Flyway-trends for waterbird species important in lakes IJsselmeer and Markermeer

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Summary

The Lakes IJsselmeer and Markermeer form the largest fresh water lake complex in the Netherlands. They have a very important function for waterbirds as breeding, moulting, migration and wintering sites. Based on these functions and the numbers of birds involved, the lakes are designated as Natura 2000 sites under the EU Birds Directive and as wetlands of international importance under the Ramsar Convention. Despite these protection measures, several important key species are in decline (species depending on fish or benthos) and identifying drivers behind this is important for future policy and management decisions. However, many of the protected waterbird species at Lakes IJsselmeer and Markermeer are migratory. This poses extra challenges when the interpretating detected trends. Population declines may be caused by many different factors, either within the IJsselmeer/Markermeer itself, or elsewhere within the East Atlantic Flyway. This report analyses population trends of important waterbird species of Lakes IJsselmeer and Markermeer at the local and flyway level, and addresses the differences and similarities found. Population trends at IJsselmeer/Markermeer in the period 1980-2010 appear significantly less favorable than the population trends in the total flyway of these species. Four species with increasing trends at the flyway level have decreased in Lakes IJsselmeer/Markermeer during the same period: Great Crested Grebe, Goldeneye, Goosander and Smew. In Pochard and Tufted Duck the decline in IJsselmeer/Markermeer is significantly stronger than the declining flyway trend. In three additional species with declining trends at Lakes IJsselmeer/Markermeer (Scaup, Little Gull and Black Tern) no flyway trends could be calculated. Based on literature they are probably negative for Scaup and Black Tern but it is not known if this decline is stronger or less strong than the decline at local level. In Little Gull the flyway trend is probably positive so clearly different from the declining local trend. Besides the analyses above we investigated also the changes in wintering numbers between countries which could show changes in distribution across Europe. Within the flyway, wintering trends in countries northeast of the Netherlands differ significantly from those in countries to the southwest, with relatively more population increases in the former and decreases in the latter. At the species level this is significant for Goldeneye and close to significance for Goosander and Smew.

For each species possible causes for the different patterns described are discussed. In general it seems that for many species local factors play an important role in the negative trends at Lake IJsselmeer and Markermeer. However these are superimposed on large-scale range shifts, probably related to global warming, in at least a selection of the species.

Samenvatting

De gebieden IJsselmeer en Markermeer zijn de grootste zoetwatermeren van Nederland. Ze hebben een zeer belangrijke functie voor broedende, ruiende, doortrekkende en overwinterende watervogels. Vanwege de grote aanwezige aantallen en de belangrijke functie die deze gebieden vervullen zijn ze aangewezen als Natura 2000 en Ramsargebieden. Ondanks deze bescherming gaan verschillende belangrijke soorten achteruit (soorten die afhankelijk zijn van vis of bodemdieren) en het is belangrijk om de oorzaken van deze achteruitgang te achterhalen voor het vormgeven van beleids- en beheermaatregelen. Echter omdat de soorten in kwestie veelal trekvogels zijn is het achterhalen van de oorzaken extra ingewikkeld omdat deze zowel in het IJsselmeer en Markermeer kunnen zijn gelegen of in de andere gebieden die de vogels gebruiken gedurende hun jaarcyclus. Dit rapport analyseert daarom zowel de populatietrends op lokaal niveau als voor de *flyway* als geheel. Uit de overeenkomsten en verschillen tussen deze trends op verschillende schaalniveau kunnen belangrijke conclusies getrokken worden of de oorzaken lokaal of elders moeten worden gezocht. De populatietrends in IJsselmeer en Markermeer blijken in 1980-2010 voor de onderzochte soorten significant harder achteruit te gaan dan in de *flyway* als geheel. Vier soorten: Fuut, Brilduiker, Grote Zaagbek en Nonnetje gaan achteruit in het IJsselmeergebied maar vooruit in de *flyway* als totaal. Voor Tafeleend en Kuifeend is de trend in het IJsselmeergebied sterker negatief dan de achteruitgang in de *flyway*. De Topper, Dwergmeeuw en Zwarte Stern gaan ook achteruit in het IJsselmeergebied. Voor Topper en Zwarte Stern weten we wel dat dit ook het geval is in de *flyway* maar er ontbreken gegevens om dit preciezer te analyseren. Voor de Dwergmeeuw is het waarschijnlijk dat de trend in de *flyway* positief is en dus ook sterk afwijkt van die in het IJsselmeergebied,

