Status of breeding Oystercatcher *Haematopus ostralegus*, Lapwing *Vanellus vanellus*, Black-tailed Godwit *Limosa limosa*, and Redshank *Tringa totanus* in the Danish Wadden Sea in 2006

Ole Thorup and Karsten Laursen

(Med et dansk resumé: Ynglende Strandskade, Vibe, Stor Kobbersneppe og Rødben i det danske Vadehav i 2006)

Abstract A complete survey of breeding waders and other waterbirds in the Danish Wadden Sea was performed every fifth year since 1996. In 2006 the coverage was almost complete and this gives the rare opportunity to calculate population totals for widespread wader species like Oystercatcher, Lapwing, Black-tailed Godwit and Redshank in one of the most important breeding areas for the four species in Denmark. Including minor gap-fillings for the few uncovered sites, 2318 pairs of Oystercatcher, 2957 pairs of Lapwing, 263 pairs of Black-tailed Godwit, and 1522 pairs of Redshank were found.

Compared with the 1996 survey – where much more pronounced gap-filling was necessary – there has been a 21% decline in numbers of Oystercatchers, an 18% decline in Lapwings, a 2% increase in Black-tailed Godwits (but a 16% decline since 2001), and a 6% decline in Redshanks.

Except for Tøndermarsken, all four species showed major declines in mainland polders where no restrictions safeguard a sufficient ground water level and a suitable land use for breeding waders: a 48% decline in Oystercatcher, a 38% decline in Lapwing, an 81% decline in Black-tailed Godwit and a 44% decline in Redshank. In addition, in 2006 Black-tailed Godwits had given up breeding in 16 out of 34 sites where the species was breeding in 1996. These mainland polders are all situated within EC special protection areas.

In the other parts of the Danish Wadden Sea, breeding numbers of Lapwings, Black-tailed Godwits and Redshanks have basically remained stable although some local increases or decreases have taken place, perhaps partly due to redistribution of individuals. In contrast, breeding numbers of Oystercatchers have declined everywhere except on two islands (Langli, Mandø) where red foxes rarely occur.

Introduction

In 2006 the third complete breeding bird survey in the Danish Wadden Sea was performed, following similar counts in 1996 and 2001.

In Denmark the most recent estimate of the population of the three most numerous and widespread breeding wader species is 10 000-14 500 pairs of Oystercatcher *Haematopus ostralegus*, 30 000-45 000 pairs of Lapwing *Vanellus vanellus*, and 12 000-15 000 pairs of Redshank *Tringa totanus* (Thorup 2004a). However, all three species are very difficult to monitor at a countrywide scale, and trend calculations are therefore often rather poorly substantiated. On the other hand it is known that the Danish Wadden Sea holds a significant proportion of the Danish total for these species (Grell 1998), and complete counts in the Wadden Sea provide a rare opportunity to establish their trends.

In contrast to the three numerous species, the Black-tailed Godwit *Limosa limosa* is a redlisted and vulnerable breeding bird in Denmark (Thorup 2004b, Danmarks Miljøundersøgelser 2006). The Danish Wadden Sea is important also for this species, with 38% of the Danish total breeding there (709 pairs at a 2000-2002 survey; Thorup 2004b). The Black-tailed Godwits are found in permanent grassland and grass fields, in particular in the polder areas behind the dikes, areas that are not systematically covered by other counting programmes such as the 'Caretaker-project' run by DOF-Birdlife Denmark.

In this paper results from the 2006 survey in the Danish Wadden Sea are presented together with trend estimates for the period 1996-2006. The breeding bird surveys do not include any systematic monitoring of management and land use. Neither is there any systematic collection of data on breeding

success in the Danish Wadden Sea. Therefore, suggestions given of the causes behind the observed trends are held at a fairly general level.

Status for a number of other shorebird species, together with brief descriptions of their trends during 1996-2006, have been presented by Laursen & Thorup (2006), and an assessment of the conservation status of breeding birds in the nine Special Protection Areas in the Danish Wadden Sea is under preparation (Laursen & Thorup in prep.).

Methods

In 2006, the third complete breeding bird survey was performed in the Danish Wadden Sea. These surveys take place every fifth year within the framework of the trilateral Wadden Sea co-operation (Koffijberg et al. 2006). In total, 35 counters made an almost complete coverage of the 44 000 ha in the designated 'Wadden Sea Area' (Essink et al. 2004) and monitored the 33 bird species selected for surveys within the International Wadden Sea monitoring programme (Hälterlein et al. 1995). Among these species are all the breeding waders in the area.

A pilot survey with limited coverage and no common counting manual was performed in 1991 (Fleet et al. 1994). An international counting manual was elaborated in 1994-1995 (Hälterlein et al. 1995), and complete international surveys after these guidelines were performed in the Wadden Sea in 1996, 2001 and 2006. In Denmark, the covered area includes nine Special Protection Areas (No.'s 49, 51, 52, 53, 55, 57, 60, 65 and 67) with an approximate total land area of 44 000 ha (Koffijberg et al. 2006). In the programme the 'Wadden Sea Area' of Denmark is subdivided into 210 'sites' of which 10 are census areas with annual counts of all species. At the remaining sites territorial waders are only counted during the complete surveys every fifth year.

Survey periods and methods

The standardized counts during the complete surveys involve two counts and mappings of individuals (at a few sites pairs) present on the site within a fixed period: Lapwing 10-30 April, Redshank 20 April – 15 May, Black-tailed Godwit 20 April – 20 May, and Oystercatcher 6 May – 10 June. In general the counts are made from the distance by telescope, from an elevated point if possible. Individuals in flocks of more than six birds are excluded and treated as non-breeders. Redshanks in polder areas are also counted as described, but in saltmarshes with high breeding densities Redshanks are counted when the counter walks through the area and flushes the birds. Also birds along the shoreline (<50 m from the shore) are included as breeders. For all species, the number of 'breeding pairs' at a site is calculated by multiplying the maximum number of individuals at the two counts by 0.7.

