Status of populations and management of Dunlin *Calidris alpina*, Ruff *Philomachus pugnax* and Black-tailed Godwit *Limosa limosa* in Denmark

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(Med et dansk resumé: Status for bestande og forvaltning af Alm. Ryle, Brushane og Stor Kobbersneppe i Danmark)

Recent overviews (e.g. Grell 1998, Thorup 2000, 2004) show that populations of a number of meadow birds confined to wet grassland – including Dunlin *Calidris alpina*, Ruff *Philomachus pugnax* and Black-tailed Godwit *Limosa limosa* – are declining in Denmark as well as elsewhere in Europe. Breeding habitat degradation due to intensification of farming is thought to be the primary cause but also increased predation, climate change, pollution and habitat change in winter quarters have been mentioned as probable factors of importance for the population declines (Beintema et al. 1995, Zöckler 2002a,b, Thorup 2004).

In order to obtain a better understanding of this decline in Denmark, all available population data of Dunlin, Ruff and Black-tailed Godwit are compiled and analysed. Previously, the results were published from four countrywide surveys in 1964-72, 1977-81, 1987-89 and 1993-96 (Dybbro & Jørgensen 1971, Ferdinand 1971, 1980, Dybbro 1985, Hansen 1985, Falk & Brøgger-Jensen 1989, Grell 1998). However none of these surveys were complete, nor did they systematically estimate populations from breeding sites not covered by the surveys. In this project the gaps are filled in with best available data from various published and unpublished sources, and the national totals from around 1970 and the 1980s are re-estimated. In addition a detailed population status is given with a list of all presently occupied breeding sites of the three species.

With the aim to examine possible management changes that could interrupt the downward trend I have compiled information on management practises in the most important areas for breeding meadow birds. In many areas there exists fairly detailed information on management, and it is analysed whether there is correlation between certain management practises and population trends. Strongly divergent population trends in areas with different management would indicate that the recent declines are caused by factors within the breeding areas rather than by more general factors like climate change or pollution.

Material and methods

Study species. In Denmark the three studied species are confined to meadows and pastures in the breeding season. The Danish breeding Dunlins belong to the small biogeographical population 'Baltic Dunlin' (for definition and demarcations of biogeographical populations see Scott & Rose 1996, Thorup 2004) which is confined to meadows and pastures around the Baltic Sea and Kattegat and along the eastern shores of the North Sea. Danish Ruffs belong to the huge European

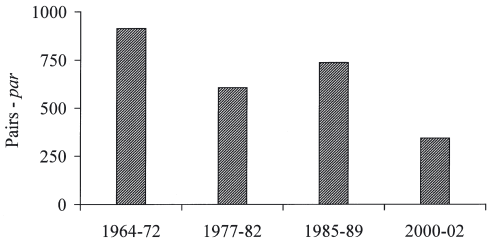


Fig. 1. Number of breeding pairs of Dunlin in Denmark in four periods.
Antal ynglepar af 'engryle' (se resuméet) i Danmark.

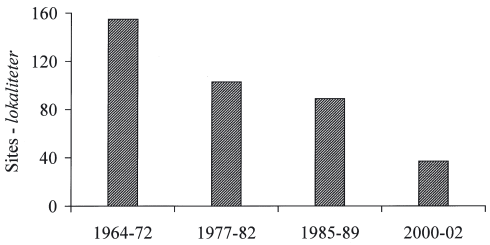


Fig. 2. Number of occupied Dunlin breeding sites in Denmark in four periods.
Antal lokaliteter med mindst ét ynglepar af 'engryle' i Danmark.

population mainly breeding in tundra and peatland in northern Fennoscandia and Russia. Danish breeding Black-tailed Godwits (of ssp. *limosa*) belong to a population breeding in grassland at middle latitudes, from the Netherlands and England to central Russia and Kazakhstan (Thorup 2004).

Present population sizes. Breeding populations of Dunlin, Ruff and Black-tailed Godwit are regularly monitored at a number of the most important sites: Annually at Tipperne (Thorup 2002), Vejlerne (Nielsen & Rasmussen 2002), Nyord (S.F. Hansen & N.P. Andreasen pers. comm.), Saltholm (M. Jørgensen pers. comm.), Vestamager (H. Olsen pers. comm.), Sydamager (P. Berg pers. comm.), Ulvedybet (M. Pedersen pers. comm.), Agger Tange (A. Linnet pers. comm.), a number of sites in Storstrøm's and Vestsjælland's counties (Jørgensen 1998, 2002, pers. comm.), and in Fyn's county (L. Bisschop-Larsen pers. comm.); and every five years in the Danish Wadden Sea (last survey in 2001; unpublished data from DOF/NERI project database).

In order to obtain up-dated estimates, I contacted a number of key-persons and asked for additional information including information on management practises. This turned out to be a very valuable source of hitherto unpublished population and management data. A list of contributors is given under acknowledgments.

Regular monitoring data and additional unpublished population data provided estimates from the years 2000-02 from almost all breeding sites of the three species (listed in Appendix 1). Some additional population data together with a large amount of negative information from sites where the species no longer breed were published in reports from the project *Fuglenes Danmark* performed in 1993-96 (Biledgaard & Nielsen 1998, Grell 1998, Lange & Nielsen 1998, Nielsen 1997a-f, Nielsen & Nielsen 1998, Pedersen & Nielsen 1998, Vikstrøm & Nielsen 1998).

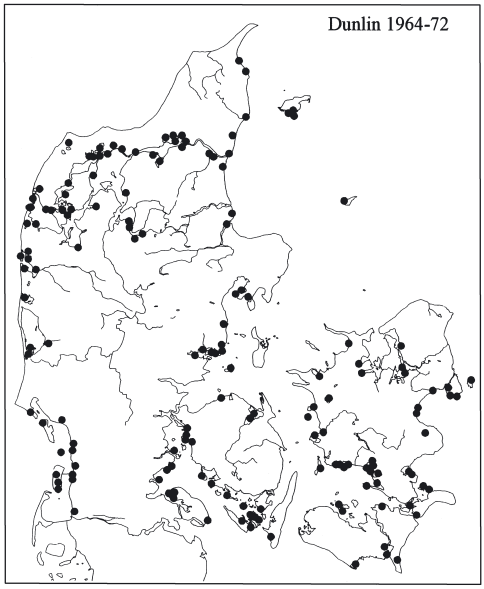
Trends. Three nation-wide surveys of the vulnerable meadow birds have been performed during the last 40 years.