Naast deze vergelijking tussen lokale trend en *flyway* trend hebben we ook verschillen en overeenkomsten in landen trends in de winter geanalyseerd, deze kunnen een aanwijzing geven voor een veranderende verspreiding van een populatie binnen Europa. Binnen de range van de *flyways* waar het IJsselmeergebied deel van uitmaakt zijn de trends in landen ten noordoosten van ons meer positief dan ten zuidwesten. Op soortsniveau is dit significant voor Brilduiker en bijna significant voor Grote Zaagbek en Nonnetje.

Per soort worden mogelijke oorzaken gegeven van de patronen zoals gevonden in deze studie. In zijn algemeenheid lijkt het dat voor de meeste soorten lokale factoren een rol spelen bij de trends zoals vastgesteld in het IJsselmeergebied. Voor een aantal soorten echter spelen deze factoren bovenop een verandering in verspreiding binnen Europa.

1. Introduction

The Lakes IJsselmeer and Markermeer form the largest fresh water lake complex in the Netherlands. They have a very important function for waterbirds as breeding, moulting, migration and wintering sites (van Eerden *et al.* 2005, Noordhuis & van Roomen 2007). Based on these functions and the high numbers of birds, the lakes are designated as Natura 2000 sites under the EU Birds Directive and as Wetlands of International Importance under the Ramsar Convention. In 2009 a large ecological study started, focusing on several waterbird species with long term declining trends and the components of the ecosystem that were suspected to be responsible for these declines. This study should finalize in 2013 and aims for clear management advice to reach a resilient and sustainable ecosystem with optimal possibilities for the target species (Noordhuis 2010). The Ministry of Economic Affairs, Agriculture and Innovation (EL&I) will use this advice to evaluate the present Natura 2000 conservation targets for the lakes.

Many of the waterbird species designated for Lakes IJsselmeer and Markermeer are migratory. This poses extra challenges when the interpretating detected trends. Population declines may be caused by many different factors, either within Lakes IJsselmeer/Markermeer, or at other sites that these populations use. Many of these IJsselmeer/Markermeer species use different sites along a large geographical range, with breeding grounds from the arctic and boreal zones of Scandinavia and Russia and towards the Mediterranean or even West-Africa for wintering. Sites shared by the same populations of birds in Western Europe, including Lakes IJsselmeer and Markermeer, are collectively called the East Atlantic Flyway. For the interpretation of the site trends at Lake IJsselmeer and Markermeer it is important to know population trends in other parts of the flyway and the flyway in total. This helps identify and understand drivers behind these trends..

In theory, there are three options for the interpretation of site trends in comparison with flyway trends (Table 1). Interpretation of stable or increasing trends at site level is not problematic. These indicate that the target population maintains itself in favourable status at site level (1). If in this case the international population declines, the international responsibility of the site manager increases. However, if the local population is decreasing the situation is more complicated. If the flyway trend is stable or increasing while the local trend is decreasing, the status of the local population is clearly unfavourable (2). In this case, it is likely local factors that are responsible for the observed trend although redistribution of the population cannot be ruled out. The assessment of the situation is even more complex if both the local and flyway trends are decreasing (3). In such cases, the cause of decline might be at the site (local decrease is stronger than international decrease) and can be addressed through local measures or could be at the breeding or wintering grounds further north or south (international decrease stronger or both equally strong) and can only be addressed through flyway level collaboration. Reliable flyway level population size and trend estimates are sufficient to interpret the situation correctly in case of (1). However, diagnosing the causes of decline in case of (2) and (3) requires a better understanding of changing use of sites in the flyway.