Missing or incomplete counts

In order to make it possible to compare total breeding numbers at the three surveys in a qualified way it has been necessary to fill gaps arising because of missing or incomplete counts.

Counts have been defined as incomplete when 1) no counts were made within the standardized counting period ±3 days, 2) the counter indicated that the result was most likely an underestimate, or 3) the time used for mapping was below one hour per 200 ha (polder areas only).

When values were missing or underestimated, the site was assigned a number of pairs on the assumption that the trend between years was similar to the trend in adjacent sites with good quality data. In the tables it is indicated how many pairs that are imputed by gap filling in each of the census years.

Results

Oystercatcher

A total of 2318 pairs were estimated for 2006 of which 96% were actually counted and 4% were estimated for incomplete or missing counts (Fig. 1, Table 1). This is 21% less than the estimate for 1996, and 13% less than the estimate for 2001 (Table 1). Declines occur in most regions and breeding habitats. However, stable or increasing numbers are seen at most sites in the northernmost Wadden Sea (Langli, Skallingen and Ho Bugt) and around the Rejsby Å estuary and the Rømø dam (Fig.1, Table 1). Particularly strong declines have taken place at Fanø Grønningen and Rømø Sønderland (72% and 70% declines, respectively).

Lapwing

A total of 2957 pairs were estimated for 2006 of which over 99% were actually counted and less than 1% were estimated for incomplete or missing counts (Figs 2-3, Table 2). This is 18% less than the estimate for 1996, but only 1.4% less than the estimate for 2001, so the decline appears vir-

Table 1. No. of breeding pairs of Oystercatcher at complete surveys in the Danish Wadden Sea. Entries where >25% of pairs are estimated owing to incomplete or missing counts are shown by shaded figures.
Antal ynglepar af Strandskade på totale tællinger i Vadehavet. Hvor >25% af de angivne par er vurderede for ikke-dækkede eller ukomplet dækkede lokaliteter er dette vist med gråtonet baggrund.

	1996	2001	2006
Islands *Øer*			
Langli	141	237	241
Fanø Grønningen	95	66	27
Fanø other saltmarshes and coastal sites *øvrige strandenge og småøer*	125	180	75
Mandø saltmarshes *strandenge*	542	311	436
Mandø polders *koge*	544	496	492
Rømø Nørreland	346	346	250
Rømø - Juvre and Toftum Enge	28	38	33
Rømø Sønderland	20	16	6
Rømø beaches and other saltmarshes *øvrige strande og strandenge*	112	93	92
Fanø and Rømø elsewhere inland *øvrige indland*	4	4	5
Total	1957	1787	1657
Saltmarshes (mainland) *Strandenge (fastlandet)*			
Skallingen	37	37	33
Ho Bugt	14	9	14
Esbjerg-Kongeåen	37	40	18
Kongeåen-V. Vedsted	46	62	23
V. Vedsted-Rømødæmningen	128	179	125
Rømødæmningen-Germany/*Tyskland*	251	197	175
Total	513	524	388
Polders, Tøndermarsken west *Vestlige Tøndermarsken*			
Margrethe Kog/Saltvandssøen	216	155	127
Tøndermarskens ydre koge	59	21	40
Total	275	176	167
Polders elsewhere (mainland) *Øvr. marskomr., fastlandet*			
Sneummarsken	14	11	10
Kongeåmarsken	28	23	14
Ribemarsken	44	35	24
Råhede-Rejsby-Brøns marsken	42	37	28
Ballummarsken	50	39	18
Tøndermarskens indre koge	17	23	8
Total	200	171	103
Fresh meadows Varde Å - Ribe Å total *Ferskenge*	12	8	4
Total counted *Optalt i alt*	2592	2503	2231
Estimated for (partially) uncovered sites *Anslået, ufuldst. dækk. omr.*	346	160	87
Total	**2952**	**2663**	**2318**

tually to have stopped: it primarily took place in the mainland polders except for the western part of Tøndermarsken (Table 2). The mainland polders held 71% of the Danish Wadden Sea total in 1996, a proportion that was reduced to 66% by 2006. At one estuary, Kongeåmarsken, the decline continued after 2001 (by 42% between 2001 and 2006).

Numbers at the Wadden Sea islands remained almost stable during 1996-2006. At only one high-density site, Fanø Grønningen, there was a marked decline from 1996 to 2001. During the same period numbers increased markedly at the nearest mainland saltmarsh, Skallingen. Similarly, the high-density site Rømø Sønderland lost a third of the

