeding sites in the Elbe estuary (Gloe, 1992; Berndt *et al.*, 2002). Careful monitoring of the remaining colonies is necessary to be alert of threats and population changes.

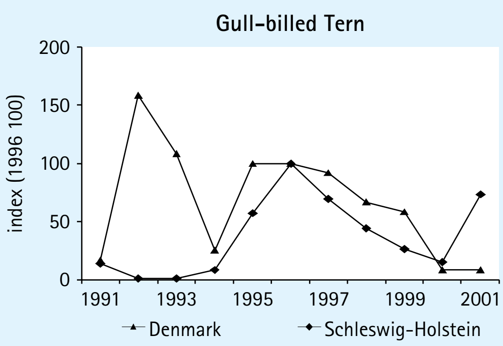


Figure 63: Trends in Gull-billed Tern 1991-2001, retrieved from annual total counts.

4.27 Sandwich Tern

Sterna sandvicensis

NL: Grote Stern D: Brandseeschwalbe DK: Splitterne

Status 1991:	16,982 pairs
Status 1996:	17,285 pairs
Status 2001:	17,172 pairs
EC Birds Directive:	Annex I
NW-Europe:	28%
Coverage:	A

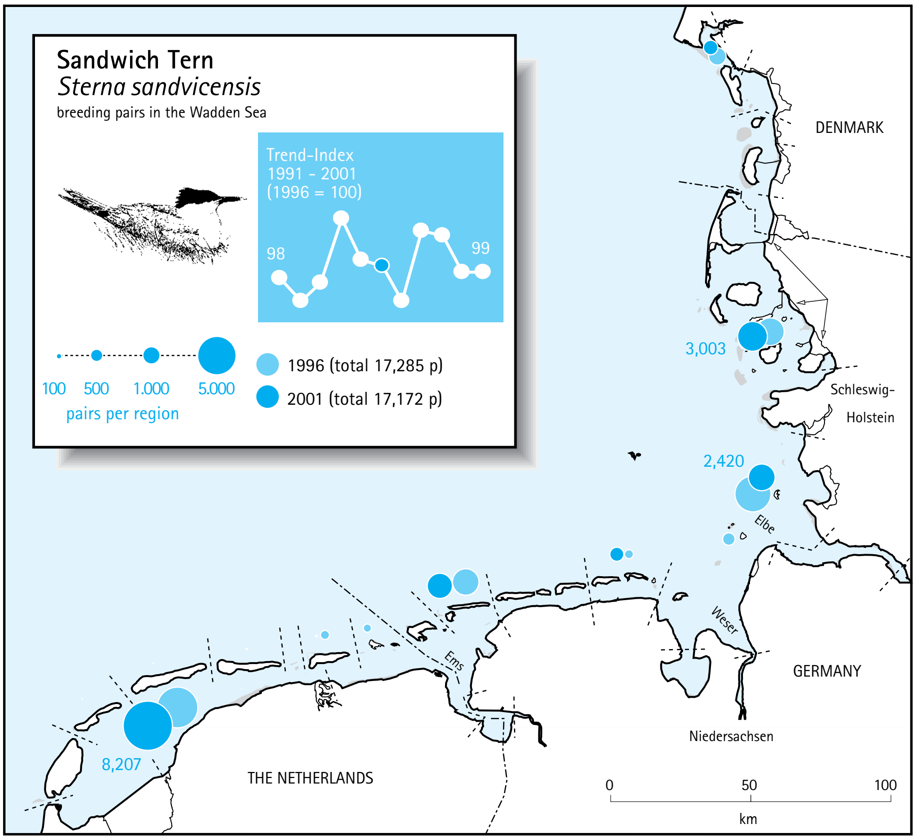


Figure 64: Breeding distribution of Sandwich Tern in the Wadden Sea in 2001 (1996 given as comparison).

Distribution and Habitat

Most Sandwich Terns breed in colonies on uninhabited islands and in undisturbed and protected areas all over the Wadden Sea. Only colonies at Juist Nds and Wangerooge Nds are associated with inhabited islands, but were occupied only for a few years and recently abandoned. The Wadden Sea is one of the strongholds in NW-Europe (> 25% of the population). Distribution is confined to only 9 colonies, of which 6 supported > 500 pairs. The largest colony is on the island Griend NL. In the period from 1996 to 2001 about 30-50% of the Wadden Sea population bred on this island. Other large colonies were Juist Nds, Trischen SH and Norderoog SH. Feeding areas are mainly located in the offshore zone of the North Sea, usually in a range of 25-30 km from the colony (Veen, 1977; Stienen, 2006). This also explains the exposed location of the colonies on the barrier islands. Only the colony at Griend is situated relatively far 'inshore'.

Population and Trends

The population in the Wadden Sea was classified as stable in the period 1991-2001, which is also expressed by nearly similar counts in 1991, 1996 and 2001. However, large fluctuations in several colonies occur, suggesting movements between colonies. In the Dutch part of the Wadden Sea, Griend had the only 'stable' colony from 1991 to 2001. After a low in 1997 with 5,000 pairs, numbers here increased to 8,207 pairs in 2001. Other colonies disappeared (Rottumerplaat in 1999) or were reduced to a few breeding pairs

(Schiermonnikoog). The fast increase at Juist Nds between 1998 and 1999 (from 1,295 to 2,176 pairs) suggests a shift from Rottumerplaat to Juist. Previously, trends at Schiermonnikoog and Rottumerplaat suggested that also these colonies showed a high rate of exchange in 1997-1998. Dynamic colony size has also been reported from Wangerooge Nds (the colony nearly disappeared in 2000) and Scharhörn HH/Nds (the colony disappeared in 1997, 1999 and 2001). In Schleswig-Holstein there has been an overall decline, although large fluctuations between colonies also occurred here. The Danish Wadden Sea had its first colony in 1992 at Langli (associated with Black-headed Gull), and reported growing numbers until 1999, after which the colony declined from 1,529 to 781 pairs.

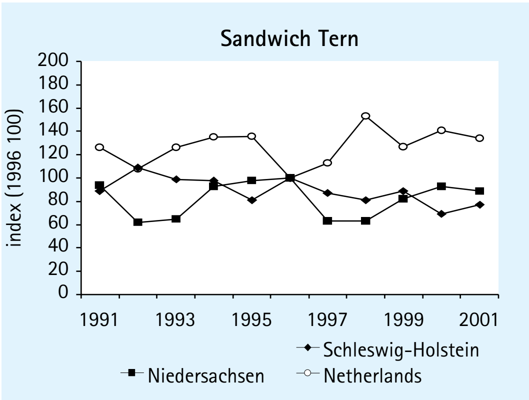


Figure 65: Trends in Sandwich Tern 1991-2001, retrieved from annual total counts.

Assessment

Even if our trends are significant, there seems to be a high degree of exchange between the various colonies in the Wadden Sea. On the long term, the population has still not recovered from the pesticide era in the 1960s. Between 1938 and 1956 up to 38,000 pairs bred in the Wadden Sea, with 90% of the population in The Netherlands (Brenninkmeijer and Stienen, 1992). In Schleswig-Holstein, the population in the 19th century was estimated at even 50,000 pairs (Hälterlein, 1998). Frequent changes in settlements from year to year suggest that Sandwich Terns may quickly respond to changing conditions in their environment. Stienen (2006) hypothesizes that fluctuating trends in colonies of Sandwich Terns around the North Sea are mainly a result of local food availability. New breeding sites, however, are often not successful. Typically, Sandwich Terns at such breeding sites start to breed late (first clutches in June). Information from Griend, Schiermonnikoog and Langli show that these late-breeding birds never breed successfully and often desert nests before hatching. Information from ringed birds shows that the birds which started breeding in June were mostly immature birds (Oosterhuis, 2001).

4.28 Common Tern

Sterna hirundo

NL: Visdief D: Flussseeschwalbe DK: Fjordterne

Status 1991: 13,677 pairs
Status 1996: 13,064 pairs
Status 2001: 14,127 pairs
EC Birds Directive: Annex I
NW-Europe: 11%
Coverage: A

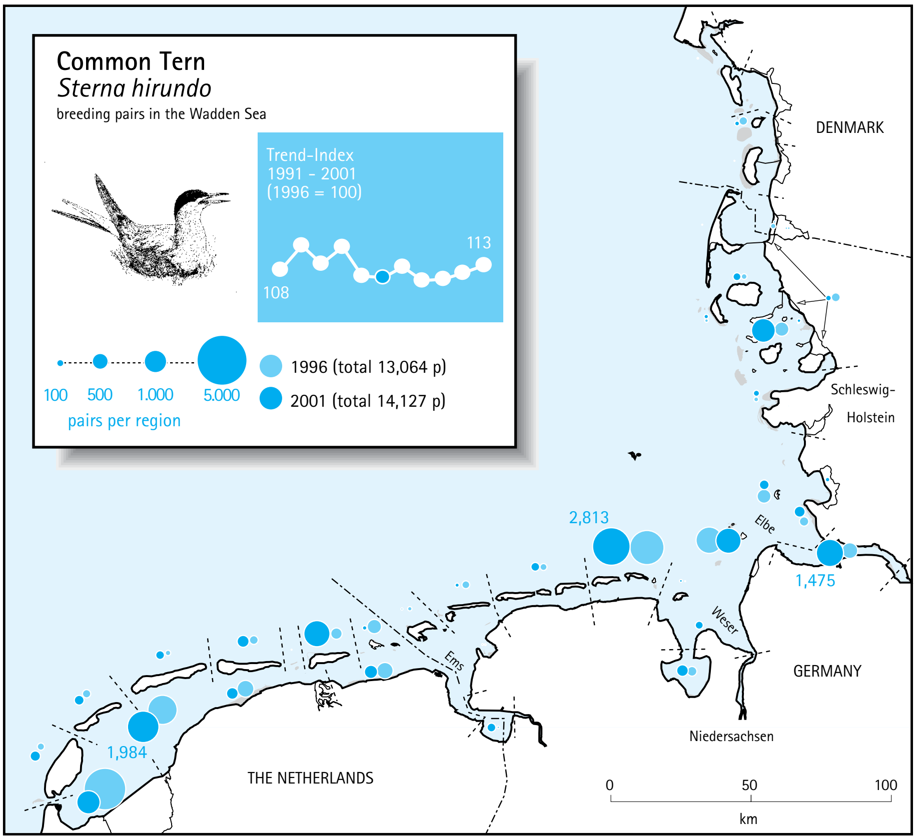


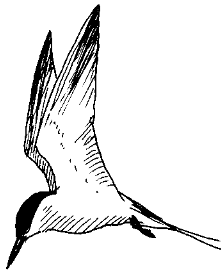
Figure 66: Breeding distribution of Common Tern in 2001 (1996 given as comparison).

Distribution and Habitat

Breeding Common Tern are widespread in the Wadden Sea and occur in many different habitats. Several colonies are located at remote (uninhabited) outer sands and islands (*e.g.* Griend NL), but birds also breed at sparsely vegetated salt marshes and in man-made habitats, *e.g.* in harbours and industrial estates, even on the rooftops of buildings. The Wadden Sea is assumed to support about 11% of the NW-European population. In 2001, 72% of all Common Terns bred on islands. Contrary to 1991-1996 (Rasmussen *et al.*, 2000), a slight increase in island-based populations was observed after 1997 (see below). The largest colonies are confined to sections west of the Elbe estuary (>75% of the overall population), e.g. Griend NL, Schiermonnikoog NL, Minsener Oog Nds and the Elbe estuary SH. As usual, the largest settlement is found at Minsener Oog (in 2001 2,813 pairs). Other major colonies were located in the Balgzand area NL and Norderoog/Süderoog SH.

Population and Trends

Although numbers might fluctuate from year to year, overall trends in annual numbers from 1991 to 2001 indicate a significant decline. This occurred in all parts of the Wadden Sea except the Netherlands, where no significant trend could be detected. The population in 2001 (14,127 pairs) was rather similar to previous surveys in 1991 and 1996. However, especially in Niedersachsen and Schleswig-Holstein, numbers in the beginning of the 1990s were at a higher level than in the second half of the 1990s (decline until 1996,



thereafter stabilization). In Schleswig-Holstein a new increase was noticed in 2001, whereas colonies in Niedersachsen and Denmark continued to decline. The Dutch population has remained rather stable over the years after an initial increase at the beginning of the 1990s. However, trends also vary considerably here at colony level. Moreover, numbers declined from 2002 onwards (van Dijk *et al.*, 2006).