This report analyses the flyway trends of important waterbird species at Lakes IJsselmeer and Markermeer and investigates the difference or similarity with trends at Lakes IJsselmeer and Markermeer themselves. It also investigates differences in trends between countries or regions from

Table 1. Assessment of local conservation status of populations by comparing site trends in the context of flyway trends. See explanation of numbers in the text.

	Flyway – Decreasing	**Flyway - Stable**	**Flyway - Increasing**
Site - Decreasing	(3) Unfavourable, international or local cause	(2) Unfavourable, local cause, local concern (relative importance decreasing)	(2) Very unfavourble, local cause, high local concern (relative importance decreasing strongly)
Site- Stable	(1) Favourable, local concern (relative importance increasing)	(1) Favourable	(1) Favourable, local concern (relative importance decreasing)
Site – Increasing	(1) Favourable, local concern (relative importance increasing strongly)	(1) Favourable, local concern (relative importance increasing)	(1) Favourable

the same flyway based on wintering numbers. Possible causes for patterns detected will be discussed. The report will also investigate and recommend improvements for international monitoring as relevant for the management of IJsselmeer and Markermeer waterbird populations.

2. Material and methods

2.1. Study sites and species

2.1.1. Lakes IJsselmeer and Markermeer

Lake IJsselmeer and Lake Markermeer are large, shallow lakes in the centre of The Netherlands. They are the two largest (1100 and 700 km^2) remains of a brackish, inland sea (Zuiderzee) after it was closed from the Wadden Sea in 1932 and partly reclaimed. Several other remains constitute much smaller lakes, and particularly a chain of about 8 of these around a group of polders called "Borderlakes" (Randmeren) are relevant in this study as well because of exchange of birds. All of these lakes together support at least a million waterbirds each winter. In Lake IJsselmeer and Markermeer the main food sources for waterbirds used to be Smelt *Osmerus eperlanus* and Zebra Mussel *Dreissena polymorpha*. Both of these have declined, as have the numbers of piscivorous and benthivorous waterbirds (Noordhuis 2010).

2.1.2 Species selection

Initially all species with Natura 2000 targets in Lakes IJsselmeer and Markermeer with a decreasing trend were selected (core species). These were supplemented with a few species for which international trends will be helpful in understanding the patterns found at Lakes IJsselmeer and Markermeer (Table 1). Based on this but taking into account the likelihood that meaningful flyway trends could be calculated, the study species for this report were selected. This resulted in a final list of nine study species, which will be fully treated in this report (Table 1). For Scaup, Little Gull, Black Tern and Common Tern flyway wide data on wintering numbers are scarce or lacking as they are all using open sea during winter (both in the North of Europe for Scaup and from the Atlantic Ocean to South Africa for the Terns and Little Gull). Also during breeding these species are distributed over vast areas in the North and East of Europe and West-Asia for which no proper simultaneous monitoring of breeding numbers exists yet. These species are treated more briefly in this report.