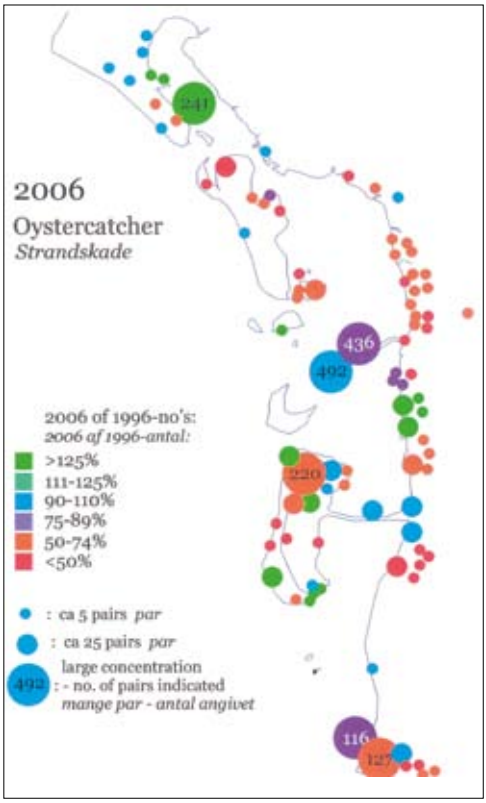

Fig. 1. Distribution and number of breeding pairs of Oystercatcher 2006, together with trends during 1996-2006. Colours depict the 2006 breeding number in percent of the 1996 breeding number with green colours showing increase, blue stability and reddish colours declines. Number of breeding pairs are shown for sites holding more than 50 pairs.
Strandskade udbredelse og antal ynglepar i 2006, samt udviklingen 1996-2006. Farverne illustrerer antal ynglepar i 2006 i procent af 1996-tallet, hvor grøn angiver fremgang, blå stabilitet, mens de rødlige farver viser tilbagegange. Antal par er angivet for lokaliteter med mere end 50 par.

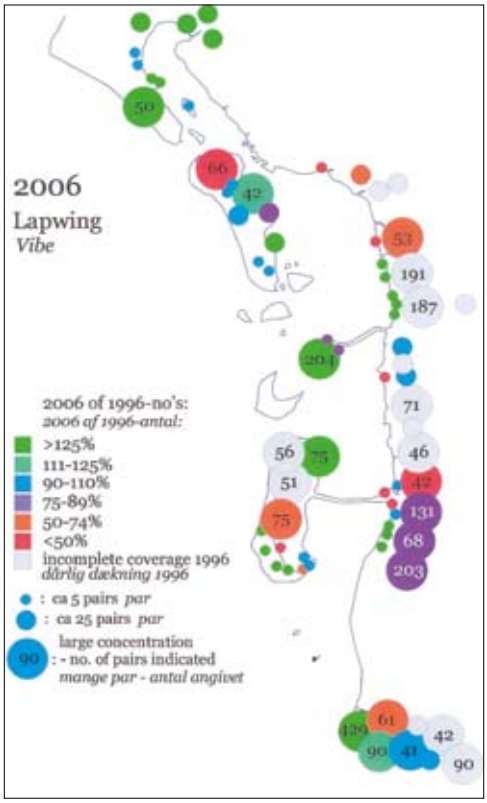

Fig. 2. Distribution and number of breeding pairs of Lapwing 2006, together with trends during 1996-2006. Colours depict the 2006 breeding number in percent of the 1996 breeding number with green colours showing increase, blue stability and reddish colours declines. Sites with no or incomplete data from 1996 shown in grey. Number of breeding pairs are shown for sites holding more than 40 pairs.
Vibe udbredelse og antal ynglepar i 2006, samt udviklingen 1996-2006. Farverne illustrerer antal ynglepar i 2006 i procent af 1996-tallet, hvor grøn angiver fremgang, blå stabilitet, mens de rødlige farver viser tilbagegange. Lokaliteter uden eller med kun delvis dækning 1996 vist med gråt. Antal par er angivet for lokaliteter med mere end 40 par.

breeding numbers between 2001 and 2006 while, during the same period, the nearby site Juvre Enge experienced a marked increase (Table 2).

Black-tailed Godwit

A total of 263 pairs were counted, and there was a complete coverage of this species (Fig. 4, Table 3). The number represents a 2% increase compared to 1996, but a 16% decline since 2001. There was a strong decline (by 71%) between 1996 and 2001 in all mainland polders (excluding the western part of Tøndermarsken), and the decline here continued during 2001-2006 (by 36%). At the same time, the western part of Tøndermarsken had a 33% increase (1996-2006, but mainly before 2001; Table 3).

A marked increase between 1996 and 2001 also took place on the island of Mandø and, to a lesser extent, on Rømø, whereas numbers on both islands

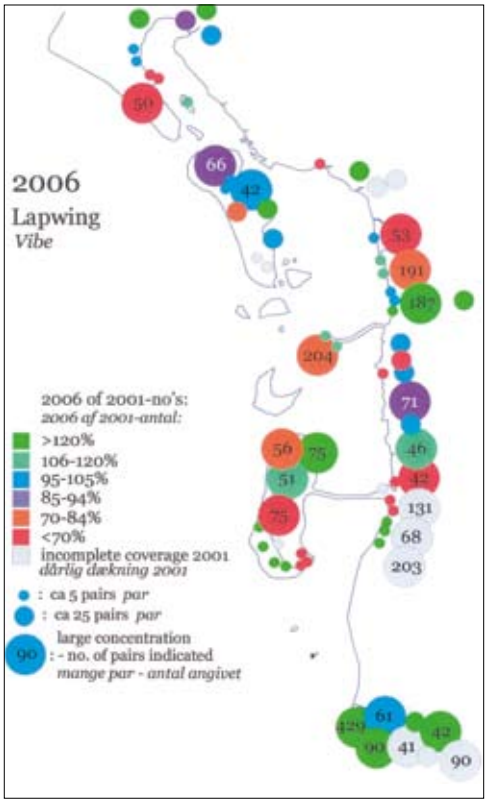

Fig. 3. Distribution and number of breeding pairs of Lapwing 2006, together with trends during 2001-2006. Colours depict the 2006 breeding number in percent of the 2001 breeding number with green colours showing increase, blue stability and reddish colours declines. Sites with no or incomplete data from 2001 shown in grey. Number of breeding pairs are shown for sites holding more than 40 pairs. (Note that the time interval is only half that depicted in Fig. 1-2 and 4.-5. The colours used in all figures correspond approximately to the same mean annual change.)
Vibe udbredelse og antal ynglepar i 2006, samt udviklingen 2001-2006. Farverne illustrerer antal ynglepar i 2006 i procent af 2001-tallet, hvor grøn angiver fremgang, blå stabilitet, mens de rødlige farver viser tilbagegange. Lokaliteter uden eller med kun delvis dækning 2001 vist med gråt. Antal par er angivet for lokaliteter med mere end 40 par. (Bemærk at perioden i denne figur kun er halvt så lang som i de øvrige figurer. Der er benyttet samme farve i alle figurerne for ca. den samme gennemsnitlige årlige ændring.)