Assessment

The Common Tern populations declined dramatically in the 1950s and 1960s as a result of contamination with organochlorides. The situation became much improved in the 1980s and 1990s, and contamination went below levels where impact on the reproductive output in the Wadden Sea has to be expected (Thyen and Becker, 2000; Becker *et al.*, 2001; Becker and Muñoz-Cifuentes, 2004). The overall decline observed in the Wadden Sea was not found elsewhere in Europe, where most populations have remained stable over the past decades (BirdLife International, 2004). Poor breeding success, as a result of lower food availability, has often been put forward as one of the main backgrounds for the declines observed (Stienen and Brenninkmeijer, 1998; Südbeck *et al.*, 1998; Rasmussen *et al.*, 2000). In Niedersachsen and Schleswig-Holstein, also habitat loss (*i.e.* decline in young dune and salt marsh areas suitable for breeding) might have been detrimental to Common Terns. Other factors involve competition for nest sites and predation. Rasmussen *et al.* (2000) showed that Common Tern populations in 1991-1996 increasingly started to breed at mainland sites. In Schleswig-Holstein e.g. the colony at Trischen dropped from 2,125 pairs in 1991 to 380 pairs in 1996 and even 186 pairs in 2001. This development has been attributed to competition for nest sites and predation by gulls in combination with vegetation succession, leading to a (nearly) complete breeding failure (Becker *et al.*, 1997; Südbeck and Hälterlein, 1997; Hälterlein, 1998). More recently, mammalian predation (notably by red foxes) seems to have caused losses at many mainland breeding sites. Especially in the Dutch Wadden Sea, Common Tern numbers declined sharply along the mainland coast after 1996, whereas island populations remained stable. Recently, storm tides and flooding in May and June have destroyed many Common Tern colonies in salt marshes and exposed outer sands. As the species often breeds at the fringe of land and water, increased sea levels and storminess, both resulting from climate change, might put Common Terns at risk in the future.

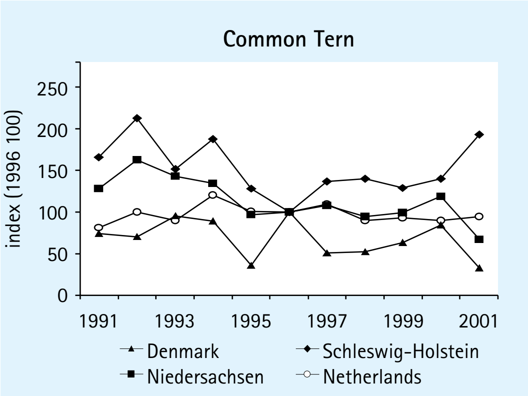


Figure 67: Trends in Common Tern 1991-2001, retrieved from annual total counts.

4.29 Arctic Tern

Sterna paradisaea

NL: Noordse Stern D: Küstenseeschwalbe DK: Havterne

Status 1991:	5,256 pairs
Status 1996:	9,011 pairs
Status 2001:	8,464 pairs
EC Birds Directive:	Annex I
NW-Europe:	1%
Coverage:	A

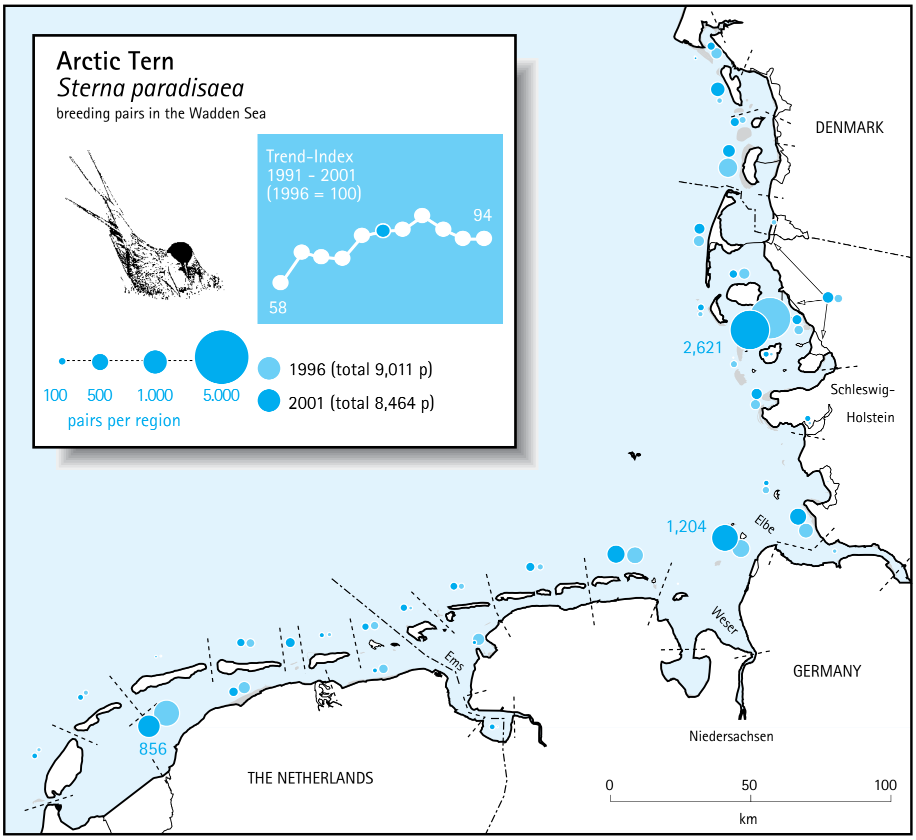


Figure 68: Breeding distribution of Arctic Tern in 2001 (1996 given as comparison).

Distribution and Habitat

Arctic Terns breeding in the Wadden Sea represent the most south-western fringe of their breeding range. Thus, largest numbers are mainly found north of the Elbe estuary, especially in Schleswig-Holstein, which supports 51% of the Wadden Sea population. In an international perspective the breeding population in the Wadden Sea accounts for only a small proportion of the NW-European population (1%). Arctic Terns frequently breed in mixed colonies with Common Tern, with the exception of breeding sites in urbanised areas like harbours and industrial zones, where the species is a rather rare visitor and Common Tern is more abundant. Moreover, Arctic Tern generally prefer more sparsely vegetated and exposed breeding sites. A major part of the colonies is subject to protection regimes. During fieldwork, sometimes problems occur in separating mixed colonies of Common and Arctic Tern (see Rasmussen *et al.*, 2000), but these are not believed to have a serious impact on the trends observed (cf. chapter 2). Large colonies are mainly found at islands (in 2001: 84% of the population). The Halligen and Norderoog/Süderoog in Schleswig-Holstein hold the largest numbers (in 2001 2,621 pairs, 31% of total population). Other large settlements include Griend NL (856 pairs) and Scharhörn HH/Nds (629 pairs).

Population and Trends

The population increased from 5,256 pairs in 1991 to 10,112 pairs in 1998. After 1998, how-

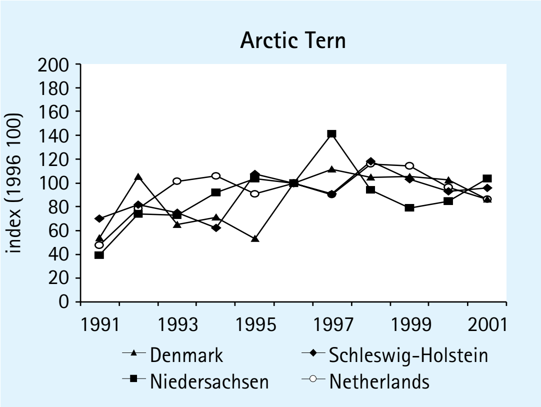
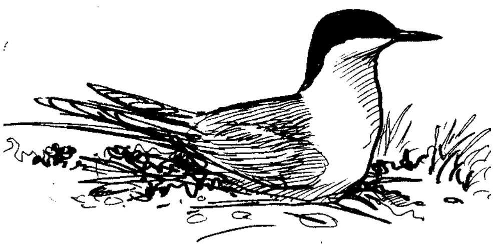


Figure 69: Trends in Arctic Tern 1991-2001, retrieved from annual total counts.

ever, the population slightly decreased to 8,464 pairs in 2001. The overall trend retrieved from annual counts from 1991 to 2001 is therefore significantly increasing. However, based on the data after 1996 there is a tendency toward decline. Trends between the countries are highly similar. Only Niedersachsen shows a more pronounced development, with a steep increase until 1997 and a decline afterwards. In the other sections, the recent decline started in 1998. In the Dutch Wadden Sea, declines have continued after 2001 (van Dijk *et al.*, 2006).

Assessment

The breeding population of Artic Tern declined dramatically in 1960s as a result of pollutants, which was also observed for other tern species. However, in the 1980s and 1990s the situation improved greatly and the population recovered. Compared to Common Tern, Arctic Tern are less vulnerable to food shortage as they have a more varied diet, including shrimps. Moreover, the breeding of Arctic Tern is more confined to islands and therefore less susceptible to predation by *e.g.* red foxes. On the other hand, many breeding sites are even more exposed to high water levels than Common Tern, making them more liable to flooding during storm tides in the breeding season. Climate change might therefore have a larger impact on a longer term.



4.30 Little Tern

Sterna albifrons

NL: Dwergstern D: Zwergseeschwalbe DK: Dværgterne

Status 1991: 654 pairs
Status 1996: 983 pairs
Status 2001: 1,121 pairs
EC Birds Directive: Annex I
NW-Europe: 16%
Coverage: A

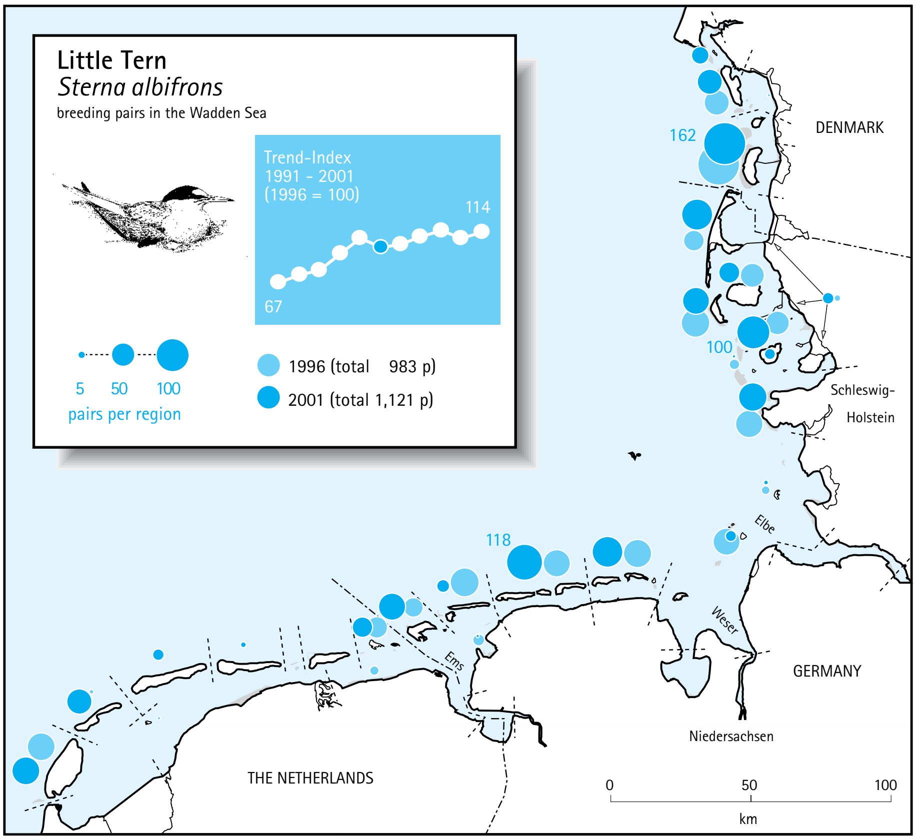


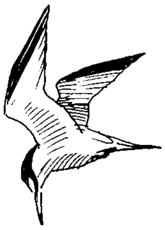
Figure 70: Breeding distribution of Little Tern in 2001 (1996 given as comparison).

Distribution and Habitat

Little Terns predominantly breed on the Wadden Sea islands (90% of the population in 2001). Preferred habitat are sandpits, beaches and primary dunes. Scattered settlements are found in artificial habitats near harbours. Habitat characteristics are highly similar to that of Kentish Plover. About 16% of the population in NW-Europe breeds in the Wadden Sea. Distribution in 2001 was in line with previous counts in 1991 and 1996. The highest numbers occur on the East Frisian islands in Niedersachsen (27% of the population), on islands in Schleswig-Holstein (28%) and on Danish Wadden Sea islands (23%). Surprisingly, the species is lacking on most Dutch islands, except Rottumeroog and Rottumerplaat, Vlieland and Texel. Breeding sites with >100 pairs are found at Rømø DK, Norderoog/Süderoog SH and Norderney/Baltrum/Langeoog Nds. Mainland settlements in 2001 were confined to Schleswig-Holstein and Denmark.

Population and Trends

After an all-time low in the 1970s and 1980s, Little Tern recovered gradually in the 1990s (Fleet *et al.*, 1994). Both the overall trends and trends in the individual countries all point at significant increases in 1991-2001. Since 1995, the population in the Wadden Sea has remained quite stable at around 1,050 pairs. In Denmark upward trends were observed until 1998, after which the population growth levelled off. The



steep increase observed here in 1991-1996 is due to lack of coverage of the main breeding sites at Rømø (Rasmussen *et al.*, 2000).