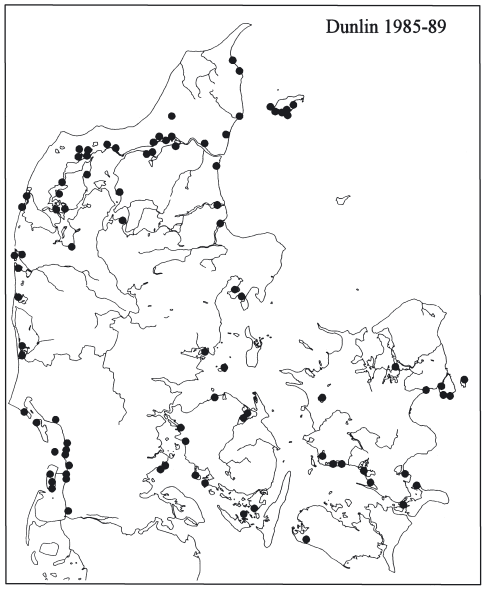
1964-72: The first large-scale survey of population sizes at Danish meadow and saltmarsh sites was undertaken in 1964-72 (Ferdinand 1971, 1980). This survey – together with a countrywide survey directed at Dunlin, Ruff and Black-tailed Godwit taking place in 1970 (Dybbro & Jørgensen 1971) – covered most sites where the three species were breeding. The only major gap was the Danish Wadden Sea where a number of the huge saltmarsh and polder areas were not surveyed effectively until 1977 (Møller et al. 1978). When more than one good count from the period are available, the first was chosen for the present purpose.

1977-82: The next larger survey (Møller et al. 1978, Dybbro 1985) again included a one-season special survey directed at Dunlin, Ruff and Black-tailed Godwit (Hansen 1985). When more good counts were available, results closest to the year 1980 were chosen.

1985-89: Another large survey was performed in 1987-89 when breeding populations were counted at most of the 111 Danish EC Special Protection Areas (Falk & Brøgger-Jensen 1990). A countywide survey was performed in Storstrøm's county 1985-89 (Jørgensen 1989), and from this period there are also data from a growing number of additional counts performed in many important meadow bird areas, published in various regional reports. When more good counts were available, results closest to the year 1986 were chosen.

Good counts. The exact number of breeding pairs (or breeding female Ruffs) is difficult to establish





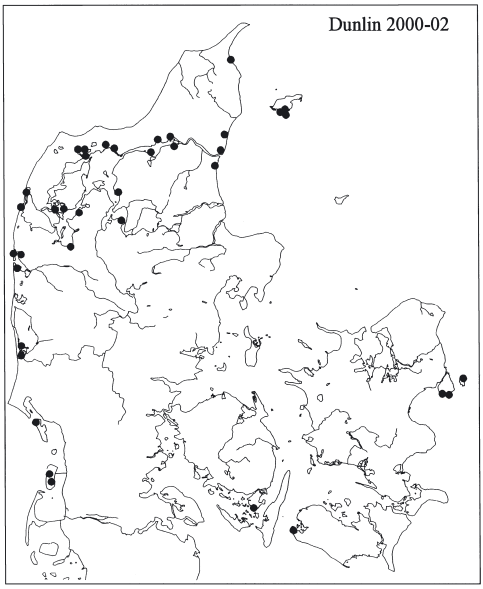


Fig. 3. Dunlin breeding sites in Denmark in three periods (Bornholm, with no breeding Dunlin during 1964-2002, is excluded from the maps).
Kort over lokaliteter med mindst ét ynglepar af 'engryle' (Bornholm, hvor Alm. Ryle ikke ynglede i perioden 1964-2002, er udeladt fra kortene).

in the three species due to the fact that they – and particularly Dunlin and Ruff – are difficult to count and interpretation of count results is not straightforward (Thorup 1998). Nevertheless, I have used the breeding numbers as they were reported. When more than one breeding figure were provided from a given year or period I have used the highest estimate, given that it was procured by an observer with good experience of the species and/or site in question. Underestimates are much more likely than overestimates in breeding surveys of the three species (Thorup 1998).

Good management. Studies in the Netherlands and Denmark of breeding performance and habitat choice in meadow birds have improved our knowledge of what various management implies for breeding Dunlin, Ruff and Black-tailed Godwit (e.g. Beintema 1991, Beintema et al. 1995, Thorup 1998, 2000). In the present context the Danish breeding sites for the three species were examined according to whether management plans ensure proper management in agreement with most or all the recommendations for good meadow bird management given by the abovementioned publications (summarized in Appendix 2).

Results

Dunlin

In 2000-02 350 pairs bred in Denmark. This is only 38% of the number of pairs in 1964-72 and 47% of the number in 1985-89 (Fig. 1). The world population of 'Baltic Dunlin' is around 1250 pairs (Thorup 2004), and breeding numbers at six Danish sites (see Appendix 1) exceeded 1% of this number qualifying them as areas of international importance. This was also the case for two EC Special Protection Areas ('Ulvedybet and Nibe

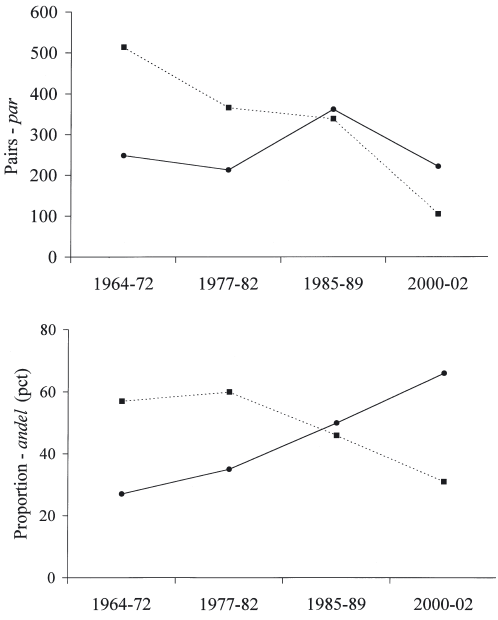


Fig. 4. Number and proportion of breeding Dunlin pairs in Danish EC Special Protection Areas at ten sites with good management for meadow birds (dots) and at the remaining protected areas with less appropriate management (squares) in 1964-2002.
Antal ynglepar og andel af ynglepar af 'engryle' i danske EF-fuglebeskyttelsesområder i hhv. ti områder med god engfugleforvaltning (prikker) og i de øvrige fuglebeskyttelsesområder uden eller med ringe engfugleforvaltning (kvadrater) i 1964-2002.

Bredning', 'Rømø') including more than one site. At present the Danish population constitutes approximately 28% of the total, a decline from 48% in 1996. In 1980 the proportion was 20% (Thorup 2000).

There was a marked contraction in breeding distribution from 1964-72 to 2000-02 (Fig. 2-3). In 1964-72 Dunlins were widely distributed at most Danish coastal meadows and saltmarshes and bred at 155 sites – approximately half of the surveyed coastal sites. In 1977-82 the species had disappeared from 33% of these sites, and in 1985-89 from an additional 10%; in eastern Denmark (east of Jylland) only 25 of 63 breeding sites were still occupied. In 2000-02 a mere 24% of the 1964-72 sites still had breeding Dunlin; the species had disappeared completely from the east coast of Jylland and from all but 8% of the sites in eastern Denmark.

In 1964-72 84% of the Danish total was found in areas that were later to be designated as EC Special Protection Areas. In 1985-89 – just after the designation – this proportion had increased to

Fig. 5. Number of breeding females of Ruff in Denmark in four periods.
Antal ynglende hunner af Brushane i Danmark.