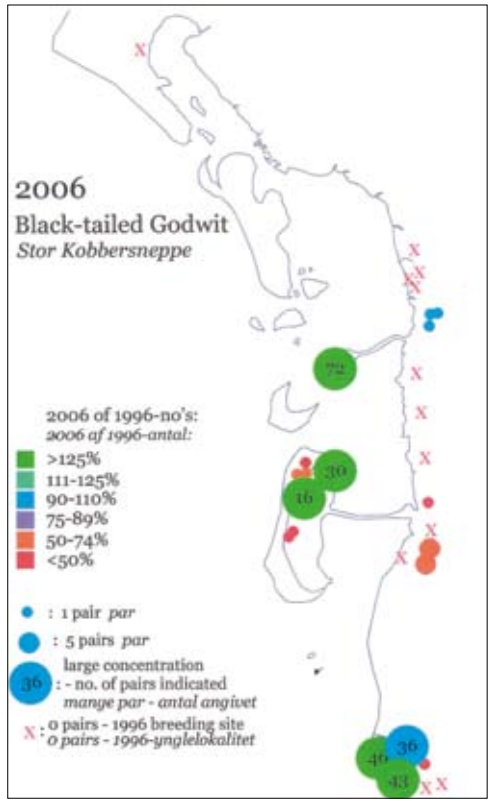

Fig. 4. Distribution and number of breeding pairs of Black-tailed Godwit 2006, together with trends during 1996-2006. Colours depict the 2006 breeding number in percent of the 1996 breeding number with green colours showing increase, blue stability and reddish colours declines. Number of breeding pairs are shown for sites holding more than 10 pairs.
Stor Kobbersneppe udbredelse og antal ynglepar i 2006, samt udviklingen 1996-2006. Farverne illustrerer antal ynglepar i 2006 i procent af 1996-tallet, hvor grøn angiver fremgang, blå stabilitet, mens de rødlige farver viser tilbagegange. Antal par er angivet for lokaliteter med mere end 10 par.

decreased (by 25%) between 2001 and 2006; the decline at the brackish meadows at Rømø Sønderland was particularly dramatic (91%). The breeding distribution of the species in the Danish Wadden Sea became significantly restricted during the ten-year period: in 1996 Black-tailed Godwit bred at 34 sites, in 2006 at only 18 sites.

Redshank

A total of 1522 pairs were estimated for 2006 of which 92% were actually counted and 8% were estimated for incomplete or missing counts (Fig. 5, Table 4). This is 6% less than the estimate for 1996, and 11% less than the estimate for 2001. The decline mainly took place at the mainland

Table 2. No. of breeding pairs of Lapwing at complete surveys in the Danish Wadden Sea. Entries where >25% of pairs are estimated owing to incomplete or missing counts are shown by shaded figures.
Antal ynglepar af Vibe på totale tællinger i Vadehavet. Hvor >25% af de angivne par er vurderede for ikke-dækkede eller ukomplet dækkede lokaliteter er dette vist med gråtonet baggrund.

	1996	2001	2006
Islands *Øer*			
Langli	6	5	6
Fanø Grønningen	145	70	62
Fanø other saltmarshes and coastal sites *øvrige strandenge og småøer*	98	96	97
Fanø inland sites *indland*	48	49	49
Mandø saltmarshes *strandenge*	13	8	9
Mandø polders *koge*	153	247	204
Rømø Nørreland	115	115	107
Rømø - Juvre and Toftum Enge	30	21	75
Rømø Sønderland	102	104	70
Rømø beaches and other saltmarshes *øvrige strande og strandenge*	27	25	25
Rømø elsewhere inland *øvrige indland*	36	47	19
Total	773	787	723
Saltmarshes (mainland) *Strandenge (fastlandet)*			
Skallingen	38	83	58
Ho Bugt	57	46	65
Esbjerg-Kongeåen - saltmarshes *strandenge*	41	6	7
Kongeåen-V. Vedsted - saltmarshes *strandenge*	9	23	32
V. Vedsted-Rømødæmningen - saltmarshes *strandenge*	50	46	16
Rømødæmningen-Germany/*Tyskland* - saltmarshes *strandenge*	23	24	23
Total	218	228	201
Polders, Tøndermarsken west *Vestlige Tøndermarsken*			
Margrethe Kog/Saltvandssøen	195	313	429
Tøndermarskens ydre koge	210	116	192
Total	405	429	621
Polders elsewhere (mainland) *Øvr. marskomr., fastlandet*			
Sneummarsken	124	77	70
Kongeåmarsken	225	177	103
Ribemarsken	572	301	328
Råhede-Rejsby-Brøns marsken	311	225	206
Ballummarsken	599	500	444
Tøndermarskens indre koge	316	216	180
Total	2147	1496	1331
Fresh meadows Varde Å - Ribe Å total *Ferskenge*	60	58	81
Total counted *Optalt i alt*	2427	2385	2930
Estimated for (partially) uncovered sites *Anslået, ufuldst. dækk. omr.*	1176	613	27
Total	**3603**	**2998**	**2957**

polders (excluding the western Tøndermarsken), with a 44% reduction since 1996, and on the island of Rømø (a 26% reduction since 2001). On Rømø the declines occurred at the outer parts of Rømø Nørreland (from 198 pairs in 2001 to 123 pairs in 2006) and at Rømø Sønderland (from 73 pairs in 2001 to 43 pairs in 2006). Another dramatic decline took place at the saltmarsh of Vilslev Forland, from 82 pairs in 2001 to only 27 pairs in 2006.