Assessment

The increase, or merely recovery, of Little Tern populations in the Wadden Sea is commonly regarded as a consequence of improved protection measures of the breeding colonies (Flore, 1997; Witte, 1997; Hälterlein, 1998; Potel *et al.*, 1998). The recent increase in Denmark is considered to be a result of protection measures as well (Rasmussen *et al.*, 2000). Like Kentish Plover, Little Terns often breed at sites which are also preferred beach resorts for outdoor recreation. High numbers of tourists might be a reason for the lack of colonies on islands like Schiermonnikoog, Ameland and Terschelling. A larger settlement at Richel (near Vlieland) in 1999 sustained. At this site, Little Terns benefited from a lack of high tides and an information system for visitors (Dijksen and Koks, 2001). As the birds breed at exposed sites, they are liable to flooding after prolonged onshore winds. Little Terns suffered from floods in 2001 and left their initial colonies in several areas. This could be seen in numbers counted on Minsener Oog: In the census period, only 23 pairs settled on the island. After the flooding event at the end of May, numbers increased considerably up to 117 pairs, the largest colony in Niedersachsen for years. It is unknown from which colonies these birds originated, but at least the nearest colony on the island of Wangerooge (46 pairs in the early breeding season), was abandoned after the flooding event (JMBB, 2002). This shows that for species like Little Tern, the census effort should be synchronised to avoid movements within one breeding season. In order to keep the population at current level, continuous effort is necessary to prevent colonies from being disturbed. Furthermore, protective measures and information campaigns should be expanded, especially in the Dutch Wadden Sea, where several islands have suitable habitat but so far did not experience settlement of Little Terns.

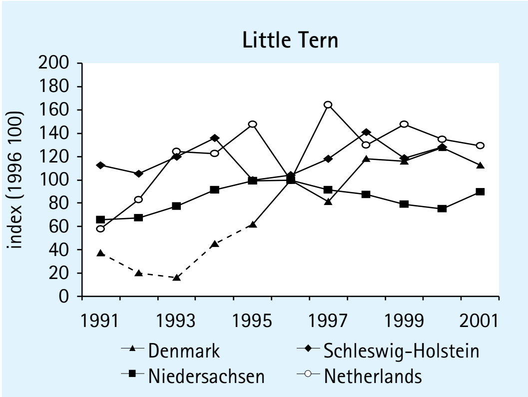


Figure 71: **Trends in Little Tern 1991–2001, retrieved from annual total counts. Dashed lines indicate incomplete coverage.**

4.31 Short-eared Owl

Asio flammeus

NL: Velduil D: Sumpfohreule DK: Mosehornugle

Status 1991:	83 pairs
Status 1996:	114 pairs
Status 2001:	89 pairs
EC Birds Directive:	Annex I
NW-Europe:	< 1%
Coverage:	A

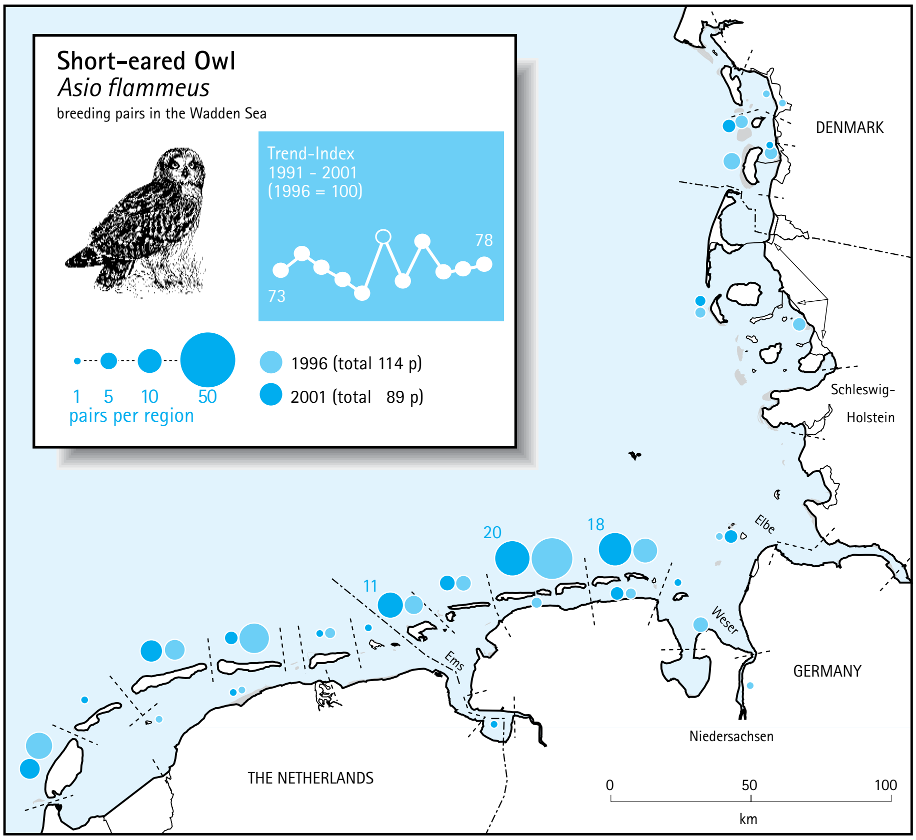


Figure 72: Breeding distribution of Short-eared Owl in 2001 (1996 given as comparison).

Distribution and Habitat

Short-eared Owls prefer open dunes and heathland as breeding habitat, often in association with feeding areas in grassland or salt marshes. Prey usually consists of voles, but locally also waders and chicks *e.g.* of Common Tern are taken (see Rasmussen *et al.*, 2000). The Wadden Sea population is mainly confined to the islands in the Netherlands and Niedersachsen. In 2001, only six pairs (7% of the population) were found along the mainland coast, three of which on the Elisabeth-Aussengroden Nds. In the northern part of the Wadden Sea only scattered breeding is recorded. The largest numbers are found on the East Frisian islands (in 2001 66% of the Wadden Sea population). Both in Niedersachsen and the Netherlands, the Wadden Sea islands support the core breeding area within the country.

Population and Trends

Data from the 2001 census were similar to 1991 (89 breeding pairs). Compared to the latest count in 1996, however, a reduction of more than 20% was observed. Although the population fluctuates (also due to cycles in vole abundance), Short-eared Owls on the Dutch islands have experienced a long-term decline. From 1991 onwards, the population decreased annually by 5%. The overall Wadden Sea trend from 1991 to 2001 does not show any significant trend since Short-eared Owl on the islands in Niedersachsen seem to thrive during the same period. The numbers here fluctuated between 42 and 69 pairs from 1996 to 2001. Recent data show that the downward trend in the Netherlands has continued, whereas in Niedersachsen the population has remained at the same level (Koffijberg *et al.*, 2005b).

Assessment

Given the current rate of decline, Short-eared Owl are on the brink of extinction on the Wadden Sea islands in the Netherlands. This decline coincides with major decreases in the Netherlands in the past decades (SOVON, 2002). Especially the population on Ameland, one of the former strongholds, has suffered major losses; from the average of 25 pairs in the early 1990s, only 2-4 pairs remained in 2001-2003. There is a striking similarity with Hen Harrier (see chapter 4.6). Poor reproduction rates seem to be a key factor causing the decline. It is hypothesized that this development has been initiated by vegetation developments in the dunes (taller vegetation, more scrub), which has disabled prey detectability (SOVON, 2002). Like Hen Harrier, populations in Niedersachsen are performing much better. Apart from a decline in 2002, the population here has hardly undergone changes since 1996 and has remained rather stable at most breeding sites. Fluctuations partly coincide with those in the Netherlands (*e.g.* peak years like 1992, 1996, 1998) suggesting factors operating at the overall population level (or similarities in vole abundance). As proposed for Hen Harrier, investigations on reproduction and diet on the islands in the Netherlands and Niedersachsen would give insight into the processes causing the declines and deliver explanations for the pronounced difference in trends in both countries.

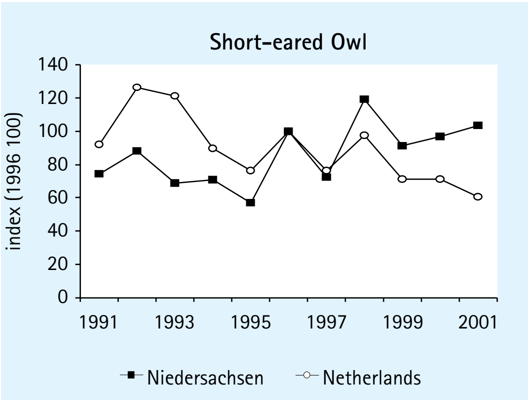


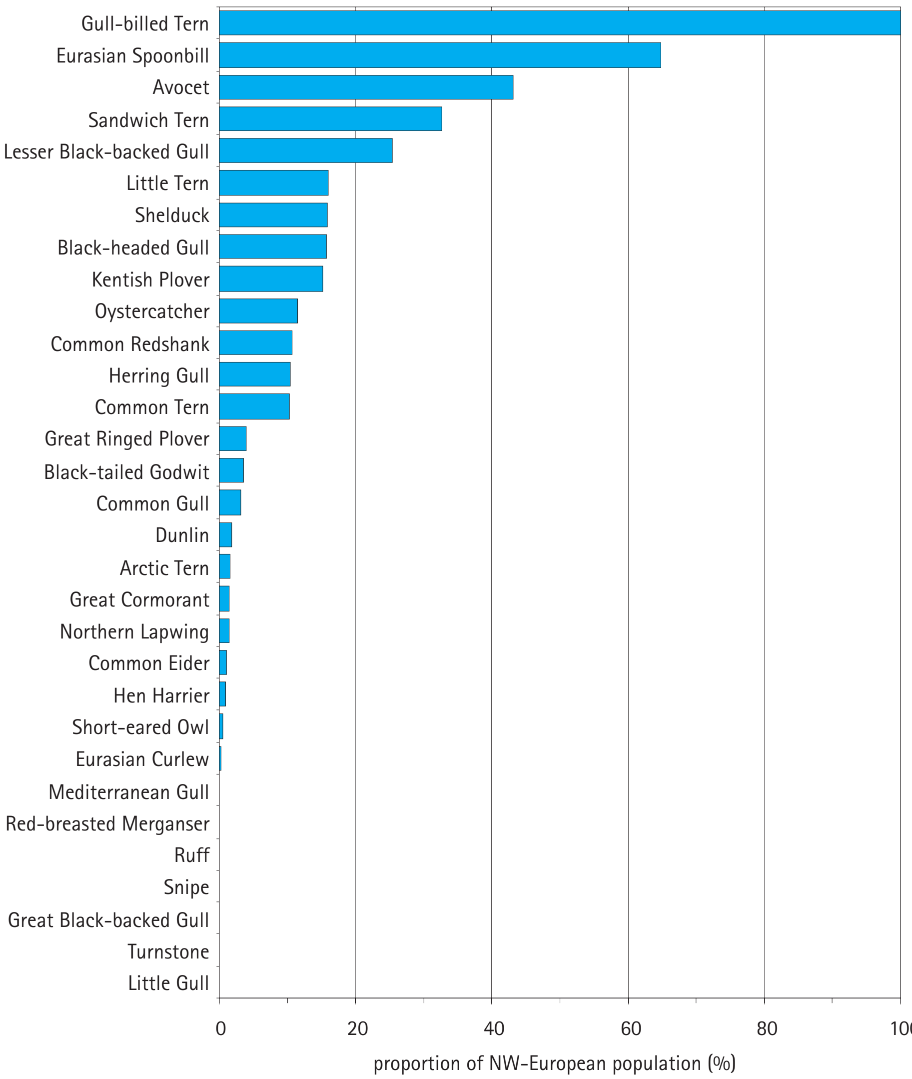
Figure 73: Trends in Short-eared Owl 1991-2001, retrieved from annual total counts.

5. Discussion

5.1 Breeding Birds in the Wadden Sea in an International Context

The Wadden Sea is generally recognised as one of the most important wetlands in the world. Counts of migratory birds by the JMMB/TMAP monitoring scheme have revealed that an estimated 10-12 million waterbirds pass the area en route from their breeding to their wintering areas or winter in the Wadden Sea (Meltofte *et al.*, 1994; Blew and Südbeck, 2005). Regarding breeding birds, populations in the Wadden Sea are much smaller. Still, for several species they represent a high proportion of the NW-European breeding bird population (Figure 74). When compared to population estimates given by BirdLife International (2004) and Thorup (2006), the entire NW-European population of Gull-billed Tern breeds in the Wadden Sea; for Eurasian Spoonbill it involves nearly two-thirds of the NW-European population. Other species for which the Wadden Sea supports more than 25% of the NW-European population are Avocet (43%), Sandwich Tern (33%) and Lesser Black-backed Gull (25%). A further eight species occur with 5-25%, *e.g.* Little Tern, Shelduck, Oystercatcher, Kentish Plover, Common Tern and Herring Gull. In another eight species numbers recorded involve 1-5% of the NW-European population. This applies to *e.g.* Black-tailed Godwit and the continental population of Dunlin (subspecies *schinzii*). Thus, for 21 out of 31 species more than 1% of the NW-European population breeds in the Wadden Sea. Compared to the previous report by Rasmussen et al. (2000), only for a few species has the proportion of the NW-European population increased (two) or declined (four) in a European context since 1996. To some extent, this will be a result of improvements in data collection in other areas/countries, consequently

Figure 74: Comparison of breeding bird populations in the Wadden Sea in 2001 with NW-European population sizes given by BirdLife International (2004) and Thorup (2006, waders only). NW-Europe is regarded as Switzerland, Luxembourg, France, Belgium, British Isles, Iceland, Wadden Sea countries, Norway, Sweden and the Baltic (i.e. the same countries considered in the previous report). In some species, populations have been adapted due to distribution of subspecies (continental *schinzii* population of Dunlin, *totanus* population of Common Redshank) or regional distribution (Gull-billed Tern in France omitted since it breeds entirely in the French Mediterranean).



giving higher estimates for the overall population. Hence, a smaller proportion breeds in the Wadden Sea. Examples of species that increasingly tend to breed in the Wadden Sea are Northern Lapwing and Lesser Black-backed Gull. Northern Lapwing has experienced declines in both the Wadden Sea and in other areas, but it seems that the rate of decline is smaller in the Wadden Sea, perhaps because the species is less affected by increased agricultural pressure in most Wadden Sea breeding habitats. Nevertheless, regarding the declines in Northern Lapwing and also Black-tailed Godwit, it is questionable whether the area has to be regarded as a core breeding area for grassland-breeding waders, as proposed in the previous report (Rasmussen *et al.*, 2000). Regarding the overall declines and contraction of the breeding range observed in the interior of the Wadden Sea countries (SOVON, 2002; Melter, 2004), the salt marshes and other habitats in the Wadden Sea are rather small and will hardly be able to function as a source breeding habitat for breeding areas further inland. Merely, they will become a refuge when inland populations further decline.