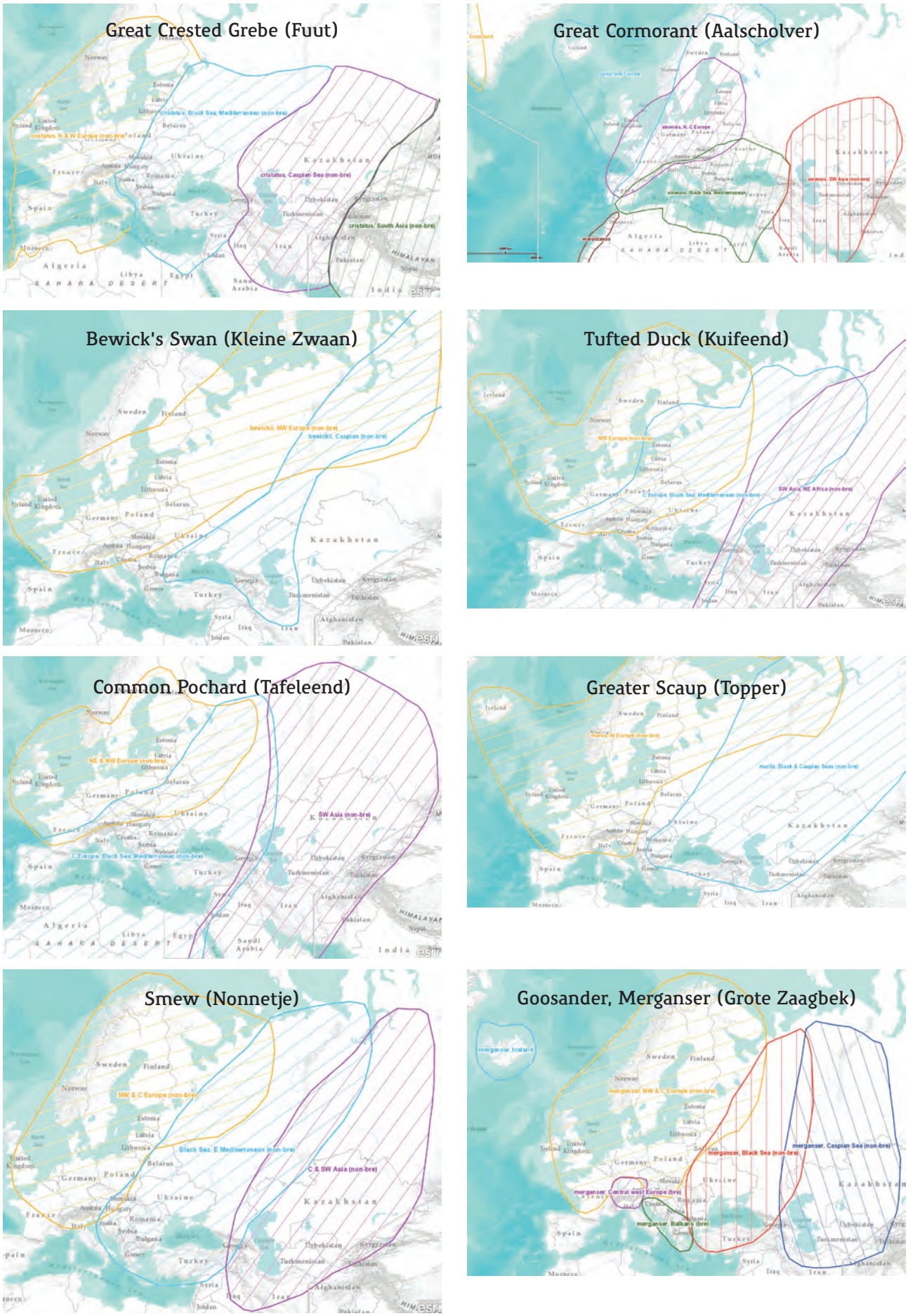
2.1.3. Geographical delineation of the relevant flyways

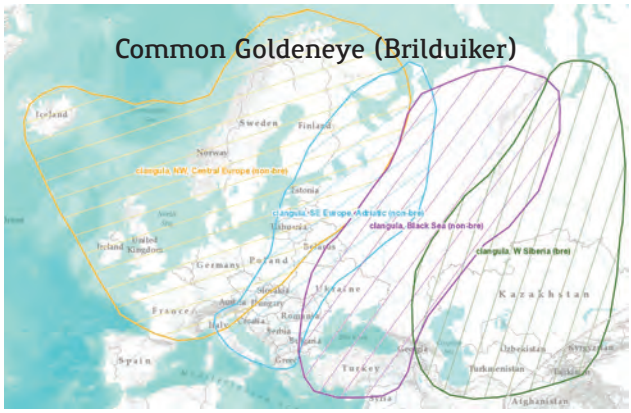
The distinction in different populations for the study species was taken from Wetlands International 2006. Within Europe and Africa a single species will often have multiple populations. Per species the international population was selected which uses Lakes IJsselmeer and Markermeer as part of their flyway. The geographical delineation of these populations are based on the maps provided in the CSN Tool which can be assessed online (Wings over Wetlands 2011, see Figure 1). These population specific flyways comprise their breeding areas, stopover-sites and wintering range.