Elsewhere, breeding numbers were mostly stable or slightly increasing. On the island of Fanø

Table 3. No. of breeding pairs of Black-tailed Godwit at complete surveys in the Danish Wadden Sea.
Antal ynglepar af Stor Kobbersneppe på totale tællinger i Vadehavet.

	1996	2001	2006
Islands *Øer*			
Mandø polders *koge*	22	90	72
Rømø Nørreland	20	34	19
Rømø - Juvre and Toftum Enge	15	16	30
Rømø Sønderland	27	23	2
Total	84	163	123
Saltmarshes (mainland) *Strandenge (fastlandet)*			
Ho Bugt	1	0	0
Kongeåen-V. Vedsted - saltmarshes *strandenge*	1	1	0
Rømødæmningen-Germany/*Tyskland* - saltmarshes *strandenge*	1	1	0
Total	3	2	0
Polders, Tøndermarsken west *Vestlige Tøndermarsken*			
Margrethe Kog/Saltvandssøen	30	42	46
Tøndermarskens ydre koge	65	83	80
Total	95	125	126
Polders elsewhere (mainland) *Øvr. marskomr., fastlandet*			
Kongeåmarsken	14	1	0
Ribemarsken	11	8	3
Råhede-Rejsby-Brøns marsken	4	2	0
Ballummarsken	43	11	11
Tøndermarskens indre koge	3	0	0
Total	75	22	14
Total counted *Optalt i alt*	255	312	263
Estimated for (partially) uncovered sites *Anslået, ufuldst. dækk. omr.*	2	0	0
Total	**257**	**312**	**263**

a displacement apparently occurred from the hitherto high-density breeding site at Fanø Grønningen to other saltmarsh sites on the island: 78 pairs disappeared from Fanø Grønningen between 1996 and 2006 while, during the same period, the number of breeding pairs at the other saltmarshes on the island increased by 72 pairs (Table 4).

Discussion

Oystercatcher

The number of breeding Oystercatchers in Denmark increased during most of the 20th century (Dybbro 1976, Grell 1998, Thorup 2004a) but probably peaked just before the start of the Wadden Sea monitoring programme in 1996. The decline here reported for 1996-2006 is consistent with a general decline in NW European breeding populations since the mid 1990s. Strong declines have been reported for breeding populations in the Netherlands during the 1990s (Koffijberg et al. 2006) and for numbers of migrants in western Denmark (supposed Norwegian breeders; Meltofte et al. 2006), and more moderate declines were seen among breeders in the German Wadden Sea between 1996 and 2004 (Koffijberg et al. 2006). Danish breeders winter in the Netherlands and France (Bønløkke et al. 2006), and depletion of shellfish populations in the Netherlands has been shown to have a negative impact on Oystercatcher survival (Ens et al. 2004).

However, in addition to such general factors, the marked differences in population trends between different breeding sites within the Danish Wadden Sea indicate that local factors are also important. Oystercatchers breeding on the islands Langli and Mandø – to which access is difficult for mammalian predators, in particular the red fox *Vulpes vulpes* – are doing much better com-

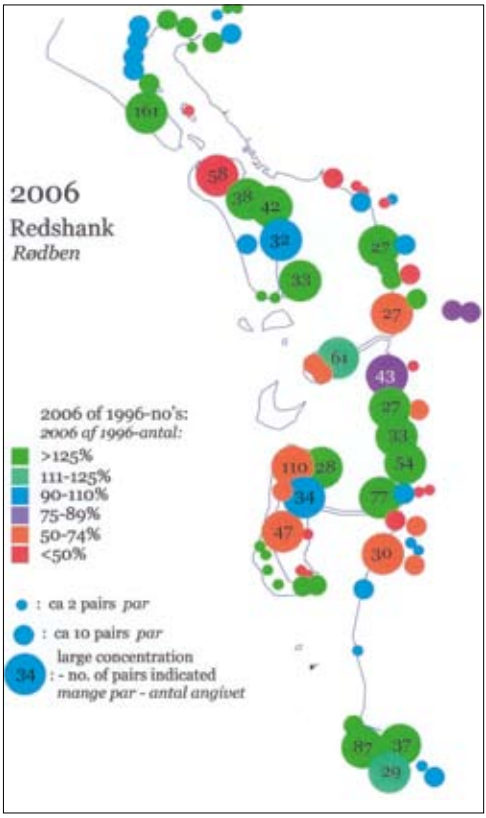

Fig. 5. Distribution and number of breeding pairs of Redshank 2006, together with trends during 1996-2006. Colours depict the 2006 breeding number in percent of the 1996 breeding number with green colours showing increase, blue stability and reddish colours declines. Number of breeding pairs are shown for sites holding more than 25 pairs.
Rødben udbredelse og antal ynglepar i 2006, samt udviklingen 1996-2006. Farverne illustrerer antal ynglepar i 2006 i procent af 1996-tallet, hvor grøn angiver fremgang, blå stabilitet, mens de rødlige farver viser tilbagegange. Antal par er angivet for lokaliteter med mere end 25 par.