Increases in the Wadden Sea reported for species like Great Cormorant, Eurasian Spoonbill, Mediterranean Gull, Common Gull, Lesser Black-backed Gull and Great Black-backed Gull are in line with international trends and reflect an expansion of the European breeding range or an increase in populations in countries around and in the Wadden Sea. In most other species, trends tend to run parallel to European trends as well. Obvious exceptions are Common Tern and Little Tern. Common Tern has internationally been evaluated as stable, but has declined in large parts of the Wadden Sea from 1991 to 2001. Only in the Dutch part of the Wadden Sea was the trend similar to the overall European trend, although the species has declined recently. In contrast, Little Tern is declining in large parts of its breeding range, but has grown in number (or: recovered from previous declines) in the Wadden Sea as a result of successful protection measures.

5.2 Factors Influencing Breeding Birds

The aims for the breeding bird monitoring of the JMBB in the Wadden Sea include the response of breeding birds to a series of factors that have been regarded as important with respect to trilateral policies and management (see chapter 1). These include impact of climate changes, fisheries, (industrial) contaminants, recreational activities and management of salt marshes. In addition, the Wadden Sea Plan (1997) has addressed targets for trilateral management policies. For breeding birds these include 'favourable food availability' and 'natural breeding success'. Although a comprehensive evaluation of trends regarding these factors often goes beyond the possibilities of the current monitoring scheme - since it just monitors population size and not the factors causing the observed population changes - the sections below will discuss some of the trends observed with respect to management and policy issues. An evaluation of the targets and the actual monitoring scheme, along with recommendations, is included in chapter 6.

5.2.1 Climate Change

During the past decades, evidence has grown that human activity has increased the amount of greenhouse gases and has initiated global warming (see *e.g.* review by Oost *et al.*, 2005). By 2100, predictions for a global average increase in temperature range from 1.4° to 5.8°C, depending on local conditions. According to these predictions, sea level will rise between 9 and 88 cm from 1990 to 2100. This will coincide with increased storminess, higher waves and more precipitation (notably extreme rainfall events) in areas at intermediate latitudes like the Wadden Sea. As a result, salt marshes and outer sands might be exposed more often to flooding and especially the (unprotected) pioneer zone will be more liable to erosion. Furthermore, the entire ecosystem might change as environmental conditions for e.g. benthos communities and also predator-prey interactions will be affected as well, in particular by temperature changes (see *e.g.* Beukema and Dekker, 2004). Even if some of these scenarios are discussed/speculative and some parameters in climate models are not certain, this process will probably affect breeding bird communities in the Wadden Sea on a long term. So far, no obvious impacts of climate change are apparent, but detection probability is low, since the breeding bird monitoring scheme has been running for 15 years now and climate change occurs over much longer time scales.

Nevertheless, some species are more susceptible than others and might be affected earlier than others. This primarily applies to those species that inhabit the fringe of salt marshes and outer sands and thus are likely to be affected by flooding events during the breeding season. Today, already parts of the populations of Avocet, Oystercatcher and Common Tern are exposed to a high risk of

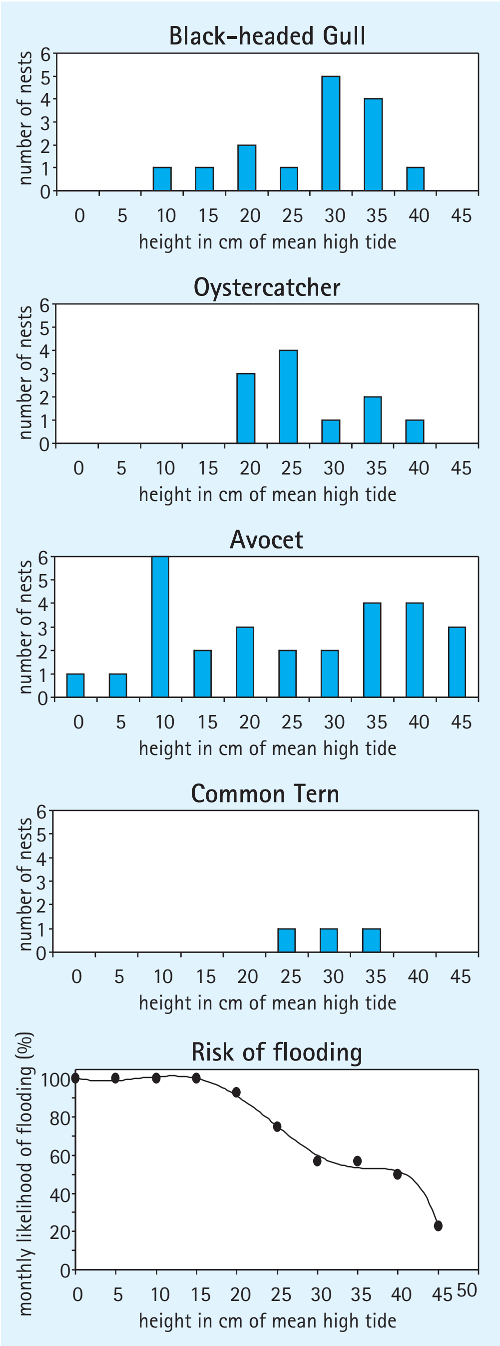


Figure 75: Nest situation in a salt marsh area in Friesland NL. The number of nests in four species and their respective heights (according to Dutch Ordnance Level, NAP) and the risk of flooding by high tides (current tidal wave considered) are shown. Redrawn after Van de Kam *et al.* (1999).

flooding, as shown by empirical data from the mainland coast in Friesland NL (Figure 75). The same will apply to species like Kentish Plover, Great Ringed Plover, Arctic Tern and Little Tern, *i.e.* all species preferring dynamic habitats and sparsely vegetated sites. Hence, increased sea level and, especially, stormy weather will increase the risk of flooding for this group of species. In 1990-2001, high water tables led to flooding in June during all complete surveys (1991, 1996, 2001) and in May during the census in 1996 (see chapter 2.6.2). In the period from 2001 to 2004, annual flooding in June resulted in breeding failures for several bird species (JMBB, unpublished). To what extent flooding has affected trends observed so far is not yet clear since some species are long-living and able to cope with periodical breeding failures. Moreover, when floods occur early in the season (*e.g.* April or early May) birds often produce replacement clutches. Flooding in June, however, might be detrimental since chicks drown and replacement clutches will not be laid. Among the seven species mentioned above, five have experienced declines in at least part of the Wadden Sea during 1991-2001. Even if most of these declines have probably been caused by reasons other than increased flooding (see next chapters), it is evident that they are extra vulnerable since their population development is already constrained by other processes. Furthermore, as demonstrated by Hötker and Segebade (2000), a species like Avocet is also highly susceptible to increased wind speed and precipitation levels when occurring in the chick-rearing phase in June. Similar relationships have been found in many other species (*e.g.* Beintema and Visser, 1989; Thyen 2005). Thus, increased storminess and precipitation are expected to have a negative impact on chick survival and breeding success of birds breeding in the Wadden Sea and will put a further constraint on the species that have shown declines already in the past decade.

5.2.2 Contamination

Monitoring of contaminant levels in bird eggs is not carried out in the scheme of the JMBB, but it is a separate parameter within TMAP, which started in 1998 (local studies in Germany started in 1981). It is carried out by the Institut für Vogelforschung "Vogelwarte Helgoland" in Wilhelmshaven (see *e.g.* Becker *et al.*, 1998; 2001; Becker and Muñoz Cifuentes, 2004). Tested substances are PCB's, HCH's, HCB, DDT + Metabolite, Chlordane, Nanachlore and mercury. The species monitored are Oystercatcher and Common Tern, which are sampled by collecting eggs at 13 sites throughout the Wadden Sea. Both species have shown significant declines in numbers in the past decade, though Oystercatcher only in the Dutch part of the Wadden Sea (recently also elsewhere) and Common Tern has recently tended to recover from the previous decline (see chapter 4.2.7 and 4.2.28). It is unlikely, however, that these trends have been influenced by current contaminant levels. As shown by Becker *et al.* (2001) levels of contaminants have gone down considerably already since the late 1980s and early 1990s and an impact on reproductive output of the species considered seems no longer likely, even if some hot spots with relatively high contaminant levels still occur and local increases have been recorded for some compounds. In the 1960s, during the 'pesticide era', several species suffered major losses, and the current population of *e.g.* Sandwich Tern still has not recovered from the declines experienced in that decade.

5.2.3 Fisheries

Two aspects of fisheries have affected breeding bird populations in the Wadden Sea in the past decades. Especially the population growth of Lesser Black-backed Gull is often thought to have been facilitated by the increased amount of fishery discards (Garthe *et al.*, 1996; Camphuysen and Garthe, 1999). Herring Gull uses this food resource as well but has also switched to benthic prey in the intertidal area in the past decades (Noordhuis and Spaans, 1992; Hilgerloh, 1998; Spaans, 1998b; Kubetzki and Garthe, 2003). Furthermore, this species regularly visits rubbish dumps. Although the amount of discards and fishery activities in the coastal zone off the Wadden Sea have been reduced (Camphuysen, 1995), it is not clear if the current trends in Lesser Black-backed Gull and Herring Gull are affected. Lesser Black-backed Gull still shows increases in all parts of the Wadden Sea, whereas Herring Gull has declined in the Netherlands and Niedersachsen. Often, both species are regarded as competitors for food (*e.g.* Noordhuis and Spaans, 1992), though not in all colonies, since both species use different food resources (*e.g.* Garthe *et al.*, 2000; Kubetzki and Garthe, 2003). The 'competition-hypothesis' would explain the fact that Herring Gull has declined in regions where the largest populations of Lesser Black-backed Gull are found (i.e. the Netherlands and Niedersachsen, accounting for 90% of the Wadden Sea population of Lesser Black-backed Gull). It is also likely that declines in Herring Gull have to be attributed to changed food stocks on the mud flats (Leopold *et al.*, 2004; see below) and less access to coastal rubbish dumps, which recently went down in number or were made inaccessible to birds (Spaans, 1998b, see Figure 59). Besides, there are indications that also Lesser Black-backed Gull currently faces changes in marine food supplies. Increasing numbers of this species have been observed in grasslands behind the seawall during the breeding season, sometimes more than 10 km inland. Previously, this was mainly observed during stormy weather, but since the late 1990s it has become a common phenomenon in the Netherlands and Niedersachsen, and recently it has also been observed in Schleswig-Holstein and Denmark. Further analysis should deliver evidence on whether population development is affected by changes in fish stocks and fishery activities in the area surrounding the breeding colonies. Studies on feeding ecology of Lesser Black-backed Gull and Herring Gull are planned in the Netherlands from 2006 onwards (NIOZ/C.J. Camphuysen).

A second aspect of fisheries has had a major impact on several breeding birds. Already in the 1980s it was shown that the numbers of Eiders decreased as a result of a change in diet from blue mussels to cockles and other alternative prey items in the Danish Wadden Sea (Laursen and Frikke, 1987). This prompted new management measures, and mussel fisheries in the Danish Wadden Sea became subject to strict regulations (Laursen and Frikke, 1987; Laursen *et al.*, 1997; Kristensen and Laursen, submitted prep.). In the Dutch Wadden Sea shellfish fisheries remained important in the 1990s, both for blue mussels and cockles (see chapter 2.6.3). The impact of shellfish fisheries on blue mussels and cockles has been intensively debated in the Netherlands, and additional management measures were taken in 1999-2000, including efforts to enhance restoration of blue mussel beds and improve food stocks available to birds by closing certain areas for fisheries. During the period from 1999 to 2004, fishery policies were evaluated in the so-called EVA-II project (Ens *et al.*, 2004). In this and preceding studies, it was concluded that declines in wintering and breeding numbers of Common Eider, Oystercatcher and migratory Red Knot, and perhaps also Herring Gull, were associated with the extensive exploitation of mussel beds and cockle stocks (Camphuysen *et al.*, 2001; Rappoldt *et al.*, 2003; Ens *et al.*, 2004; Leopold *et al.*, 2004, Verhulst *et al.*, 2004; Ens and Kats, 2004). The combination of removal of blue mussel stocks in the Dutch Wadden Sea in the early 1990s, years with poor spatfall, the occurrence of severe cold spells in the mid 1990s (affecting both mussel stocks and winter mortality of birds), cockle fisheries and perhaps also increased storminess, finally resulted in unfavourable food conditions for bivalve-eating birds. Previous management measures to improve food stocks for birds were considered insufficient and were not able to halt the declines in bird numbers (Ens *et al.*, 2004). As a result, a ban on mechanical cockle fisheries in the Dutch Wadden Sea was adopted in autumn of 2004. Blue mussel fisheries were still allowed, but new management measures have been initiated to develop a sustainable fishery effort. Further monitoring is carried out to evaluate shellfish fishery policies and trends in bird numbers, including monitoring of breeding success (Willems *et al.*, 2005).