95%, while 97% of the present breeding population is within the protected areas. At ten sites the state or county (or a private idealistic foundation) undertakes good management for breeding meadow birds while at the remaining EC Special Protection Areas management is, at most, partly directed towards meadow birds. Population trends from 1985-89 to 2000-02 at the well-managed sites differ markedly from those at the other protected areas (Fig. 4; $\chi_1^2 = 20.5$, $P < 0.001$).

Ruff

The latest counts amount to 132 breeding females, a mere 11% of the total from 1964-72 (1219) and 16% of the total from 1985-89 (Fig. 5). When taking into account unsuccessful females overlooked during the counts, the total Danish population in 2000-02 is estimated at 150 females. At a biogeographical population level Denmark is only of marginal importance since the population total is in the order of 244 000 – 526 000 females. However, the Danish breeders constitute around 10% of the birds breeding in meadows in central

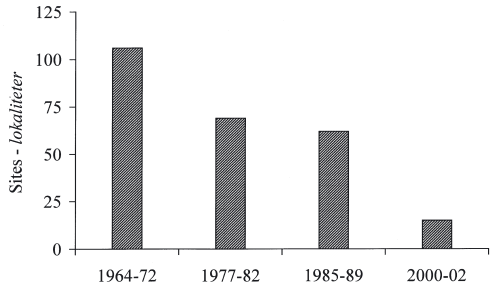
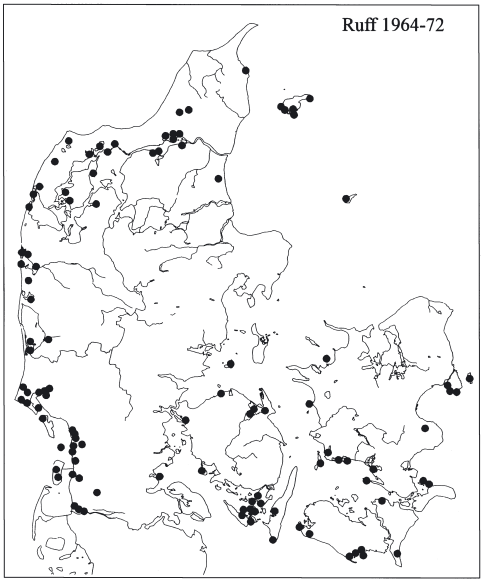
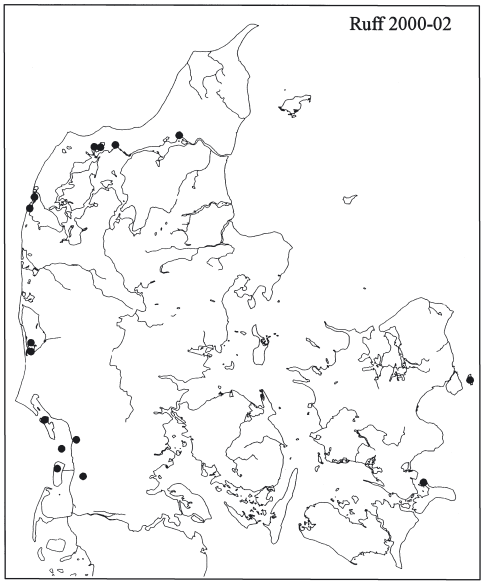


Fig. 6. Number of occupied Ruff breeding sites in Denmark in four periods.
Antal lokaliteter med mindst én ynglehun af Brushane i Danmark.





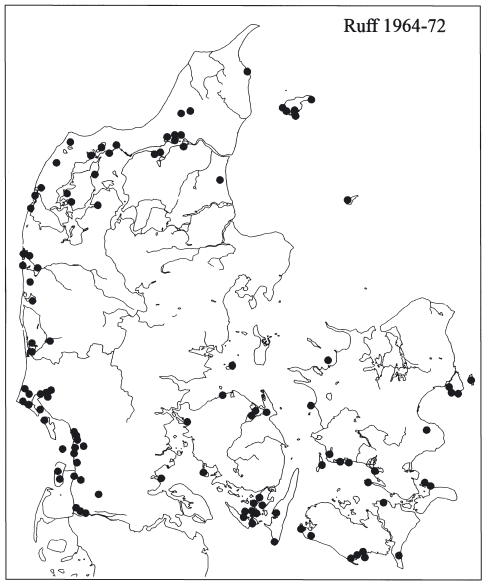


Fig. 7. Ruff breeding sites in Denmark in three periods (Bornholm, with no breeding Ruff during 1964-2002, is excluded from the maps).
Kort over lokaliteter med mindst én ynglehun af Brushane (Bornholm, hvor Brushane ikke ynglede i perioden 1964-2002, er udeladt fra kortene).

and western Europe where the population is declining steeply (Thorup 2004).

There was a similar strong decline in the number of breeding sites (Fig. 6-7). In 1964-72 Ruffs bred at 106 sites of which 76 were situated along the west coast of Jylland. In 1977-82 the species had disappeared from 35%, and in 1985-89 from 42% of these sites. Today the species remains at only 15 sites of which 11 are occupied each year. The range contraction was particularly pronounced in Storstrøm's county in the southeast where Ruffs disappeared from 77% of the breeding sites between 1964-72 and 1985-89.

From the first survey in 1964-72 Ruffs were largely confined to areas that were later to be designated as EC Special Protection Areas, with 91% of the birds inside such areas. Just after the designation this value had increased to 97%, showing that the designation of Protection Areas covered the species very well. The Ruff is listed in Annex 1 in the EC Birds Directive, which lists species that are in need of special protective measures. All breeding sites in 2000-02 are within EC Special Protection Areas.

From 1964-72 to 1985-89 breeding numbers increased in ten well-managed areas. This increase was particularly marked between 1977-82 and 1985-89 when most management plans were developed and implemented (Fig. 8). In the other less well-managed EC Special Protection Areas populations declined during the same period. From 1985-89 to 2000-02 Ruffs declined everywhere, but the decline was much more moderate in the ten well-managed areas (Fig. 8; $\chi_1^2 = 31.6$, $P < 0.001$).

Black-tailed Godwit

The total Danish population was 709 pairs in 2000-02; 4% more than in 1964-72, but only 76% of the 935 pairs present when the population peaked in 1977-82 (Fig. 9). The Danish breeders

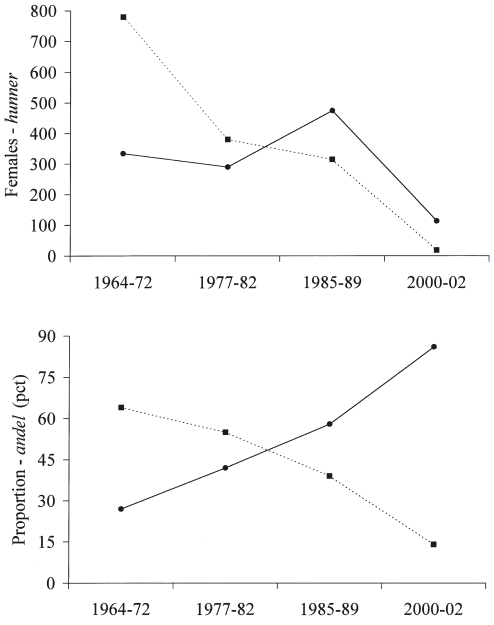


Fig. 8. Number and proportion of breeding Ruff females in Danish EC Special Protection Areas at ten sites with good management for meadow birds (dots) and at the remaining protected areas with less appropriate management (squares) in 1964-2002.
Antal ynglende hunner og andel af ynglende hunner af Brushane i danske EF-fuglebeskyttelsesområder i hhv. ti områder med god engfugleforvaltning (prikker) og i de øvrige fuglebeskyttelsesområder uden eller med ringe engfugleforvaltning (kvadrater) i 1964-2002.