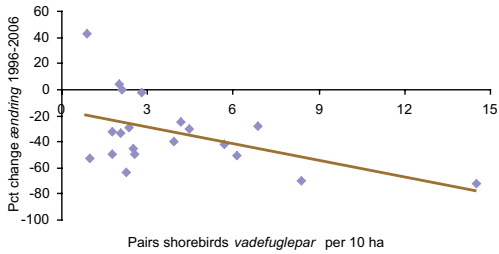

Fig. 6. Relationship between total density of breeding territorial shorebirds (waders) in 1996 (pairs/10 ha) in 20 sub-regions of the Danish Wadden Sea with unlimited access and regular occurrence of foxes in recent years and the trend in the number of pairs of Oystercatchers during 1996-2006.
Forholdet mellem den samlede yngletæthed af territorialt ynglende vadefugle i 1996 (par pr 10 ha) i 20 områder af det danske Vadehav med regelmæssige besøg af jagende ræve de senere år og udviklingen i antallet af ynglepar af Strandskade 1996-2006.

pared to populations elsewhere (5% decline during 1996-2006 compared with 33% elsewhere; Table 1).

Fanø Grønningen and Rømø Sønderland saw a 71% decline during 1996-2006. Both sites, which had very high densities of breeding territorial waders in 1996, were regularly visited by red foxes in 2006 (K. Fischer & O. Thorup unpubl.). In general, our data show that in case of regular occurrence of red foxes, declines were stronger in areas with high overall densities of breeding waders than in areas with lower densities (Fig. 6). This correlation is statistically significant (r = -0.489, P = 0.029), suggesting that Oystercatchers counteract predation on nests and young by increased dispersal of territories, although the same pattern could arise if there was a strong natal philopatry in the sense that young birds recruited to the natal site itself or very close to it, and that recruitment thus depended on successful production of offspring by the local breeders. Studies at nearby Tipperne showed that Oystercatcher was more vulnerable to increased nest predation than any other territorial wader species (Thorup 2006).

According to the most recent estimate, from the late 1990s, the birds breeding in the Wadden Sea constituted 20-30% of the total Danish Oystercatcher population (Thorup 2004a), so a 21% decline in the Wadden Sea should lead to a reduced Danish Oystercatcher population. No such reduction is apparent in the Danish Point Count Census, however – the population index for the species remained stable during 1996-2005 (Heldbjerg 2007).

Lapwing

The survey in 2006 was the first that included a comprehensive coverage of the extensive mainland polders. In the estimates from 1996 and 2001 a much higher proportion of sites (33% and 20%, respectively) were counted incompletely or not at all, so that Lapwing numbers had to be estimated on the assumption that bird numbers developed in parallel to numbers at adjacent sites. That as-

Table 4. No. of breeding pairs of Redshank at complete surveys in the Danish Wadden Sea. Pairs calculated as 0.7 × individuals (see discussion). Entries where >25% of pairs are estimated owing to incomplete or missing counts are shown by shaded figures.
Antal ynglepar af Rødben på totale tællinger i Vadehavet. Antal par bestemt som 0,7 × antal individer. Hvor >25% af de angivne par er vurderede for ikke-dækkede eller ukomplet dækkede lokaliteter er dette vist med grålonet baggrund.

	1996	2001	2006
Islands *Øer*			
Langli	6	2	2
Fanø Grønningen	136	61	58
Fanø other saltmarshes and coastal sites *øvrige strandenge og småøer*	77	123	149
Fanø inland sites *indland*	8	11	11
Mandø saltmarshes *strandenge*	49	49	61
Mandø polders *koge*	36	32	25
Rømø Nørreland	230	230	157
Rømø - Juvre and Toftum Enge	6	13	23
Rømø Sønderland	77	73	43
Rømø beaches and other saltmarshes *øvrige strande og strandenge*	37	42	45
Rømø elsewhere inland *øvrige indland*	17	17	8
Total	679	653	582
Saltmarshes (mainland) *Strandenge (fastlandet)*			
Skallingen	90	107	168
Ho Bugt	61	68	72
Esbjerg-Kongeåen - saltmarshes *strandenge*	109	103	43
Kongeåen-V. Vedsted - saltmarshes *strandenge*	57	52	49
V. Vedsted-Rømødæmningen - saltmarshes *strandenge*	172	294	245
Rømødæmningen-Germany/*Tyskland* - saltmarshes *strandenge*	101	90	63
Total	589	714	640
Polders, Tøndermarsken west *Vestlige Tøndermarsken*			
Margrethe Kog/Saltvandssøen	69	116	87
Tøndermarskens ydre koge	47	48	68
Total	116	164	155
Polders elsewhere (mainland) *Øvr. marskomr., fastlandet*			
Sneummarsken	32	14	7
Kongeåmarsken	17	15	13
Ribemarsken	29	17	30
Råhede-Rejsby-Brøns marsken	25	18	13
Ballummarsken	63	40	33
Tøndermarskens indre koge	23	12	9
Total	189	116	105
Fresh meadows Varde Å - Ribe Å total *Ferskenge*	40	56	40
Total counted *Optalt i alt*	1281	1529	1404
Estimated for (partially) uncovered sites *Anslået, ufuldst. dækk. omr.*	333	174	118
Total	**1614**	**1703**	**1522**

sumption may not hold in all situations. Within some areas, e.g. Ballummarsken and Tøndermarsken (Figs 2-3), there is a clear tendency for sites to develop in parallel. On the other hand, local changes in conditions such as area of spring-sown crops – a land use type that attracts a large proportion of the breeding Lapwings in the mainland polders – may strongly influence the local popula-

tion development, a fact that might explain why trends in numbers have varied within the Ribemarsken/Kongeåmarsken area (Fig. 3). Among sites with incomplete or no counts in 1996, several show large declines between the uncertain number from 1996 and the 2006 count, so that the magnitude of the general decline between the two years could well have been overestimated. While the counted and calculated values combined show a 38% decline from 1996 to 2006 for the mainland polders (except western Tøndermarsken) (Table 2), the decline at sites with good coverage at both surveys is only 30%.