5.2.4 Recreation

The Wadden Sea is a popular destination for tourists. Tourism represents an important socio-economic factor in the region and has increased in the past decades. Today, the area is visited by an estimated 10 million tourists annually as well as 30-40 million day trippers (IRWC in Gätje *et al.*, 2005). Beaches are one of the most favoured areas. Here, conflicts with typical beach-breeding species like Great Ringed Plover, Kentish Plover and Little Tern arise. Several studies have shown that settlement and breeding success of these species are negatively affected by human disturbance (Schulz and Stock, 1991; 1993, Tulp, 1998; Schulz, 1998). Declines in beach-breeding species were already reported before the start of the JMBB-Program (*e.g.* Flore, 1997; 1998; Hälterlein, 1998) and protection of these species is also expressed in the Wadden Sea Plan, by adoption of the aim of a natural breeding success. In the meanwhile, management measures have been taken (or proposed) to protect breeding sites from human disturbance (e.g. Witte, 1997; Schulz, 1998, Hälterlein, 1998; Potel *et al.*, 1998; Rasmussen *et al.*, 2000; Kersten, 2004; Krol, 2005). For Little Tern, which breeds in distinct colonies, this led to a population recovery in the 1990s (see chapter 4.2.30). However, Great Ringed Plover and Kentish Plover still show declines in nearly all parts of the Wadden Sea, also since 2001 (Koffijberg *et al.*, 2005b). The exception is Denmark, where Kentish Plover increased from 1991 to 2001 as a result of dispersion from large colonies in Schleswig-Holstein. Contrary to Little Tern, both species breed more scattered, are more opportunistic regarding breeding sites and therefore are more difficult to protect. Nevertheless, protection of the actual and potential breeding sites, including their feeding range (Tulp, 1998) remains urgent since other opportunities to stimulate settlements will not suffice. Both species benefited from the embankments in Schleswig-Holstein by the end of the 20th century (Hälterlein, 1998), but since vegetation succession in these areas has proceeded, predation pressure has increased and further embankments are not to be expected, this habitat is no longer available. In addition, restoration of coastal dynamics, beneficial to all species breeding on the fringe of land and water, is not an opportunity since it is often in contradiction with coastal defence works (Petersen *et al.*, 2005). In addition, climate change and sea level rise are expected to cause considerable erosion of the sandy North Sea shores (Oost *et al.*, 2005) and perhaps also influence breeding success negatively (see chapter 5.3.1).

5.2.5 Agriculture and Salt Marsh Management

Until the 1980s, mainland salt marshes in the Wadden Sea were primarily in agricultural use, for livestock grazing or hay-making. Especially in Schleswig-Holstein and Niedersachsen, the influence of agriculture has decreased considerably since the beginning of the 1980s after establishment of the national parks (see chapter 2.5.3). Reduction of human use of salt marshes, including artificial drainage, and stimulation of natural developments is implemented in trilateral policies for salt marshes in the Wadden Sea Plan and is also aimed for by the EC Habitats Directive (Lutz *et al.*, 2003; Bakker *et al.*, 2005). Since salt marshes are an important habitat for breeding birds and support a large part of the Wadden Sea population in many species, several studies have dealt with the response of breeding birds to changes in salt marsh management. In general terms, lower agricultural pressure or abandonment of livestock grazing is beneficial to those species preferring tall vegetation, for instance ducks like Shoveler, waders like Common Redshank, passerine species like Skylark, Meadow Pipit, Yellow Wagtail, Reed Bunting and also Short-eared Owl (Hälterlein, 1998; Eskildsen *et al.*, 2000; Esselink, 2000; Thyen, 2000; Schrader, 2003; Oltmanns, 2003; Thyen and Exo, 2003; Hälterlein *et al.*, 2003). Species diversity increases when management effort of salt marshes is reduced, especially since occurrence of passerines expands (Schrader, 2003; Thyen and Exo, 2003; Thyen, 2005). The re-colonization of Black-tailed Godwit observed in salt marshes in Schleswig-Holstein is also considered a result of the reduction of livestock grazing (Eskildsen *et al.*, 2000; Hälterlein *et al.*, 2003). On the other hand, studies in Niedersachsen have shown that Black-tailed Godwit, as well as Oystercatcher and Northern Lapwing prefer shorter swards and might be facilitated by agricultural activities (Thyen, 2000; Oltmanns, 2003). Avocet, Great Ringed Plover, Kentish Plover, Common and Arctic Tern preferably breed at sites with sparse or short vegetation as well (Oltmanns, 2003; Schrader, 2003). Moreover, Avocet benefits from drainage works, which frequently offer young successional vegetation sites along the drainage canals (Koopman, 2003) and perhaps also increase food availability (Engelmoer in Willems *et al.*, 2005). Thus, responses to changes in management might go in different directions, depending on the habitat preferences of a species and the geomorphological characters of the salt marshes.

A second aspect that has to be mentioned here, but that is not assessed in the current JMBB-Program, is differences in breeding success among different management regimes. Studies in Niedersachsen, reviewed by Thyen and Exo (2003), point at a higher reproductive output for several species when nests are concealed in vegetation. Direct impact of livestock grazing (*i.e.* trampling) or by machinery (destruction of clutches) was considered low, but note that sites with a high agricultural intensity were not available to compare in this review. Studies in Denmark, in the coastal grasslands of the Tøndermarsken, have shown that the daily risk for a Lapwing nest to be trampled increase from 0.05 at the density of about three young cattle/ha to 0.2 at about eight young cattle/ha. (Nielsen, 1996 in Rasmussen and Laursen, 2000). In regularly utilised farmland, trampling of clutches by livestock and destruction of nests by machines is a common phenomenon (Beintema *et al.*, 1995). As shown by Thyen and Exo (2003), not only the direct impact of agriculture matters but also the timing of breeding might be delayed when vegetation growth is suppressed. Through this process, the amount of suitable habitat in the optimal time of the breeding season declines and risk of predation might increase (since nests are less concealed). As hypothesised by Esselink (2000), intense spring-grazing of geese might well replace agricultural activities and lead to a similar delay in timing of breeding and less concealed nest sites.

Among the 31 species dealt with in the breeding bird monitoring, Oystercatcher, Avocet, Northern Lapwing, Black-tailed Godwit and Common Redshank breed in highest densities in salt marshes. Overall trends in these species from 1991 to 2001 point at fluctuating numbers (Oystercatcher, Common Redshank), stable numbers (Avocet) or declines (Northern Lapwing, Black-tailed Godwit). Considering only Schleswig-Holstein and Niedersachsen, where most pronounced changes in salt marsh management occurred, significant trends were observed for Oystercatcher (increase), Avocet (increase in Schleswig-Holstein but decline in Niedersachsen), Northern Lapwing (stable in Schleswig-Holstein), Black-tailed Godwit (decline in Niedersachsen) and Common Redshank (increase in Schleswig-Holstein but decline in Niedersachsen). Thus trends are highly variable and partly opposite to what would be expected (*e.g.* Common Redshank, decrease in Niedersachsen). For Oystercatcher and Avocet, population changes in the Wadden Sea observed after 1990 are more likely to be caused by food conditions and predation pressure rather than changes in salt marsh management (see chapters 4.2.7 and 4.2.8). The decline in Northern Lapwing is dominated by declines in the Netherlands, where impact of agricultural activities in the coastal meadows behind the seawall might have been detrimental (see chapter 4.2.11). The same applies to Black-tailed Godwit, which is also declining in salt marshes in Niedersachsen and at most inland breeding sites in all Wadden Sea countries. Declines in Common Redshank in Niedersachsen are opposite to what would be expected when taking into account that this species benefits from reduction in management. Thus, trends in population size as retrieved by the trilateral monitoring do not seem to show clear responses to habitat changes. This is not surprising since many salt marshes are still in a transition zone between entirely man-managed and natural vegetation processes, making detection of pronounced trends difficult within a decade (*cf.* Oltmanns, 2003). Moreover, as observed in *e.g.* Avocet and Oystercatcher, potential impact of habitat changes is overruled by other, currently more important factors. This means that impact of management might exist, but has not become visible yet. Finally, responses in changes in management currently might indeed be shown by different reproduction rates (*e.g.* Thyen and Exo, 2003), which is not trilaterally monitored yet. In order to get more insight into relationships between breeding bird trends and vegetation development, we therefore recommend more direct studies to compare trends in breeding birds and vegetation on a wider scale. Such studies will be enhanced by the fact that e.g. vegetation typology is now largely harmonised between the Wadden Sea countries (Bakker *et al.*, 2005) and available for further analysis. Furthermore, studies on breeding success are needed to clarify changes in reproductive output between different management regimes (see chapter 6.2). This can be achieved by the adoption of a trilateral monitoring program for breeding success (see chapter 6.2).

5.2.6 Other Aspects

In the past decade, an increase in predation pressure has been reported from many mainland salt marshes in the Wadden Sea (*e.g.* Hötker and Segebade, 2000; Rasmussen *et al.*, 2000; Koopman, 2003; Oltmanns, 2003). For some time, similar reports have been given for the Baltic coast of

Germany (Hartmann and Stier, 2003; Kube *et al.*, 2005). Red foxes *Vulpes vulpes* are most often mentioned as key predators. Colonial breeding birds like Black-headed Gull and Avocet seem to be affected at most. As a result, Black-headed Gull colonies have switched to the islands (see chapter 4.2.21) where mammalian predators are largely absent (at least red foxes and *mustelidae*). A similar development has been reported in the Netherlands for Common Tern (Dijksen and Koks, 2003). The precise impact on predation on a wider scale remains unknown since few data on nest-success and reproductive output are available (*cf.* chapter 5.3.5). So far, local studies have been carried out on the mainland coast in the Jadebusen area Nds, Leybucht Nds and Dollard NL and on the island of Wangerooge Nds. Thyen and co-workers found high rates of predation on the mainland coast in the Jadebusen, *e.g.* in Common Redshank, for which hatching success was only 2-11%, and 61-66% of all nests were raided by predators (Thyen and Exo 2003; Thyen *et al.,* 2005). On the island of Wangerooge, hatching success was much higher (89%) due to an absence of large mammalian predators like mustelids and red fox. For Avocet, Vaas and Melter (2005) monitored nest success and reproductive output in the Leybucht area Nds. They showed that only 1% of all nests hatched. Most of them (75%) were deserted at night, and tracks suggested red fox as the main predator. A similar study on Avocet by Klaassen-Bos (2005) in the Dutch section of the Dollard pointed at similar results; hatching success varied between 1.5% and 25% at two study sites. The results from these studies show that impact of predation might be large, at least on a local scale.

In terms of management, it is difficult to propose specific measurements, since predator-prey relations are often complex and are also often associated with habitat changes (Langgemach and Bellebaum, 2005). Maintaining the predator-free status of the islands is of high importance since islands can function as a source for mainland populations, as has been observed in Common Redshank in Niedersachsen (Thyen *et al.*, 2005). Also, the increases in Black-headed Gull (entire Wadden Sea) and Common Tern (Dutch section of the Wadden Sea) on islands indicate that islands are important refuges for breeding birds. Construction of connections between mainland and islands has previously shown (*e.g.* Sylt SH) that predators are easily facilitated. Any considerations of improvement of mainland-island connections (*e.g.* Hallig Oland, Schleswig-Holstein) therefore should take predation risk into account. Population control of predators is much more difficult and hampered by lack of knowledge of both predator densities and ecology and the precise impact on predation on breeding birds due to only incidental and local studies on hatching and breeding success. Several experiments with *e.g.* electrical fences have been used with different success (see Langgemach and Bellebaum, 2005 for review) but are not applicable on the scale of the Wadden Sea. The same applies to population reduction of predators by hunting or trapping. Only on small islands might the hunting of red foxes be successful, as shown on the 70 ha small island of Langli DK. Here, reduction of red fox numbers proved to reduce the predation problem significantly, leading to an almost fox-free breeding island in most years and a growth in numbers of colony breeding birds (L.M. Rasmussen). Similar experiences on the German Baltic, however, have shown that breeding success is not guaranteed when predator populations are controlled (Langgemach and Bellebaum, 2005; Kube *et al.*, 2005). Many other studies have shown that predator control on a longer term rarely leads to significant declines in predation rates (review by Langgemach and Bellebaum, 2005). Only management of formerly introduced species (like feral cats, rats, hedgehog) on islands without a connection with the mainland coast might be a solution, since it restores the initial predator-free status and resettlement without human help is not possible. In the Wadden Sea however, these species are hardly known to play an important role in predation. Therefore, providing conditions for a 'natural breeding success' on a long-term, as addressed in the Wadden Sea Plan, should be preferably done by habitat management and management of food resources, to keep populations thriving and keep the impact of predation on the local scale.