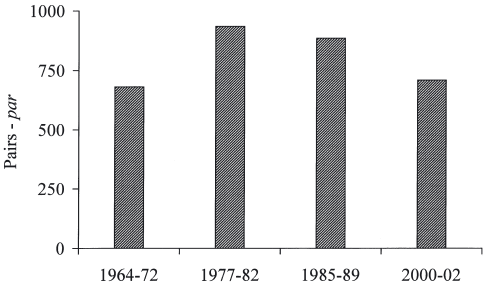


Fig. 9. Number of breeding pairs of Black-tailed Godwit in Denmark in four periods.
Antal ynglepar af Stor Kobbersneppe i Danmark.

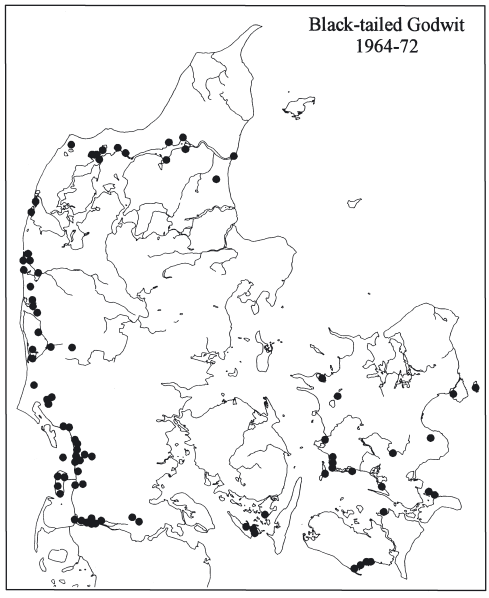
constitute a small but growing proportion of the world population of *L. l. limosa* (0.5% in the mid 1980s, 0.7% in 2002; Thorup 2004). During the last 20 years the major European populations in the Netherlands, Germany, Poland and Belarus halved, and the subspecies is now of particular conservation concern (Thorup 2004).

Throughout the period 1964-2002 Black-tailed Godwits have been concentrated along the west coast of Jylland (Fig. 10). In 1964-72 55% of 84 breeding sites were in this region, while 13% were in the Limfjorden area and 15% on Sjælland. The 20 largest breeding sites were all situated in Jylland, 13 of them in the Wadden Sea. In 2000-02 58% of 33 breeding sites were along the west coast of Jylland, 9% at Limfjorden and 21% on Sjælland. Today 16 of the 20 largest breeding sites are in Jylland, 9 of them in the Wadden Sea.

Despite the increase in numbers until 1977-82, the species disappeared from 34% of the breeding sites occupied in 1964-72 (Fig. 11). In 1985-89 the proportion of sites being deserted had increased to 40%, and in 2000-02 to 61%.

The entire Danish population of Black-tailed Godwit has bred within the 111 EC Special Protection Areas since they were designated in 1983, and in 1964-72 97% of the total was found in areas that were later to be designated. In ten well-managed areas breeding numbers increased both before and after the designation, while populations in the remaining EC Special Protection Areas declined

Fig. 10. Black-tailed Godwit breeding sites in Denmark in three periods (Bornholm, with no breeding Black-tailed Godwit during 1964-2002, is excluded from the maps).
Kort over lokaliteter med mindst ét ynglepar af Stor Kobbersneppe (Bornholm, hvor Stor Kobbersneppe ikke ynglede i perioden 1964-2002, er udeladt fra kortene).



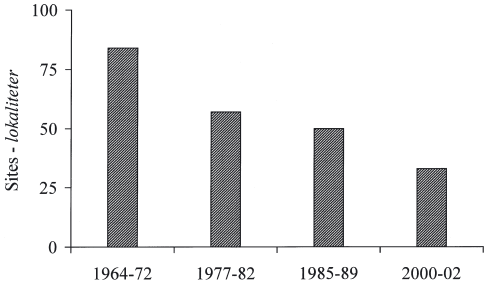


Fig. 11. Number of occupied Black-tailed Godwit breeding sites in Denmark in four periods.
Antal lokaliteter med mindst ét ynglepar af Stor Kobbersneppe i Danmark.

markedly during the period from 1985-89 – just after designation – to 2000-02 (Fig. 12; difference between area categories: $\chi_1^2 = 56.9$, $P < 0.001$).

Discussion

Coverage. Existing data did not ensure complete coverage in any of the four periods chosen for the trend analysis. However, between 81% and 100% (average 87%) of the estimated populations were counted within the chosen periods for all species and periods except two: 1) only 64% of the Black-tailed Godwit estimate from 1964-72 was counted

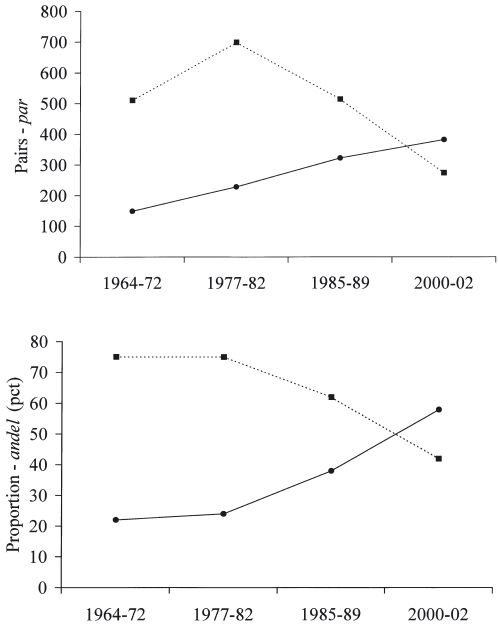
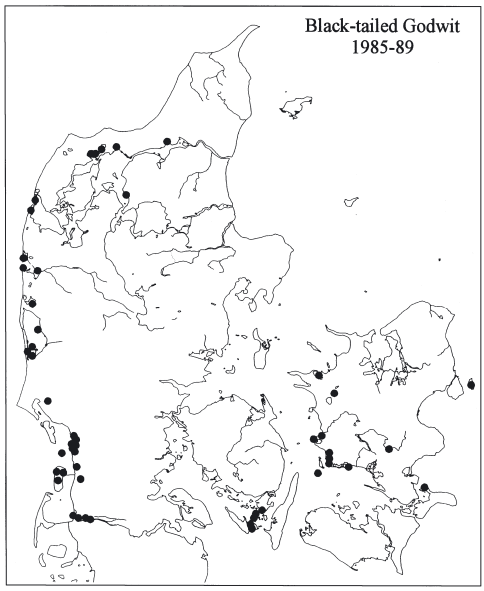
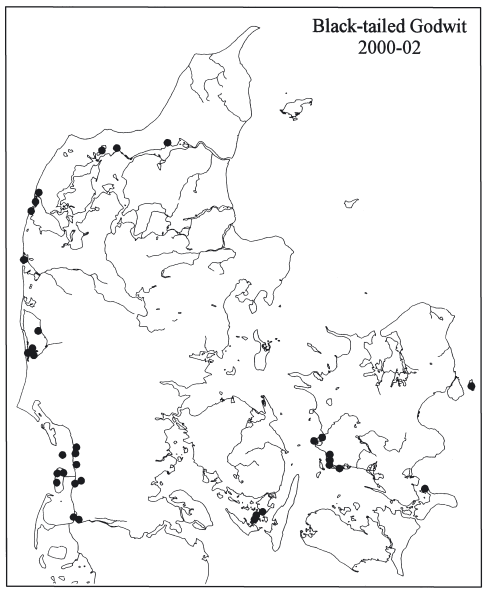