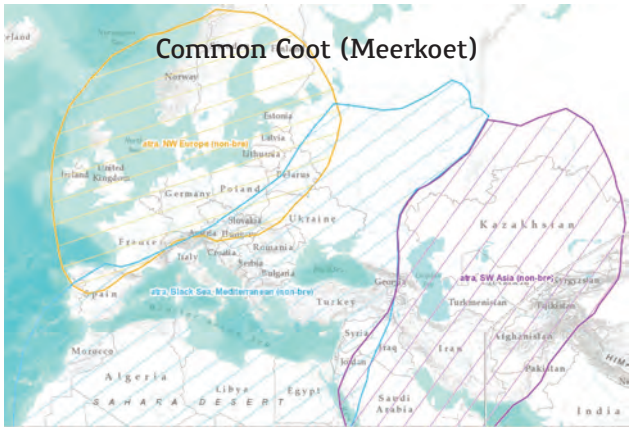
Table 2. Overview of species for which flyway trends will be informative in relation to Lake IJsselmeer and Markermeer management (species sorted by food choice). Besides English and Dutch species names and food choice the Natura 2000 goals are also given in terms of maintenance goals (maintaining present carrying capacity for the species) or restoration goals (improving carrying capacity for the species). In the column species type, the core species are given with 1 (species with a decreasing trend in IJsselmeer/Markermeer), for species indicated with 2 flyway trends will help in improving the ecosystem knowledge. In the last column, the way the species are treated in this report are given, species indicated 1 are fully treated (as enough data is available to perform flyway wide analyses), for species indicated 2 only limited information on flyway level is available and they are only treated briefly.

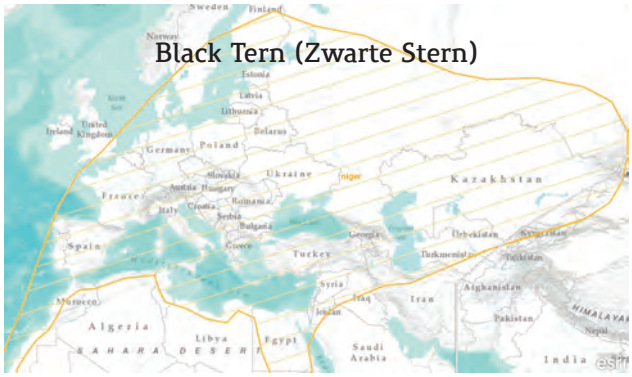
English species name	Dutch species name	Food type	N2000 goal	Species type	this report
Pochard	Tafeleend	Benthos	Maintenance	1	1
Tufted Duck	Kuifeend	Benthos	maintenance	1	1
Scaup	Topper	Benthos	Maintenance	1	2
Goldeneye	Brilduiker	Benthos	Maintenance	1	1
Coot	Meerkoet	Benthos/Plants	Maintenance	2	1
Smew	Nonnetje	Fish	Restoration	1	1
Goosander	Grote Zaagbek	Fish	Restoration	1	1
Great Crested Grebe	Fuut	Fish	Restoration	1	1
Great Cormorant	Aalscholver	Fish	Maintenance	2	1
Little Gull	Dwergmeeuw	Fish	Restoration	1	2
Black Tern	Zwarte Stern	Fish	Restoration	1	2
Common Tern	Visdief	Fish	Maintenance	2	2
Bewick's Swan	Kleine Zwaan	Plants	Maintenance	2	1

Figure 1. Geographical delineation of the flyway populations (in yellow, Cormorant in pink) included in this study (from Wings over Wetlands 2011).









2.2. Material

2.2.1. Waterbird monitoring at Lakes IJsselmeer and Markermeer

Lakes IJsselmeer and Markermeer are counted each month through aerial surveys since 1980, by the 'Waterdienst' from the Ministry of Infrastructure and Environment (van Eerden *et al.* 2005). The counts of Lakes IJsselmeer and Markermeer are also used within the Dutch waterbird monitoring scheme as part of a governmental ecological surveillance ('Netwerk Ecologische Monitoring'). The Dutch waterbird monitoring is coordinated by Sovon in collaboration with several governmental bodies and Statistics Netherlands (Hornman *et al.* 2012). The main aims are to (a) assess national and site-based trends in waterbird numbers at key-sites, including all Natura 2000 sites, and (b) assess the total size of waterbird populations in The Netherlands. The waterbird monitoring scheme covers all important wetlands by monthly counts in September – April or July – June depending on the number of waterbirds present in the summer months.