The Lapwings in the Danish Wadden Sea constituted 6-8% of the Danish total in the most recent estimate from the late 1990s (Thorup 2004a). The apparent 18% decline in the Wadden Sea between 1996 and 2005 is similar to the decline in all of Denmark as shown by the Danish Point Count Census during the same period (19%; Heldbjerg 2007).

Black-tailed Godwit

The population increase in the Danish Wadden Sea from 1996 to 2001 took place at a time when numbers decreased at most other Danish breeding sites (Thorup 2004b); during the same years there was a moderate decline in the German and Dutch Wadden Sea (Koffijberg et al. 2006). In Tøndermarsken, the population increased by 32% (Table 3), which may have been caused by local recruitment, made possible by improved breeding conditions. On the other hand, the 309% increase seen on Mandø must reflect a large element of redistribution and immigration. Dispersal following the breakdown of two nearby breeding sites, at Vilslev Enge and Ballum Enge (Table 3), may account for the major part of the immigration to Mandø.

At the last countrywide estimate (2000-2002), a total of 266 pairs of Black-tailed Godwit in the Danish Wadden Sea constituted 38% of the total Danish population (Thorup 2004b). The 2001 Wadden Sea total was not fully incorporated into the Danish total in that publication, however, and of the revised Danish 2001-2002 total of 755 pairs the Wadden Sea accounts for 41%. The decrease by 49 pairs in the Wadden Sea since then has a significant impact on the Danish total, as do the development in other areas, notably the 21% decline in the NW Jylland (Vejlerne, Agger Tange, Harboøre Tanger; Kjeldsen & Nielsen 2008 and in litt.) and the 17% decline in Ringkøbing Fjord (Thorup 2007).

The smaller breeding sites in Denmark are usually surveyed each year (Vikstrøm 2007, DOFbasen unpubl.) and the 2006-2007 Danish total can be estimated at 610-620 pairs, compared to c. 935 pairs in 1980 when the population peaked (Thorup 2004b). As a consequence of this development, the Black-tailed Godwit was redlisted in the latest update the Danish list (Danmarks Miljøundersøgelser 2006).

Apparently, the number of breeding pairs in the Danish Wadden Sea peaked some 15 years before the beginning of the present counting programme, as did numbers in Denmark in general. However, no complete counts of the Wadden Sea polder areas exist previous to 1996. The best coverage in the past was in 1977, when most areas in the southern part were surveyed (Møller et al. 1978), and in 1982, when many sites were surveyed during a nationwide survey (Dybbro 1985). Estimates based on these surveys are 325 pairs in 1977 and 383 pairs in 1982 (Thorup 2003 and unpubl.). Compared with the 1982 peak year, the Danish Wadden Sea total in 2006 was reduced to 69%.

Few breeding sites in the Danish Wadden Sea are in areas where restrictions are imposed as regards drainage or land use (e.g., ploughing and mowing dates), and large scale drainage in the mainland polder areas, ploughing of fields with godwit nests, and mowing of grass fields with godwit chicks, are frequently observed (M. Clausen, N. Knudsen, L.M. Rasmussen & O. Thorup unpubl.). However, due to the lack of systematic collection of data on breeding success it is not possible to conclude at which breeding sites Black-tailed Godwits are able to reproduce themselves. A combination of agreements with farmers and restrictions of land use in the western part of Tøndermarsken (Clausen et al. 2007) has had the effect that breeding numbers were stable during 2001-2006, when breeding numbers decreased at most other sites. Most likely, such agreements to safeguard a high water level, and restrictions of land use prohibiting early mowing or ploughing of semi-natural grassland, are necessary measures in order to maintain the breeding population of Black-tailed Godwit in the Wadden Sea polders.

Redshank

The major decline of 44% in the mainland polders (outside western Tøndermarsken) from 1996 to 2006 hardly affected the Wadden Sea total since these areas only held 12% of the total in 1996, and 7% in 2006. Redshanks in the Tøndermarsken polders made up an additional 7% in 1996 and 10%

The breeding population of Oystercatchers declined all over the Wadden Sea except for two islands without foxes. All four species examined in the paper suffered widespread declines in the mainland polders despite the status of such areas as EEC special protected areas. Photo: Klaus Dickmann.
Ynglebestanden af Strandskader faldt overalt i Vadehavet undtagen på to øer uden ræve. Med undtagelse af Tøndermarsken gik alle arterne tilbage i baglandsområderne på trods af disses status som EF-fuglebeskyttelsesområder.

in 2006. Before 1996 there are few good data from polders except Tøndermarsken, but these areas must have had a much larger number of breeding pairs in the past. In Tøndermarsken alone, 535 pairs bred in 1984 (Rasmussen & Gram 1997), compared to 139-176 pairs there during 1996-2006.