Fig. 12. Number and proportion of breeding Black-tailed Godwit pairs in Danish EC Special Protection Areas at ten sites with good management for meadow birds (dots) and at the remaining protected areas with less appropriate management (squares) in 1964-2002.
Antal ynglepar og andel af ynglepar af Stor Kobbersneppe i danske EF-fuglebeskyttelsesområder i hhv. ti områder med god engfugleforvaltning (prikker) og i de øvrige fuglebeskyttelsesområder uden eller med ringe engfugleforvaltning (kvadrater) i 1964-2002.





within the period (a further 20% in 1977), and 2) only 72% of the Dunlin estimate for 1985-89 was counted within the period (most of the remaining in 1980 and 1983). The missing Dunlin data from 1985-89 are not supposed to have caused any bias. On the other hand the missing Godwit data, in particular from the Wadden Sea, could have biased the result one way or the other – trends in the large polder areas in the Wadden Sea during the second half of the 1960s and first half of the 1970s are virtually unknown.

The proportion of sites covered within the chosen periods are generally high. Exceptions are sites with small numbers of Dunlin and Ruff that have a high proportion of overlapping data in 1977-82 and 1985-89, and Dunlin sites in 2000-02 of which 38% were actually counted in 1993-96. In consequence, the distribution maps for Dunlin and Ruff from 1985-89 (Fig. 3 and 7) to some extent show the situation a few years earlier, and the 2000-02 map for Dunlin may give a too optimistic picture of the number of occupied sites, as some of the smaller sites may have been abandoned during the late 1990s.

Population estimates. For all three species the 1964-72 estimates in the present analysis (Dunlin 914 pairs, Ruff 1219 females, Black-tailed Godwit 681 pairs) are much higher than previously published estimates from the 1970 survey: Dunlin 600, Ruff 450-500 and Black-tailed Godwit 350 (Dybbro & Jørgensen 1971). The discrepancy is partly due to a better coverage of the present analysis, in particular the inclusion of the large populations of Ruff and Black-tailed Godwit in polders and saltmarsh in the Wadden Sea area. Furthermore, the construction of a number of embankments in the late 1960s (e.g. Ferdinand 1980) that destroyed or deteriorated huge areas of wet grassland meant a wide-scale population decline for meadow birds. In many cases the present 1964-72 estimates are based on pre-embankment populations while the Dybbro & Jørgensen estimates were calculated from post-embankment figures.

Possible negative factors not related to breeding site management. Dunlins and Black-tailed Godwits show a high breeding site-tenacity (Groen 1993, Thorup 1999) and the fact that population trends in well-managed areas are positive (or only slightly negative), in contrast to other areas, makes it highly unlikely that factors outside the breeding areas have played a major role in the recent population declines of the two species. If conditions outside the breeding areas worsened significantly it should influence populations negatively everywhere. On the other hand, the Ruff exhibits a less pronounced site-tenacity and is more nomadic (Andersen 1948, 1951, Scheufler & Stiefel 1985), and reduced adult survival might well result in a concentration of the decreasing populations to the best breeding sites, in agreement with the pattern seen in this analysis.

Zöckler (2002b) suggested that global warming influenced the Ruff population negatively in the southernmost part of its range. I find it unlikely, however, that this could be the case for Danish breeders. Historically, Ruffs bred south to central France, Hungary and Ukraine (Glutz von Blotzheim et al. 1975), and climate change up till now has hardly warmed the Danish climate to a level that makes it unsuitable for breeding Ruff.

Habitat deterioration in the common winter quarters in western Africa has also been suggested to be an important cause of the wide-scale population declines in Ruff and Black-tailed Godwit in continental Europe (Zöckler 2002a). Population declines in Ruffs in the West African wintering sites are poorly documented, however, and repeated counts in Mali during 1972-2001 did not show any decline (Trolliet & Girard 2001). Moreover, the almost synchronous population development in Dunlin – utilizing a completely different winter habitat – does not support the proposition that the main reason for the recent declines in these species should be found outside Denmark.

Increased predation may have contributed to the recent population declines. In various studies from northern Europe, Marsh Harrier *Circus aeruginosus*, fox *Vulpes vulpes* and feral mink *Lutreola vison* have been found to decrease the breeding success of waders significantly (Jönsson 1985, 1991, Thorup 1998, 2002, Olsen 2000, Zöckler 2002a). Danish populations of these three species have increased substantially, the Marsh Harrier tenfold between 1964 and 1996 (Ferdinand 1980, H.E. Jørgensen in Grell 1998), and mink only appeared in Danish meadows and saltmarshes during the last 10-20 years (Hald-Mortensen 1998). There is also a general impression of a wide-scale increase in the number of foxes throughout Denmark (Hald-Mortensen 1998, Rasmussen 1999, Kjeldsen 2000, N.P. Andreasen, K. Fischer, J. Gregersen, S.F. Hansen pers. comm.). However, predator control is only performed in some of the areas, well-managed as well as less well-managed, and it is therefore unlikely

that increased predation is a primary cause of the population declines.

Another factor potentially reducing breeding success in waders is airborne soluble nitrogen (ammonium or nitrate) pollution. During the 1980s levels of these substances increased markedly in Denmark; subsequently, the increase slowed, and a slight reduction was observed in the late 1990s and early 2000s (Wilhjelmudvalget 2001). Conceivably, the application of airborne nitrogen nutrients may deteriorate breeding conditions by promoting vegetation growth, especially in Dunlin and Ruff that have a long breeding periods with small chicks well into July. These chicks are kept in moist depressions and dried-out pools in the meadows and hence require patches of fairly low and open vegetation (Thorup 1998). The tolerance level of the two species has never been examined in detail, however.