6. Implications for Management

6.1 Target Evaluation

6.1.1 Wadden Sea Plan

Two targets have been included in the Wadden Sea Plan (CWSS 1997) in order to evaluate population changes in breeding birds. These are 'natural breeding success', dealing with availability of suitable breeding habitat and the factors mentioned in chapter 5.3 and 'favourable food availability', dealing with suitable food stocks for breeding birds and their offspring (as well as migratory birds). Analysis of trends in breeding birds from 1991 to 2001 has shown that these targets have not been met for a number of species. Breeding success of at least Great Ringed Plover and Kentish Plover is still affected by negative habitat quality (lack of habitat dynamics) and human disturbance (leading to low reproductive output). So far, conservation action for these species has been taken at a local scale, but it has apparently not been able to halt the ongoing widespread declines. A major problem in comparison to *e.g.* Little Tern, which has benefited from conservation effort, is that for both species obvious breeding sites are often lacking and feeding sites after young have hatched are not taken into account. Both do not breed in distinct colonies like Little Tern. Therefore, conservation action should anticipate the breeding and feeding habits of both species and be taken before settlement occurs. Moreover, insight into large-scale processes that might cause declines is needed for both species, since they also experience declines elsewhere in the breeding range. This should involve research on breeding success, survival and movements (by colour-ring studies).

To what extent breeding success of other species is affected is less understood. As stated before (chapter 5), monitoring of breeding success is not part of the JMBB-Program and so far has been carried out at a local scale and during a pilot study in the German Wadden Sea (Thyen *et al.*, 1998). Hence, an overall evaluation of this parameter is not possible with only the data on population changes from the current breeding bird monitoring scheme. In the case of Great Ringed Plover and Kentish Plover, specific research by experts on these species has shown the bottlenecks regarding reproduction. For the majority of species such data is not available. Regarding the small numbers of breeding Ruff, Dunlin and Gull-billed Tern, where reproduction is of vital importance to retain the last breeding pairs, conservation action or specific measures might be taken into consideration as well. Especially Ruff and Dunlin are on the verge of extinction and without urgent conservation action (mainly through habitat protection) these species will not survive as breeding birds in the Wadden Sea. Gull-billed Tern is a threatened species since it breeds concentrated at only one breeding site, which makes it extremely susceptible to any kind of disturbance or changes in its environment. Considering that virtually all former breeding sites in Denmark have been abandoned, there may be no alternative breeding sites for this species. Careful monitoring of the remaining breeding sites of Ruff, Dunlin and Gull-billed Tern, including habitat changes, is recommended. Finally, as shown in the previous section (chapter 5.3.6.), 'natural breeding success' might be a prerequisite to overcoming the impact of predation. The impact of predation will increase when also other criteria providing a natural breeding success are not met (Langgemach and Bellebaum, 2005; Teunissen *et al.*, 2005).

Regarding the target of 'favourable food availability', intensive shellfish-fisheries in the Dutch part of the Wadden Sea (and previously also in Denmark) have had a major impact on breeding Common Eider and Oystercatcher, and perhaps also Herring Gull. Therefore, the ban on mechanical cockle fisheries in the Netherlands in 2004 (by legislation implemented from 1 January 2005 onwards) has been an important step towards an improvement of the available food stocks for shellfish-eating species. With the decision to discontinue cockle-fisheries in the Dutch Wadden Sea, large-scale fishery activities on this bivalve have now been phased out in the entire Wadden Sea (see Marencic, 2005). In addition to the ban on cockle fisheries, fisheries on blue mussels in the Dutch Wadden Sea have adopted new regulations as well. In a trilateral context, Dutch blue mussel fisheries (from culture lots) accounted for 60% of the average annual landings from 1993 to 2004 (Marencic, 2005). From 2005 onwards, measures will be taken to arrive at a sustainable fishery policy. Research and monitoring of breeding and migratory birds will evaluate whether these measures will prove successful with regard to food stocks available to the birds.

6.1.2 Breeding Birds in the Context of EC Directives and Red Lists

Besides the targets of the Wadden Sea Plan, the conservation status of breeding birds in the Wadden Sea has also been summarised in a 'Trilateral Red List of Birds of the Wadden Sea Area' (Rasmussen et al., 1996). Categories range from 'critical' (*e.g.* Dunlin, Ruff) to 'international responsibility for residents' (*e.g.* Shelduck, Hen Harrier, Oystercatcher). Compilation of this Trilateral Red List was only possible with the data from the trilateral monitoring program, and it played an important role in the initial evaluation of nature conservation policies in the Wadden Sea. However, it has not achieved much overall authority in practice since then. Moreover, to some extent it has meanwhile been overruled by regulations from the EC Birds and Habitats Directive, the implementation of which is in progress (Habitats Directive) and which will become increasingly important regarding conservation and monitoring of breeding birds in the Wadden Sea. It should be noted, however, that some characteristic Wadden Sea breeding bird species face problems or occur internationally in high numbers (*e.g.* Oystercatcher, Great Ringed Plover, Black-headed Gull), but are not well covered by the EC Directives. Thus, a specific instrument for the Wadden Sea still could be valuable to safeguard this category of species. The establishment of a 'List of Priority Species' would achieve this goal. In line with the sequence of the total counts, once every five years, this list could be reviewed to assist the evaluation of trilateral targets and recommendations. Proposed criteria for species on this list should be (1) occurring with >1% of the NW-European population and/or (2) experiencing a decline in 1991-2001. These criteria are met by nine species (Table 5). Besides these nine species, 14 species are listed on Annex I of the EC Birds Directive. As shown earlier (Table 4, chapter 3.2.1), trends for Annex I species Hen Harrier, Avocet, Kentish Plover, Dunlin, Ruff, Sandwich Tern, Common Tern and Short-eared Owl currently all point at an unfavourable conservation status, not only in 1991-2001. Recent data suggest that downward trends did not halt in 2001, but have continued afterwards in nearly all species (Koffijberg *et al.*, 2005b; van Dijk *et al.*, 2006).

Table 5:
List of characteristic breeding birds in the Wadden Sea that are not covered by the EC Birds Directive, but that are considered important with respect to conservation and management. This 'priority list' was compiled according to the criteria (1) population in the Wadden Sea should be >5% of the NW-European population or (2) NW-European population share is 1-5% and the trend in 1991-2001 indicates a decline, see text for details.

Shelduck *Tadorna tadorna*
Oystercatcher *Haematopus ostralegus*
Great Ringed Plover *Charadrius hiaticula*
Northern Lapwing *Vanellus vanellus*
Black-tailed Godwit *Limosa limosa*
Common Redshank *Tringa totanus*
Black-headed Gull *Larus ridibundus*
Lesser Black-backed Gull *Larus fuscus*
Herring Gull *Larus argentatus*

6.2 Recommendations for Further Studies

With this report, data on longer-term trends in breeding birds in the entire Wadden Sea have become available for the first time. When also taking data from 2002-2005 into account, monitoring data for breeding birds in the Wadden Sea now comprise a period of 15 years. Even if this period is rather short when e.g. compared to long-term changes in climate, the results from the JMBB scheme show that it is a powerful tool to assess changes in breeding bird populations in the Wadden Sea and point at negative trends in species which are considered important in management and conservation. In some species, we were able to explain the observed changes and evaluate them with respect to trilateral targets addressed in the Wadden Sea Plan. However, this was mainly possible by using data from occasional research projects. Still, there is an urgent need to have information on several other population parameters of breeding birds in the Wadden Sea, especially breeding success, and also survival. Without such data, it is not precisely known what mechanisms cause the observed trends, so backgrounds remain partly uncertain up to now. As a result, evaluation of management and conservation measures is difficult. Research on breeding success and response to management changes has hitherto only been carried out at specific sites, unevenly spread over the Wadden Sea. These studies have been important to get first insights into the processes behind the population changes (see examples in *e.g.* chapter 5.3.5), but most often it is not known if the results can be applied to the entire Wadden Sea since studies have been conducted at a local level only. Therefore, at least three types of trilateral projects should be initiated to improve our understanding of changes in breeding bird populations:

1. Monitoring of breeding success. To monitor breeding success, a pilot study was undertaken in Germany (Niedersachsen and Schleswig-Holstein) in 1996-97 (Thyen *et al.*, 1998; Thyen, 2005), but despite its aims, it has never been implemented in TMAP. A further study, according to similar methods as proposed by Thyen *et al.* (1998), has been set up in the Dutch Wadden Sea in 2004-2005 as part of the evaluation of shellfish-fisheries ('Food for Birds' project). This study will be continued in 2006 (Willems *et al.*, 2005). Methodological aspects of monitoring of breeding birds have been studied well and trilateral standards could be easily implemented, so the parameter 'breeding success' is ready and overdue for inclusion in the JMBB-Program. Knowledge on reproductive output would not only be important to explain trends, it will also be an important early-warning tool to detect environmental changes, since many species in the Wadden Sea are long-living and data on reproduction would forecast negative population developments in an earlier stage and give much more insight into population dynamics (Thyen *et al.*, 1998; Thyen, 2005; Willems *et al.*, 2005), *e.g.* in Oystercatcher, Avocet, Kentish Plover, Great Ringed Plover, Black-tailed Godwit and Common Redshank. The same also applies with special respect to e.g. the role of contaminants, which will have an impact on reproduction, and not necessarily on numbers (*cf.* Becker and Muñoz Cifuentes, 2004). Hence, also evaluation of management measures and conservation action will be more efficient when reproduction data are known.

2. Improve data series on annual survival rates. A third aspect that has to be covered when aiming for an integrated population monitoring of bird numbers is data on annual survival and mortality data. Implementation of such a scheme is more difficult than the parameter breeding success, but by encouraging volunteer ringers and anticipating on research project much progress can be made compared to the current situation. Moreover, trilateral colour-ring projects on target-species (*e.g.* Kentish Plover, Great Ringed Plover) would help to clarify the downward trends and understand the population dynamics observed in these species.

3. Analyses with existing (trilateral) data to correlate changes in bird populations with changes in *e.g.* habitat. As impressively shown by the latest Quality Status Report (Essink *et al.*, 2005), international monitoring of the Wadden Sea has arrived at high standards. However, there are currently few interactions between the different monitoring projects. Partly this is because the various monitoring schemes have been running for a too short period or only recently have data been made comparable at a trilateral scale. The latter applies *e.g.* for vegetation data of the salt marshes (Bakker *et al.*, 2005). Comparison of trends in vegetation and breeding birds on the scale of the entire Wadden Sea would be a main step towards better understanding of changes in breeding bird communities in response to management of salt marshes. So far, few local studies have been carried out to assess this aspect (see chapter 5.3.5). Results are sometimes contradictory, perhaps because other site-specific aspects interplay as well. Therefore, a trilateral project set-up is recommended to overcome these methodological aspects. Similar projects could be set up to get insight into the role of food availability by combining bird data and macrozoobenthos data or data on fish stocks. Furthermore, regarding e.g. the contrasting trends observed in Hen Harrier and Short-eared Owl between the Netherlands and Niedersachsen, comparative research projects are recommended to get insight into the backgrounds for the different trends.

A fourth point which should be considered is an evaluation of breeding bird trends and habitat management in dunes. So far, only few dune-breeding species are included in the JMBB-Program, mainly because monitoring was initially set up to focus on birds using the intertidal mud flats and rare breeding birds. However, trilateral policies have recognised dunes as being important to breeding birds (Petersen and Lammerts, 2005) and population dynamics of breeding birds may serve as indicators for dune management as well. A full coverage of all dune-breeding species (including many passerines) is currently no option regarding the monitoring activities already achieved. However, to get more insight into dynamics in breeding birds in dunes, the next total count in 2006 will also include Northern Wheatear, which is a characteristic dune-breeding species, and which has its core breeding area in the Wadden Sea.

Besides these proposals for trilaterally designed studies, we furthermore encourage any kind of national and local study that tries to explain changes in breeding birds with respect to food availability, changes in habitat, management or recreation. Even baseline ecological studies on some of the species currently experiencing declines would be most helpful to understand population dynamics and, eventually, to initiate management measures. Data from the running monitoring scheme can be made available as reference data, or can be used in further scientific analyses.