In this analysis, a factor 0.7 was used to calculate the number of pairs from the number of counted breeders in the field. In previous analyses (e.g. Rasmussen & Thorup 1998, Rasmussen 2003, Thorup 2004a) a much larger factor (2.4) was used (while a factor 3.4 was used to convert number of mapped pairs into estimated pairs); this factor was based on intensive studies of high-density populations in the Netherlands and W Denmark (Dallinga 1993, Esselink et al. 2000, Thorup unpubl.). The factor 0.7 was applied in order to introduce consistency into published Danish, German and Dutch Wadden Sea breeding figures of Redshank (e.g. Koffijberg et al. 2006), although estimates derived by this method are supposed markedly to underestimate true numbers. The best estimates would probably be obtained by using the conversion factor 2.4 for counts in marsh habitats

(salt and brackish), and the factor 0.7 in the other breeding habitats like polders, dunes and narrow coastal stretches. When applying this method to the 2006 figures, the Danish Wadden Sea total can be estimated at 4098 pairs, as compared to 5149 pairs when using the factor 2.4 for all sites.

Although the total number of breeding pairs is only known with great uncertainty, the assessment of trend and relative distribution (Table 4, Fig. 5) is probably fairly accurate. As calculated in Table 4, a 6% decline (from 1614 to 1522 pairs) between 1996 and 2006 emerges. If the factor 2.4 had been used, the decline would still be 6% (from 5479 to 5149 pairs), and if the factor 2.4 was applied for salt and brackish marshes and 0.7 for other breeding habitats, the decline would be 8% (from 4445 to 4098 pairs).

The relative importance of the Wadden Sea for breeding Redshanks in Denmark cannot be given very precisely, owing to the uncertain population estimates. The most recent estimate of the Danish total was 12 000-15 000 pairs in the late 1990s, with 30-35% (4400-5000 pairs) in the Wadden Sea (Thorup 2004a and unpubl.). As the decrease in the Danish Wadden Sea since then has been slight, and marked declines are known for at least one important site outside the Wadden Sea, Tipperne (Thorup 2006), the current proportion of the Danish Redshanks breeding in the Wadden Sea must be of the same magnitude as, or even higher than in the late 1990s.

According to the Danish Point Count Census, Redshank numbers in Denmark were halved between 1983 and 1993, but then stabilised with no clear tendency during 1993-2005 (Heldbjerg 2007).

In summary, breeding pairs of Oystercatchers and Lapwings declined markedly in the Danish Wadden Sea during 1996-2006, Redshank numbers declined slightly, and breeding numbers of Black-tailed Godwits fluctuated. Declines and increases were very unevenly distributed within the Wadden Sea.

Except for Tøndermarsken, all four species declined markedly in mainland polders where no restrictions safeguard a sufficient ground water level and a suitable land use for breeding waders. In addition, in 2006 Black-tailed Godwits had given up breeding in 16 of the 34 sites where the species was breeding in 1996. These declines took place despite the fact that all mainland polders are situated within EC special protection areas.

In the other parts of the Danish Wadden Sea, breeding numbers of Lapwings, Black-tailed Godwits and Redshanks basically remained stable although some local increases and decreases took place, perhaps partly due to redistribution of individuals. In contrast, breeding numbers of Oystercatchers declined everywhere except on the islands Langli and Mandø to which red foxes have limited access.

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Resumé

Ynglende Strandskade, Vibe, Stor Kobbersneppe og Rødben i det danske Vadehav i 2006

I 2006 blev der foretaget en ynglefugletælling af vadefugle og andre vandfugle i hele Vadehavsområdet. I Danmark var der en næsten fuld dækning af alle øer, fastlandsstrandenge og marskområder i Det danske Vadehav. Der foretages en stor ynglefugletælling hvert femte år, og dette er den tredje tælling siden optællingsprogrammet blev startet i 1996. Tællingerne giver en sjælden mulighed for at beregne det samlede antal ynglepar af vidt udbredte vadefugle som Strandskade, Vibe, Stor Kobbersneppe og Rødben i et stort område, hvor arterne forekommer talrigt. I 2006 fandtes 2318 par Strandskader, 2957 par Viber, 263 par Store Kobbersnepper og 1522 par Rødben.

I 1996 var dækningen dårligere, og det har været nødvendigt at beregne et sandsynligt antal ynglepar for ikkedækkede lokaliteter. Fra 1996 til 2006 var der en tilbagegang på 21% for Strandskade, en tilbagegang på 18% for Vibe, en fremgang på 2% for Stor Kobbersneppe (men en tilbagegang på 16% mellem 2001 og 2006) og en tilbagegang på 6% for Rødben.

Alle fire arter havde en kraftig tilbagegang i marskområderne på fastlandet udenfor den vestlige del af

Tøndermarsken fra 1996 til 2006. Disse områder har det tilfælles, at der ikke er nogen krav til forvaltning, der sikrer tilstrækkeligt fugtige områder og en landbrugsmæssig udnyttelse, der giver gode muligheder for ynglende vadefugle. Tilbagegangen i denne tiårs periode var på 48% hos Strandskade, 38% hos Vibe, 81% hos Stor Kobbersneppe og 44% hos Rødben. Ydermere ynglede Stor Kobbersneppe i 2006 ikke længere på 16 af de 34 ynglelokaliteter, som de ynglede på i 1996. Alle de optalte marskområder ligger indenfor udpegede EF-fuglebeskyttelsesområder.

I resten af Det danske Vadehav har Vibe, Stor Kobbersneppe og Rødben stort set opretholdt stabile bestande, selv om der er helt lokale frem- og tilbagegange, der måske delvist kan forklares med flytninger mellem naboområder. Derimod er Strandskade gået tilbage i hele Det danske Vadehav med undtagelse af øerne Langli og Mandø, hvor der er en begrænset forekomst af ræv.

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