Conclusion. An analysis of management practises in the 25 most important meadow bird breeding sites in Denmark (elaborated in Thorup 2004) identified four key elements in good management: 1) the maintenance of a high freshwater table in the meadows, 2) absence of fertilizer application, 3) grazing with cattle in moderate densities and a fairly late release date (late May – early June), 4) regular mowing late in the season (July-August). Most likely, the introduction of strict regulations concerning these four management tools in management plans for EC Special Protection Areas designated to protect breeding meadow birds would be necessary in order to safeguard viable populations of Dunlin, Ruff and Black-tailed Godwit in Denmark, where elements (1) and (4) in particular are rarely practiced nowadays. In addition, it is important for the future survival of Ruff and Black-tailed Godwit that the salinity of floodwater in fresh or fresh-brackish meadows is not increased for, e.g., nature restoration purposes, because the two species are almost completely confined to low salinity water regimes, with Ruff having the lowest salt water tolerance (Glutz von Blotzheim et al. 1975, Thorup 1998, 2002).

Acknowledgments

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Resumé

Status for bestande og forvaltning af Alm. Ryle, Brushane og Stor Kobbersneppe i Danmark

Bestandene hos adskillige engfugle er gået tilbage de senere år, både i Danmark og i det øvrige Europa (Grell 1998, Thorup 2000, 2004). I Danmark gælder det i særlig grad 'engryle' (den biogeografiske bestand af Almindelig Ryle omkring Østersøen og Kattegat og langs Nordsøens østkyst), Brushane og Stor Kobbersneppe. Denne undersøgelse har til formål at dokumentere tilbagegangen og at undersøge årsagerne, for i givet fald at finde måder at stoppe den på. For at få så komplet et billede som muligt, blev et stort antal bøger, artikler og rapporter gennemgået og en lang række nøglepersoner kontaktet. Udover yngledata 1964-2002 indsamledes så mange informationer som muligt om forvaltningen i de vigtigste engområder i Danmark.

Der var særligt mange yngledata fra tre perioder: 1964-72 (Dybbro & Jørgensen 1971, Ferdinand 1971, 1980), 1977-82 (Møller et. al 1978, Dybbro 1985, Hansen 1985) og 1985-89 (Jørgensen 1989, Falk & Brøgger-Jensen 1990). For disse tre perioder og for de allerseneste år (2000-02) var det muligt at beregne en dansk bestand for engryle, Brushane og Stor Kobbersneppe (Fig. 1, 5 og 9). For udækkede lokaliteter anvendtes yngletal fra nærmeste år med god dækning.

Der ynglede i 2000-02 350 par engryler. Det er kun 38% af bestanden i 1964-72 og 47% af bestanden i 1985-89 (Fig. 1), og arten er forsvundet fra 76% af de lokaliteter, den ynglede på i 1964-72 (Fig. 2-3). De 350 par udgør ca 28% af den samlede bestand af engryle på omkring 1250 par (Thorup 2003a), og seks lokaliteter (se Appendiks 1) og yderligere to EF-fuglebeskyttelsesområder ('Ulvedybet og Nibe Bredning', 'Rømø') huser mere end 1% af bestanden og er af international betydning.

Engrylen var allerede lige efter udpegningen af EF-fuglebeskyttelsesområderne i 1983 koncentreret til disse. I 1985-89 fandtes 95% af bestanden i fuglebeskyttelsesområderne. Alligevel har bestanden mellem 1964-72 og 2000-02 kun holdt sig relativt stabil på ti lokaliteter med god engfugleforvaltning forestået af stat, amt eller velgørende fonde. I de øvrige EF-fuglebeskyttelsesområder har fortsat intensivering i landbrugsdriften betydet store tilbagegange eller lokal forsvinden (Fig. 4).

I 1964-72 blev der optalt 1219 ynglehunner af Brushane fordelt på 106 lokaliteter. I 2000-02 var dette tal faldet til kun 132 hunner på 15 lokaliteter (Fig. 5-7), og den aktuelle bestand vurderes til ca 150 hunner. Faldet i antal ynglelokaliteter er sket temmelig jævnt gennem

perioden, mens den store tilbagegang i antal ynglefugle fandt sted mellem 1985-89 og 2000-02, på trods af, at stort set alle Brushanens ynglelokaliteter var blevet udpeget som EF-fuglebeskyttelsesområder i 1983. Tilbagegangen var dog væsentligt mindre markant i ti områder med god engfugleforvaltning end i de øvrige fuglebeskyttelsesområder (Fig. 8).

I 2000-02 blev der optalt 709 par Stor Kobbersneppe. Det er nogle få par mere end de 681 par, der optaltes i 1964-72, men kun 76% af 1977-82 bestanden på 935 par (Fig. 9). Bestanden var i 2000-02 væsentlig mere koncentreret end i 1964-72, idet arten i den mellemliggende periode forsvandt fra 62% af ynglelokaliteterne (Fig. 10-11). Mens den samlede bestand af Stor Kobbersneppe gik tilbage mellem 1985-89 og 2000-02, er bestanden gået frem i ti områder med god engfugleforvaltning (Fig. 12).

Bestandstallene fra 1964-72 er for alle tre arter væsentligt over de tal, der blev estimeret efter specialoptællingen i 1970 (Dybbro & Jørgensen 1971). De vigtigste årsager må være 1) de store bestande af Brushane og Stor Kobbersneppe i marsk- og forlandsområder i Vadehavet blev meget mangelfuldt dækket under 1970-tællingen; mange blev dækket for første gang i 1977 (Møller et al. 1978) og er indregnet i denne undersøgelses 1964-72 tal. 2) mange vigtige våde engområder blev inddiget, drænet og/eller opdyrket mellem 1964 og 1970 (Ferdinand 1980), og denne undersøgelses 1964-72 tal indeholder mange yngletal fra før inddigningerne, hvor Dybbro & Jørgensens tal er fra efter disse afvandinger.

Engryle og Stor Kobbersneppe er meget trofaste over for deres tidligere ynglested (Groen 1993, Thorup 1999), mens Brushane kun vender tilbage til sit tidligere yngleområde i et vist omfang (Andersen 1948, 1951). Da der er en statistisk signifikant forskel på bestandsudviklingen i de ti områder med god engfugleforvaltning og i de øvrige EF-fuglebeskyttelsesområder, må det anses for givet, at de vigtigste årsager til arternes tilbagegang skal søges i yngleområderne og ikke f.eks. være et varmere klima eller forringede betingelser i vinterkvarteret, som foreslået af Zöckler (2002a, 2002b) for Brushane og Stor Kobbersneppe.

Stigende bestande af de vigtigste prædatorer af fugleæg og rugende fugle, især Rørhøg, ræv og forvildet mink, kan påvirke engfuglebestande negativt, og det gælder også luftbåret opløseligt kvælstof, hvor niveauet i de senere år har været væsentligt højere end for 20-30 år siden. Men ingen af disse forhold påvirkes af den aktuelle forvaltning af engene, og de kan derfor ikke forklare den afgørende forskel i bestandsudviklingen i områder med god og mindre god engfugleforvaltning. Det, der især adskiller forvaltningen i de to typer områder, er, at i de godt forvaltede områder 1) opretholdes en høj fugtighed (fersk- eller ferskbrakvand) på engene, 2) undgås gødskning, og der sørges for 3) afgræsning med kreaturer i moderate tætheder og med relativ sen udsætning (sidst i maj – først i juni) og 4) regelmæssigt høslæt efter yngletiden (juli-august). Især 1) og 4) er sjældne elementer i forvaltningen uden for de ti områder med god engfugleforvaltning, og det vil sikkert være centralt for overlevelsen af engryle, Brushane og Stor Kobbersneppe i de øvrige EF-fuglebeskyttelsesområder (og andre steder), at der udarbejdes forvaltningsplaner, der inddrager disse fire elementer.