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Annex 1 Species List

List of the species in the Joint Monitoring Program for Breeding Birds in the Wadden Sea and their native language names

Euring	English name	Scientific name	Nederlandse naam	Deutscher Name	Dansk navn
720	Great Cormorant	Phalacrocorax carbo	Aalscholver	Kormoran	Skarv
1440	Eurasian Spoonbill	Platalea leucorodia	Lepelaar	Löffler	Skestork
1730	Shelduck	Tadorna tadorna	Bergeend	Brandente	Gravand
2060	Common Eider	Somateria mollissima	Eidereend	Eiderente	Ederfugl
2210	Red-breasted Merganser	Mergus serrator	Middelste Zaagbek	Mittelsäger	Toppet Skallesluger
2610	Hen Harrier	Circus cyaneus	Blauwe Kiekendief	Kornweihe	Blå Kærhøg
4500	Oystercatcher	Haematopus ostralegus	Scholekster	Austernfischer	Strandskade
4560	Avocet	Recurvirostra avosetta	Kluut	Säbelschnäbler	Klyde
4700	Great Ringed Plover	Charadrius hiaticula	Bontbekplevier	Sandregenpfeifer	Stor Præstekrave
4770	Kentish Plover	Charadrius alexandrinus	Strandplevier	Seeregenpfeifer	Hvidbrystet Præstekrave
4930	Northern Lapwing	Vanellus vanellus	Kievit	Kiebitz	Vibe
5120	Dunlin	Calidris alpina	Bonte Strandloper	Alpenstrandläufer	Almindelig Ryle
5170	Ruff	Philomachus pugnax	Kemphaan	Kampfläufer	Brushane
5190	Common Snipe	Gallinago gallinago	Watersnip	Bekassine	Dobbeltbekkasin
5320	Black-tailed Godwit	Limosa limosa	Grutto	Uferschnepfe	Stor Kobbersneppe
5410	Eurasian Curlew	Numenius arquata	Wulp	Grosser Brachvogel	Stor Regnspove
5460	Common Redshank	Tringa totanus	Tureluur	Rotschenkel	Rødben
5610	Turnstone	Arenaria interpres	Steenloper	Steinwälzer	Stenvender
5750	Mediterranean Gull	Larus melanocephalus	Zwartkopmeeuw	Schwarzkopfmöwe	Sorthovedet Måge
5780	Little Gull	Larus minutus	Dwergmeeuw	Zwergmöwe	Dværgmåge
5820	Black-headed Gull	Larus ridibundus	Kokmeeuw	Lachmöwe	Hættemåge
5900	Common Gull	Larus canus	Stormmeeuw	Sturmmöwe	Stormmåge
5910	Lesser Black-backed Gull	Larus fuscus	Kleine Mantelmeeuw	Heringsmöwe	Sildemåge
5920	Herring Gull	Larus argentatus	Zilvermeeuw	Silbermöwe	Sølvmåge
6000	Great Black-backed Gull	Larus marinus	Grote Mantelmeeuw	Mantelmöwe	Svartbag
6050	Gull-billed Tern	Gelochelidon nilotica	Lachstern	Lachseeschwalbe	Sandterne
6110	Sandwich Tern	Sterna sandvicensis	Grote Stern	Brandseeschwalbe	Splitterne
6150	Common Tern	Sterna hirundo	Visdief	Flussseeschwalbe	Fjordterne
6160	Arctic Tern	Sterna paradisaea	Noordse Stern	Küstenseeschwalbe	Havterne
6240	Little Tern	Sterna albifrons	Dwergstern	Zwergseeschwalbe	Dværgterne
7680	Short-eared Owl	Asio flammeus	Velduil	Sumpfohreule	Mosehornugl

Annex 2 List of Census Areas

List of census areas in the Wadden Sea (see Figure 2 for locations) that are used to assess trends in this report. The size is given in ha, coverage in 2001 (Y=yes, N=no).

Country	Census region	Region name	Trilateral code	Name census area	Size in ha	Coverage 2001
NL	1	Texel	11001	De Schorren	47	Y
NL	1	Texel	11002	De Slufter	96	Y
NL	1	Texel	11003	De Bol/Wagejot	88	Y
NL	1	Texel	11004	Westerduinen/Bleekersvallei	304	Y
NL	1	Texel	11005	De Geul	35	Y
NL	1	Texel	11006	Prins Hendrik polder	98	Y
NL	2	Vlieland	12020	Kroon's polders	184	Y
NL	2	Vlieland	12021	Vallei van het Veen	223	Y
NL	2	Vlieland	12022	Richel	223	Y
NL	3	Griend	12023	Griend	21	Y
NL	4	Terschelling	12024	Noordvaarder	207	Y
NL	4	Terschelling	12025	Waterplak	166	Y
NL	4	Terschelling	12026	Polder Hoorn	83	Y
NL	4	Terschelling	12027	Douwkesplak	192	Y
NL	4	Terschelling	12028	Vierde Duintjes, dunes	265	Y
NL	4	Terschelling	12029	Vierde Duintjes, salt marsh (included in 12028)		Y
NL	5	Ameland	12030	Lange Duinen, noord	14	Y
NL	5	Ameland	12031	polder near Hollum	178	Y
NL	5	Ameland	12032	Hagedoornveld	126	Y
NL	5	Ameland	12033	Nieuwlandsreid	366	Y
NL	6	Engelsmanplaat/'t Rif	12034	Engelsmanplaat/'t Rif	775	Y
NL	7	Schiermonnikoog	12035	Bancks polder	33	Y
NL	7	Schiermonnikoog	12036	Oosterkwelder	764	Y
NL	8	Rottumeroog en -plaat	13050	Rottumerplaat	723	Y
NL	8	Rottumeroog en -plaat	13069	Rottumeroog	202	Y
NL	8	Rottumeroog en -plaat	13070	Zuiderduin	38	Y
NL	9	oast Noord-Holland	11007	Balgzand saltmarsh	67	Y
NL	9	coast Noord-Holland	11010	Wieringen 1 Westerland	17	Y
NL	9	coast Noord-Holland	11011	Wieringen 2 Stroe	5	Y
NL	9	coast Noord-Holland	11012	Wieringen 3 Vatrop	7	Y
NL	9	coast Noord-Holland	11009	Stroeërkoog	58	Y
NL	10	coast Friesland	12037	Blija zomerpolder & kwelder	218	N
NL	10	coast Friesland	12038	Holwerd-oost	116	Y
NL	10	coast Friesland	12039	Paesummerlannen	168	Y
NL	10	coast Friesland	12040	Polder De Band	122	Y
NL	11	coast Groningen	13065	Julianapolder	51	Y
NL	11	coast Groningen	13066	Linthorst-Homanpolder	38	Y
NL	11	coast Groningen	13067	Noordpolder	55	Y
NL	11	coast Groningen	13068	Lauwerpolder	29	Y
NL	12	Dollart-Außenems	13053	Polder Breebaart	68	Y
NL	12	Dollart-Außenems	13059	Dollard 1 CCP km 9 Wa	38	Y
NL	12	Dollart-Außenems	13060	Dollard 2 CCP km 7 Wb	37	Y
NL	12	Dollart-Außenems	13061	Dollard 3 CCP km 4 Ia	27	Y
NL	12	Dollart-Außenems	13062	Dollard 4 CCP km 3 If	43	Y
NL	12	Dollart-Außenems	13063	Dollard 5 RWP km 1 IIb	32	Y
NL	12	Dollart-Außenems	13064	Dollard 6 RWP km 0 Iie	21	Y
NL	12	Dollart-Außenems	13055	Carel Coenraadpolder akker	84	N
Nds	12	Dollart-Außenems	21020	Bohrinsel Süd	24	Y
Nds	12	Dollart-Außenems	21021	Buttje Pad Süd	41	Y
Nds	13	Leybucht	21022	Buscherheller	64	Y
Nds	13	Leybucht	21023	Mittelplate	65	Y

Country	Census region	Region name	Trilateral code	Name census area	Size in ha	Coverage 2001
Nds	13	Leybucht	21024	Hauener Hooge	52	Y
Nds	15	Juist-Memmert	21005	Memmert	261	Y
Nds	15	Juist-Memmert	21033	Aussichtsdüne, Augustenhöhe /Juist	115	Y
Nds	16	Norderney-Baltrum-Langeoog	21026	Schlopp-Ost / Norderney	40	Y
Nds	16	Norderney-Baltrum-Langeoog	21027	Peilbake / Norderney	85	Y
Nds	16	Norderney-Baltrum-Langeoog	21032	Pyrolatal West, Pyrolatal / Langeoog	132	Y
Nds	17	Norderland-Harlingerland	21025	Westerneßmer Vorland - Teichbecken	56	Y
Nds	18	Elisabeth-Außengroden	21010	Vorland	180	Y
Nds	18	Elisabeth-Außengroden	21011	Vorland W	150	Y
Nds	19	Spieker./Wanger./Minsener Oog	21003	Minsener Oog	125	Y
Nds	19	Spieker./Wanger./Minsener Oog	21028	Franzosenschanze /Spiekeroog West	63	Y
Nds	19	Spieker./Wanger./Minsener Oog	21029	Legde Heller West / Spiekeroog Ost	98	Y
Nds	20	Mellum	21004	Mellum	336	Y
Nds	22	Jadebusen	21016	Vorland S, Vorland N	300	Y
Nds	22	Jadebusen	21017	Vorland	330	Y
Nds	24	Wurster Küste	21007	Vorland N, Vorland S, Vorland Sommer-polder N, Vorland Sommerpolder S	970	N
Nds	25	Neuwerk-Scharhörn	22001	Scharhörn	18	Y
Nds	25	Neuwerk-Scharhörn	22002	Nigehörn	20	Y
Nds	25	Neuwerk-Scharhörn	22003	Neuwerk Vorland O	85	Y
Nds	26	Elbe Niedersachsen	21030	Baljer Loch, Außendeich Nordkehdingen West	59	Y
Nds	26	Elbe Niedersachsen	21031	Wildvogelreservat Nordkehdingen	59	Y
SH	28	Salt marshes in Dithmarschen	23001	Vorland Dieksander Koog Nord	155	Y
SH	28	Salt marshes in Dithmarschen	23002	Vorland Friedrichskoog/Aug. Vikt. Koog	143	Y
SH	28	Salt marshes in Dithmarschen	23003	Helmsand	1027	Y
SH	28	Salt marshes in Dithmarschen	23004	Vorland Hedwigenkoog	219	Y
SH	29	Trischen	23014	Trischen	1549	Y
SH	35	Salt marshes in Eiderstedt	23005	Vorland St. Peter	245	Y
SH	35	Salt marshes in Eiderstedt	23006	Tuemlauer Bucht	72	Y
SH	35	Salt marshes in Eiderstedt	23007	Westerhever-Vorland	27	Y
SH	35	Salt marshes in Eiderstedt	23008	Vorland Norderheverkoog	181	Y
SH	36	Salt marshes in Nordfriesland	23009	Vorland Schobuell	328	Y
SH	36	Salt marshes in Nordfriesland	23010	Vorland Nordstrand Sued	60	Y
SH	36	Salt marshes in Nordfriesland	23011	Hamburger Hallig	75	Y
SH	36	Salt marshes in Nordfriesland	23012	Vorland Marienkoog	149	Y
SH	36	Salt marshes in Nordfriesland	23013	Vorland Rickelsbüller Koog	528	Y
SH	37	Halligen	23015	Hallig Norderoog	377	Y
SH	37	Halligen	23016	Hallig Langeneß	61	Y
SH	37	Halligen	23017	Hallig Langeneß Vorland	367	Y
SH	39	Amrum	23019	Amrum-Odde	561	Y
SH	40	Föhr	23018	Foehrer Vorland	256	Y
SH	41	Sylt	23020	Sylt Sandinseln Keitum	11	Y
SH	41	Sylt	23021	Sylt Morsum-Odde	119	Y
DK	43	Rejsby-Ballum salt marshes	31014	Ballum Forland	97	Y
DK	43	Rejsby-Ballum salt marshes	32016	Råhede Vade	58	Y
DK	44	Ribe-Darum salt marshes	32015	Jedsted Forland	133	Y
DK	45	Ho Bugt coast Skallingen	32013	Skallingen	223	Y
DK	45	Ho Bugt coast Skallingen	32014	Tarphage Enge	155	Y
DK	46	Langli	32001	Langli	97	Y
DK	47	Fano	32007	Grønningen	92	Y
DK	49	Romo-Jordsand	31006	Stormengene	55	Y
DK	49	Romo-Jordsand	31011	Rømø Nørreland	151	Y
DK	51	Ballummarsken	31007	Husum Enge	224	Y

Annex 3 Species Numbers 2001

Species and numbers in each census region in 2001. Census regions correspond with those in Figure 2. Note that census region 12 is situated in the Netherlands and Niedersachsen (in Table 1 considered as Niedersachsen) and census region 26 is situated in both Niedersachsen and Schleswig-Holstein (in Table 1 considered as Schleswig-Holstein).