I flere af de bedste yngleområder for engfugle er der de senere år tilført mere havvand i et forsøg på at modvirke andre uønskede ændringer i naturtilstanden. Disse projekter har ikke taget højde for den negative effekt øget saltindhold i vandregimet har på fuglearter som Brushane, der ikke tolererer meget salt i sit yngleområde. Også Stor Kobbersneppe er sårbar over for saltpåvirkning. En god forvaltning for Brushane og Stor Kobbersneppe inkluderer derfor også, at yngleenge ikke oversvømmes af vand med et saltindhold på mere end ca 5 promille.

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Appendix 1

Most recent population estimates from Danish breeding sites for Dunlin, Ruff and Black-tailed Godwit.
* site of international importance for the biogeographical population 'Baltic Dunlin' by exceeding 1% of total population (Thorup 2004).
Nyeste bestandsopgørelse fra ynglelokaliteter for Alm. Ryle, Brushane og Stor Kobbersneppe.
** Lokalitet af international betydning for den biogeografiske bestand 'engryle' (huser over 1% af den samlede bestand; Thorup 2004).*

Dunlin *Calidris alpina*

Site	Co-ordinates	Pairs	Survey year
Tipperne*	55°53'N 08°12'E	69-70	2002
Bygholm Vejle*	57°03'N 09°06'E	63	2002
Agger Tange*	56°45'N 08°15'E	34	2002
Harboør Tange*	56°39'N 08°10'E	31-33	2002
Værnengene*	55°52'N 08°15'E	29-31	2002
Læsø syd*	57°13'N 11°00'E	20	1996
Ulvedybet	57°05'N 09°40'E	10	2001
Bøvling Fjord	56°25'N 08°08'E	9	1993
Rømø Sønderland	55°07'N 08°30'E	8	2002
Rømø Nørreland	55°10'N 08°30'E	8	2002
Vesløs-Arup Vejler	57°01'N 08°55'E	8	2001
Aflandshage	55°33'N 12°36'E	6-7	2002
Fanø Grønningen	55°28'N 08°22'E	6	2001
Risgårde Enge	56°47'N 09°12'E	4-5	1996
Nørholm Enge	57°03'N 09°48'E	4	2000
Saltholm	55°39'N 12°45'E	3	2002
Monnet, Tåsinge	54°57'N 10°34'E	2-3	2001
Geråa Enge	57°07'N 10°24'E	2	1999
Fjordholmene-Aggersborg	57°02'N 09°10'E	2	1996
Hovsør Røn	56°59'N 08°52'E	2	1996
Ryås udløb	57°06'N 09°47'E	2	1996
Munkholm Odde	56°42'N 08°34'E	2	1995
Holmen-Fjand Grønne	56°22'N 08°09'E	2	1994
Geddal Enge	56°33'N 08°46'E	2	1994
Egense Strandenge	56°57'N 10°17'E	1-2	1994
Jerup Strand	57°32'N 10°26'E	1	2002
Kofoeds Enge	55°34'N 12°35'E	1	2001-02
Læsvig	57°01'N 08°53'E	1	2001
Vårholme	57°01'N 09°34'E	1	2001
Albuen	54°50'N 10°58'E	1	1998
Løkkedyb, Lovns Bredning	56°36'N 09°16'E	1	1995
Rotholme-Hestør Odde	56°41'N 08°38'E	1	1995
Nordmandshage, Hals	56°58'N 10°20'E	1	1995
Handbjerg Strand	56°28'N 08°45'E	1	1995

Ruff *Philomachus pugnax*

Site	Co-ordinates	Females	Survey year
Tipperne	55°53'N 08°12'E	60	2002
Bygholm Vejle	57°03'N 09°06'E	37	2002
Saltholm	55°39'N 12°45'E	9	2002
Harboør Tange	56°39'N 08°10'E	4-5	2002
Værnengene	55°52'N 08°15'E	4	2002
Rømø Nørreland	55°10'N 08°30'E	4	2002

Ruff, continued

Ballum Enge	55º08'N 08º43'E	2	2002
Nyord	55º02'N 12º13'E	2	2002
Mandø Koge	55º17'N 08º34'E	1-3	1999-02
Ribemarsken nord	55º21'N 08º41'E	1-2	2000-02
Ryås udløb	57º06'N 09º47'E	1-2	1995
Agger Tange	56º45'N 08º15'E	1	2002
Fanø Grønningen	55º28'N 08º22'E	1	2002
Vesløs-Arup Vejler	57º01'N 08º55'E	1	2001
Læsvig	57º01'N 08º53'E	1	2001

Black-tailed Godwit *Limosa limosa*

Site	Co-ordinates	Pairs	Survey year
Bygholm Vejle	57º03'N 09º06'E	185	2002
Tipperne	55º53'N 08º12'E	90	2002
Mandø Koge	55º17'N 08º34'E	86	2001
Tøndermarsken ydre Koge	54º56'N 08º41'E	55	2000
Agger Tange	56º45'N 08º15'E	50	2002
Rømø Nørreland	55º10'N 08º30'E	34	2001
Saltvandssøen-Margrethekog	54º56'N 08º39'E	30	2000
Rømø Sønderland	55º07'N 08º30'E	23	2001
Harboør Tange	56º39'N 08º10'E	21	2000
Værnengene	55º52'N 08º15'E	20-21	2002
Saltholm	55º39'N 12º45'E	19	2002
Juvre-Toftum Enge	55º11'N 08º35'E	16	2001
Nyord	55º02'N 12º13'E	13	2002
Ballum Enge	55º08'N 08º43'E	11	2001
Borreby Mose	55º14'N 11º17'E	9	2002
Ribemarsken	55º19'N 08º42'E	8	2001
Bøvling Fjord	56º25'N 08º08'E	7	1997-00
Lejsø	55º22'N 11º07'E	5-6	2002
Polde, Nymindestrømmen	55º51'N 08º11'E	4-5	2002
Vesløs-Arup Vejler	57º01'N 08º55'E	4	2001
Rørmose, Skælskør	55º15'N 11º16'E	3	2002
Rejsby-Brønsmarsken	55º13'N 08º41'E	2	2001
Birkholm	54º56'N 10º30'E	2	2001
Monnet, Tåsinge	54º57'N 10º34'E	2	2001
Store Egholm	54º55'N 10º29'E	1-2	2001
Store Vejlen/Frølunde Fed	55º22'N 11º13'E	1	2002
Stigsnæs Vejle	55º13'N 11º15'E	1	2002
Flasken, Sevedø	55º12'N 11º19'E	1	2002
Ballum Forland	55º07'N 08º40'E	1	2001
Klægbanken	55º59'N 08º17'E	1	2001
Flade Sø	56º47'N 08º15'E	1	1994
Ulvedybet	57º05'N 09º40'E	0-1	2001-02

Sources: Amstrup 2001, pers. comm., N.P. Andreasen pers. comm., K. Bakken pers. comm., P. Berg pers. comm., Biledgaard & Nielsen 1998, L. Bisschop-Larsen pers. comm., Christensen 1990, pers. comm., DOF/DMU project database 'Breeding birds in the Danish Wadden Sea', J. Gregersen pers. comm., Grell 1998, S.F. Hansen pers. comm., Jørgensen 1998, 2002, pers. comm., M. Jørgensen pers. comm., Lange & Nielsen 1998, A. Linnet pers. comm., H.H. Nielsen pers. comm., Nielsen 1997a-f, Nielsen & Nielsen 1998, Nielsen & Rasmussen 2002, H. Olsen pers. comm., M. Pedersen pers. comm., Pedersen & Nielsen 1998, L.M. Rasmussen pers. comm., P.A.F. Rasmussen pers. comm., C. Schneider pers. comm., M. Thelander pers. comm., Thorup 2002, Vikstrøm & Nielsen 1998, Villesen 2002, Østergaard pers. comm.

Appendix 2

Proper management for Dunlin, Ruff and Black-tailed Godwit in order to ensure suitable conditions for successful breeding (based on studies in the Netherlands and at Tipperne; Møller 1978, Altenburg et al. 1985, Beintema 1991, Beintema et al. 1995, Thorup 1998, 2000 and unpublished).
Krav fra engryle, Brushane og Stor Kobbersneppe til god forvaltning af yngleområdet.

	Dunlin *engryle*	Ruff *Brushane*	Black-tailed Godwit *Stor Kobbersneppe*
Water table. *Fugtighed.*	Wet meadows. Groundwater table at maximum 30 cm below surface in May and early June. Drainage not accepted. *Fugtige enge, grundvandsstand må højst være 30 cm under jordoverflade i maj og første halvdel af juni. Afvanding må ikke finde sted.*	Wet meadows. Groundwater table a t maximum 30 cm below surface in May and early June. Drainage not accepted. *Fugtige enge, grundvandsstand må højst være 30 cm under jordoverflade i maj og første halvdel af juni. Afvanding må ikke finde sted.*	Wet meadows. Groundwater table at maximum 30 cm below surface in May. *Fugtige enge, grundvandsstand må højst være 30 cm under jordoverflade i maj.*
Surface structure. *Struktur i jordoverfladen.*	Dependence of well developed structures with pools and gullies, which gradually dry out during late May and June. *Afhængig af strukturer i engen med pander og loer, der tørrer gradvist ud i slutningen af maj-juni.*	Dependence of well developed structureswith pools and gullies, which gradually dry out during late May and June. *Afhængig af strukturer i engen med pander og loer, der tørrer gradvist ud i slutningen af maj-juni.*	No requirements. *Ingen krav.*
Fertilizer application. *Gødskning.*	Fertilizer application destroys breeding habitat. *Gødskning ødelægger ynglehabitat.*	Fertilizer application destroys breeding habitat. *Gødskning ødelægger ynglehabitat.*	Moderate application of fertilizer accepted, at maximum 50-100 kg N per hectare. *Tolererer moderat gødskning, op til 50-100 kg N/ha.*
Grazing.[1] *Græsning.*[1]	Cattle or horses released after 25 May (density corresponding to 1 young cattle per ha) or 5 June (density corresponding to 2 young cattle per ha). *Kreaturer eller heste. Tidligste udsætning 25. maj ved 1 ungkreatur/ha eller 5. juni ved 2 ungkreaturer/ha.*	Cattle or horses released after 28 May (density corresponding to 1 young cattle per ha) or 5 June (density corresponding to 2 young cattle per ha). *Kreaturer eller heste. Tidligste udsætning 28. maj ved 1 ungkreatur/ha eller 5. juni ved 2 ungkreaturer/ha.*	Cattle or horses released after 15 May (density corresponding to 1 young cattle per ha) or 25 May (density corresponding to 2 young cattle per ha). *Kreaturer eller heste. Tidligste udsætning 15. maj ved 1 ungkreatur/ha eller 25. maj ved 2 ungkreaturer/ha.*
Mowing.[2] *Høslæt.*[2]	Mowing after 15 July. *Tidligste høslætdato 15. juli.*	Mowing after 15 July. *Tidligste høslætdato 15. juli.*	Fertilized meadows: Mowing after 20 June. Meadows not fertilized: Mowing after 25 June. *Gødskede enge: tidligste høslætdato 20. juni. Ugødskede enge: tidligste høslætdato 25. juni.*
Salt. *Salt.*	At least 10‰ salt accepted in water systems of the meadows. *Tåler i hvert fald op til 10‰ salt i engenes pande- og losystemer.*	Vulnerable to salt and the species abandons sites approaching approximately 5‰ salt in the water systems of the meadows. *Meget sårbar over for salt, ved saltpromiller på omkring 5 i engenes vandsystemer ophører arten med ynglen.*	At least 10‰ salt accepted in water systems of the meadows. *Tåler i hvert fald op til 10‰ salt i engenes pande- og losystemer.*
Height of vegetation at nest. *Vegetationshøjde, redehabitat.*	Nests situated in 5-15 cm high vegetation with a good view. *Reder placeres i 5-15 cm høj vegetation med godt udsyn.*	Nests situated in 10-20 cm high and not too dense vegetation with a fair view. *Reder placeres i 10-20 cm høj og ikke for tæt vegetatio, med noget udsyn.*	Nests situated in 5-15 cm high vegetation with a good view. *Reder placeres i 5-15 cm høj vegetation med godt udsyn.*
Height of vegetation where chicks are reared. *Vegetationshøjde, ungeføringshabitat.*	Chicks are reared in open 2-20 cm high vegetation. *Ungerne føres i åben vegetation af 2-20 cm's højde.*	Chicks are reared in open 10-20 cm high vegetation. *Ungerne føres i åben vegetation af 10-20 cm's højde.*	Until the age of 2-3 weeks chicks are reared in 15-30 cm high vegetation. *Til de er 2-3 uger gamle føres unger i vegetation af 15-30 cm's højde.*
Lower limit of management. *Minimal pleje.*	Grazing and/or mowing is necessary in order to sustain proper vegetation height and structure. *Græsning og/eller slåning nødvendig, for at krav til vegetationshøjde og struktur kan opretholdes.*	May breed temporarily in moist and slowly growing fallow but in the long view grazing and/or mowing must substain proper vegetation height and structure. *Kan yngle i fugtig, langsomtvoksende brak, men på længere sigt er græsning og/eller slåning nødvendig for at krav til vegetationshøjde og struktur kan opretholdes.*	Grazing and/or mowing is necessary in order to sustain proper vegetation height and structure. *Græsning og/eller slåning nødvendig, for at krav til vegetationshøjde og struktur kan opretholdes.*

[1] Calculated on the criterion that at most 25% of the nests may be destroyed by cattle. *Beregnet ud fra, at højst 25% af artens reder må gå tabt pga. nedtrampning.*
[2] Calculated on the criterion that at most 20% of the chicks may be killed by mowing. *Beregnet ud fra, at højst 20% af artens unger må gå tabt pga. slåning.*