Region code	Country / census region	Great Cormorant	Eurasian Spoonbill	Shelduck	Common Eider	Red-breasted Merganser	Hen Harrier	Oystercatcher	Avocet	Great Ringed Plover	Kentish Plover	Northern Lapwing	Dunlin	Ruff	Common Snipe	Black-tailed Godwit	Eurasian Curlew
	The Netherlands																
1	Texel	200	203	139	66	0	20	534	169	40	1	439	0	0	0	177	118
2	Vlieland	919	150	101	2,207	0	4	301	28	1	2	17	0	0	0	1	54
3	Griend	0	0	27	66	5	0	424	0	2	0	0	0	0	0	0	0
4	Terschelling	0	151	287	1,660	0	30	2,013	129	11	9	505	0	0	1	326	146
5	Ameland	0	37	377	146		3	2,092	79	6	3	715	0	0	0	352	101
6	Engelsmansplaat-Rif	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0
7	Schiermonnikoog	0	192	337	2,943	0	12	1,294	19	5	5	174	0	0	2	42	74
8	Rottumeroog & Rottumerplaat	77	14	34	1,047	0	1	317	18	6	4	3	0	0	0	0	1
9	coast Noord Holland	0	5	15	0	0	0	238	420	8	4	13	0	0	0	39	0
10	coast Friesland	0	0	63	0	0	0	1,266	1,453	36	0	589	0	1	0	230	0
11	coast Groningen	0	0	47	14	0	0	965	1,018	4	1	23	0	0	0	11	0
12	Dollard-Aussenems (NL+Nds)	103	0	275	1	0	0	635	604	51	21	117	3	0	1	23	2
	Niedersachsen																
13	Leybucht	0	0	70	0	0	0	560	450	65	10	163	0	0	0	83	0
14	Borkum-Lütje Hörn	212	8	312	284	0	13	1,338	127	10	7	125	0	0	12	69	24
15	Juist-Memmert	182	21	244	108	0	7	1,135	124	2	1	29	0	0	0	1	5
16	Norderney-Baltrum-Langeoog	0	18	1,018	28	0	17	4,091	151	20	2	224	0	0	3	92	59
17	Norderland-Harlingerland	0	0	184	1	0	0	434	30	18	8	41	0	0	1	3	0
18	Elisabeth-Aussengroden	0	0	25	0	0	0	116	58	2	0	28	0	0	0	6	0
19	Spieker./Wanger./Minsener Oog	0	13	405	147	0	13	1,208	95	25	7	188	0	0	1	54	7
20	Mellum	35	18	77	426	2	1	523	0	10	0	3	0	0	0	0	0
21	Aussenjade	0	0	9	0	0	0	14	0	2	0	22	0	0	0	4	0
22	Jadebusen	0	0	53	0	0	1	340	178	47	0	84	0	0	0	8	6
23	Butjadingen	0	0	23	0	0	0	154	0	2	0	21	0	0	0	11	0
24	Wurster Küste	152	0	14	0	0	0	56	3	25	0	235	0	0	0	2	0
25	Neuwerk-Scharhörn	203	0	29	0	0	0	529	13	10	5	23	0	0	0	0	0
55	Ems	0	0	43	0	0	0	17	5		0	132	0	0	21	86	0
56	Weser	0	0	19	0	0	0	25	0	1	0	76	0	0	2	41	0
26	Elbe Estuary (Nds+SH)	0	0	57	0	0	0	417	310	3	0	697	0	2	10	228	0
	Schleswig-Holstein																
27	Wetlands in Dithmarschen	0	0	251	0	0	0	891	197	52	0	953	0	7	5	191	0
28	Salt marshes Dithmarshen	0	0	69	0	0	0	1,249	1,264	7	4	173	0	0	0	4	0
29	Trischen	253	0	74	0	0	0	325	0	6	3	0	0	0	0	0	0
30	Eider Estuary	0	0	55	0	0	0	395	282	21	1	442	0	11	11	58	0
31	Nordstrand polders	0	0	60	0	0	0	180	0	0	0	100	0	0	0	0	0
32	Outer sands in Nordfriesland	0	0	0	0	0	0	19	0	5	0	0	0	0	0	0	0

Region code	Country / census region	Common Redshank	Turnstone	Mediterranean Gull	Little Gull	Black-headed Gull	Common Gull	Lesser Black-backed Gull	Herring Gull	Great Black-backed Gull	Gull-billed Tern	Sandwich Tern	Common Tern	Arctic Tern	Little Tern	Short-eared Owl
	The Netherlands															
1	Texel	223	0	4	0	1,549	1,499	16,329	7,292	0	0	0	208	57	71	7
2	Vlieland	18	0	1	0	30	870	3079	4,360	0	0	0	188	62	58	1
3	Griend	11	0	0	0	26,780	27	4	35	0	0	8,207	1,984	856	0	0
4	Terschelling	599	0	0	0	1,675	193	15,848	5,566	6	0	2	151	11	12	8
5	Ameland	400	0	0	0	7,673	1,119	3,786	5,728	0	0	6	282	120	3	3
6	Engelsmansplaat-Rif	0	0	0	0	0	0	0	0	0	0	0	2	171	0	0
7	Schiermonnikoog	154	0	0	0	6,921	836	10,679	10,302	1	0	10	1,364	45	0	1
8	Rottumeroog & Rottumerplaat	2	0	0	0	76	100	1,292	4,738	0	0	0	38	93	38	1
9	coast Noord Holland	36	0	1	0	7,036	414	29	27	0	0	0	1,079	0	0	0
10	coast Friesland	409	0	0	0	2,142	0	2	271	0	0	0	270	165	0	1
11	coast Groningen	462	0	0	0	8,580	0	17	0	0	0	0	348	43	0	0
12	Dollard-Aussenems (NL+Nds)	851	0	0	0	1,080	46	3	113	0	0	0	152	58	0	1
	Niedersachsen															
13	Leybucht	622	0	0	0	44	1	0	0	0	0	0	6	32	1	0
14	Borkum-Lütje Hörn	169	0	0	0	2,768	234	305	1,370	0	0	0	33	105	67	11
15	Juist-Memmert	129	0	0	0	5,698	352	5,195	4,427	0	0	2,147	163	74	15	4
16	Norderney-Baltrum-Langeoog	221	0	0	0	10,398	829	6,671	4,759	0	0	0	151	142	118	20
17	Norderland-Harlingerland	346	0	0	0	1	0	0	5	0	0	0	0	0	0	0
18	Elisabeth-Aussengroden	250	0	0	0	0	0	0	0	0	0	0	0	0	0	3
19	Spieker./Wanger./Minsener Oog	203	0	1	0	16,104	514	5,598	1,655	0	0	663	2,813	555	86	18
20	Mellum	61	0	0	0	5	371	3,519	10,509	0	0	0	15	2	0	1
21	Aussenjade	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Jadebusen	2,015	0	0	0	460	18	0	0	0	0	0	18	0	0	0
23	Butjadingen	340	0	0	0	0	0	0	0	0	0	0	126	0	0	0
24	Wurster Küste	292	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	Neuwerk-Scharhörn	29	0	0	0	7,658	15	499	1,489	0	0	0	1,266	629	11	3
55	Ems	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	Weser	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	Elbe Estuary (Nds+SH)	242	0	1	0	2,052	131	0	0	0	7	0	1,475	0	0	0
	Schleswig-Holstein															
27	Wetlands in Dithmarschen	305	0	0	0	1	7	0	2	0	0	0	40	6	0	0
28	Salt marshes Dithmarshen	387	0	0	0	4,759	53	0	131	0	46	0	236	491	0	0
29	Trischen	104	0	0	0	4,210	219	1,247	5,843	5	0	2,420	186	53	2	0
30	Eider Estuary	336	0	0	0	356	8	0	4	0	0	0	2	66	0	0
31	Nordstrand polders	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	Outer sands in Nordfriesland	0	0	0	0	0	0	0	6	0	0	0	0	2	1	0

Region code	Country / census region	Great Cormorant	Eurasian Spoonbill	Shelduck	Common Eider	Red-breasted Merganser	Hen Harrier	Oystercatcher	Avocet	Great Ringed Plover	Kentish Plover	Northern Lapwing	Dunlin	Ruff	Common Snipe	Black-tailed Godwit	Eurasian Curlew
33	Wetlands in Eiderstedt	0	0	16	0	0	0	12	40	0	0	10	0	0	0	0	0
34	Wetlands in Nordfriesland	0	0	92	14	4	0	632	674	98	41	712	0	9	19	107	0
35	Salt marshes in Eiderstedt	0	0	42	0	0	0	1,265	363	37	93	73	2	0	0	8	0
36	Salt marshes in Nordfriesland	0	0	85	0	0	0	1,619	618	29	2	224	0	0	2	31	0
37	Halligen	0	1	203	195	23	0	5,497	377	100	1	94	0	0	0	1	0
38	Pellworm	0	0	467	0	0	0	1,926	107	18	0	664	0	0	0	28	0
39	Amrum	0	0	97	162	6	0	873	78	19	0	119	0	0	1	0	1
40	Föhr	1	0	214	11	0	1	929	61	7	0	488	0	0	0	71	0
41	Sylt	0	0	108	0	0	2	535	87	67	16	276	0	0	15	126	0
	Denmark																
42	Margrethe Kog wetland-Koldby	0	0	20	2	0	0	199	136	28	1	21	0	0	0	0	0
43	Rejsby-Ballum salt marshes	0	0	93	22	0	0	253	11	38	1	62	1	0	0	1	0
44	Ribe-Darum salt marshes	0	0	6	35	0	0	102	27	45	0	29	0	0	0	0	0
45	Ho Bugt coast Skallingen	0	0	22		0	0	54	3	37	0	131	0	0	1	0	0
46	Langli	0	0	7	196	0	0	132	18	3	0	5	0	0	0	0	0
47	Fanø	0	0	71	40	0	0	233	13	13	18	244	6	0	26	0	22
48	Mandø	0	0	0	637	1	0	809	81	1	0	255	1	0	0	90	0
49	Rømø-Jordsand	0	0	29	39	2	0	509	47	40	68	290	12	3	12	73	20
50	Tøndermarsken	0	0	13	0	1	0	98	7	0	1	493	0	0	1	125	0
51	Ballummarsken	0	0	28	0	0	0	40	25	0	0	276	0	0	0	11	0
52	Rejsby- og Brønsmarsken	0	0	39	0	0	0	37	10	0	0	224	0	0	2	2	0
53	Ribe- og Tjæreborgmarsken	0	0	35	0	0	1	70	163	10	0	517	0	0	23	8	0
54	Varde Ådal	0	0	0	0	0	0	1	0	0	0	82	0	0	17	0	0
	Total breeding pairs Wadden Sea	**2337**	**831**	**6,480**	**10,497**	**44**	**126**	**39,927**	**10,170**	**1093**	**340**	**11,643**	**25**	**33**	**189**	**2,824**	**640**

Region code	Country / census region	Common Redshank	Turnstone	Mediterranean Gull	Little Gull	Black-headed Gull	Common Gull	Lesser Black-backed Gull	Herring Gull	Great Black-backed Gull	Gull-billed Tern	Sandwich Tern	Common Tern	Arctic Tern	Little Tern	Short-eared Owl
33	Wetlands in Eiderstedt	14	0	0	0	27	0	0	0	0	0	0	0	0	0	0
34	Wetlands in Nordfriesland	403	0	0	0	726	23	5	165	2	1	0	63	227	12	0
35	Salt marshes in Eiderstedt	537	0	0	0	1,395	184	0	120	0	0	0	73	215	74	0
36	Salt marshes in Nordfriesland	943	1	0	0	3,865	118	8	181	0	0	0	25	171	0	0
37	Halligen	508	0	0	0	14,510	1,437	155	3,531	1	0	3,003	1,126	2,621	100	0
38	Pellworm	267	0	0	0	348	23	0	7	0	0	0	1	64	11	0
39	Amrum	77		0	0	394	1,947	5,789	1,536	4	0	0	38	81	66	2
40	Föhr	75	0	0	0	2,210	47	58	125	0	1	0	123	122	40	0
41	Sylt	223	0	0	0	289	161	23	468	2	0	0	2	206	88	0
	Denmark															
42	Margrethe Kog wetland-Koldby	2	0	0	0	1	4	0	22	0	0	0	10	0	0	0
43	Rejsby-Ballum salt marshes	444	0	0	0	0	0	0	0	0	0	0	0	0	0	1
44	Ribe-Darum salt marshes	217	0	0	0	10	0	0	0	0	0	0	0	0	0	0
45	Ho Bugt coast Skallingen	196	0	0	0	57	6	0	7	0	0	0	5	14	28	0
46	Langli	3	0	0	0	9,310	1,555	219	3,211	0	0	714	0	118	0	0
47	Fanø	275	0	0	0	322	9	0	0	0	0	0	0	359	57	0
48	Mandø	75	0	0	0	196	346	12	665	5	0	0	44	144	0	3
49	Rømø-Jordsand	516	0	0	0	379	117	1	30	1	1	0	2	281	162	0
50	Tøndermarsken	235	0	0	0	1	4	0	22	0	0	0	10	0	0	0
51	Ballummarsken	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	Rejsby- og Brønsmarsken	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	Ribe- og Tjæreborgmarsken	80	0	1	0	3,259	0	0	0	0	0	0	9	0	0	0
54	Varde Ådal	96	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total breeding pairs Wadden Sea	**14,722**	**1**	**9**	**0**	**155,355**	**13,837**	**80,372**	**78,722**	**27**	**56**	**17,172**	**14,127**	**8,461**	**1,121**	**89**

Annex 4 Field Workers and Institutions

The total survey in 2001 and the annual coverage of census areas had not been possible without the help of all fieldworkers, staff from various institutes and staff from site-managers, the latter also being essential in permitting access to their reserves. All participants and contributors are listed below according to their country.

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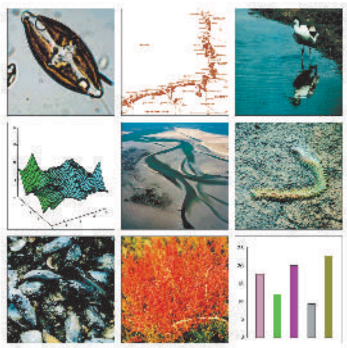

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