2.2.2. Waterbird monitoring at the flyway level

Two main methods are available for flyway level monitoring of waterbird numbers: simultaneous counting during the breeding season or during the winter season. For some populations counting during the migration season or by marking-resighting can be useful. For some populations results of both breeding and winter period are usable but usually either the breeding period or the wintering period is most suitable.

Monitoring during winter

International monitoring during January has a long history and is organized within the International Waterbird Census (IWC) coordinated by Wetlands International. It has been developed to monitor the changes in the status and distribution of waterbird populations and to assist the identification of internationally important sites for waterbirds in January. The IWC and the associated information services, such as the Conservation Status Report (CSR) for the AEWA Agreement (Nagy *et al.* 2012) and the global Waterbird Population Estimates (Wetlands International 2006) for the Ramsar convention are important sources of policy relevant information. Although the program started in 1967, many countries started their monitoring later and coverage of different waterbird species started at different times. In the current study counting data of the IWC from the period 1980-2010 have been used.

Monitoring during the breeding season

International coordination of monitoring breeding birds is a more recent activity. Within Europe, the European Bird Census Council coordinates monitoring of common breeding birds since the be-

ginning of the 1990's and trends are calculated back to 1980 (PECBMS 2012). However within this scheme most waterbirds are not included. Another source of data on breeding bird numbers and trends are from the ' Birds in Europe' projects coordinated by BirdLife International. For these projects, all European countries are asked to estimate the sizes of their breeding populations and wintering populations every 10 years. This information is used for a European wide assessment of status. The first project was in 1994, the second in 2004 (Birdlife International 2004) and the third is underway. The assessment of 2004 is a useful source of information for some of the Lakes IJsselmeer and Markermeer species.

Wetlands International, BirdLife International and some national monitoring organizations (such as BTO, Sovon and Sempach) are currently cooperating within the African Eurasian Waterbird Monitoring Partnership with the aim to further improve the international monitoring of waterbirds.

2.2.3. Site allocation and counts selection

IWC sites were first allocated to flyway populations. As certain regions of Europe are covered by more than one flyway population (see figure 1) additional choices were made than only using counts from all sites within the flyway boundary. The following 'rules' are applied (see van Roomen *et al.* 2011):

1. Population is not overlapping with other flyway populations. All sites within flyway boundary can be used.

Table 3. Number of sites (where the species has been seen) per country per flyway population of the species. Countries having zero sites does necessarily mean that the species is not occurring there, it could mean that the country is outside the flyway delineation of the population concerned. Differences in number of sites between countries does not indicate the importance or unimportance of a species in a country. The number for a species can be very different from one site to the other. Also the level at which countries are supplying their data (sites, subsites, counting units) can differ between countries resulting in different numbers between countries.

	Great Crested Grebe	Great Cormorant	Bewick`s Swan	Common Pochard	Tufted Duck	Common Goldeneye	Smew	Goosander	Eurasian Coot
Algeria	31								
Austria	151	177	1			163	76	109	221
Belarus						2	1	3	4
Belgium	536	585	45	481	564	183	203	246	834
Czech	128	398				207	72	294	421
Denmark	44	50	24	48	49	49	47	48	49
Estonia	50	38	12	22		197	41	196	49
Finland	76	81	6	22	15	333	64	409	98
France	341	145	36	246	128	210	105	176	313
Germany	1560	1795	428	1676	1560	1643	1200	1673	2249
Hungary	3	7	1			4		34	53
Ireland	157		26	167	223	144	6	16	165
Italy	460	7	3			49	29		
Kaliningrad (Russia)	1	1				2	1	2	2
Latvia	46	33	6	31		142	49	144	51
Lithuania	4	5	1	5		7	4	7	5
Luxembourg		1		1	1	1	1		
Morocco	13								
Netherlands	96	96	166	96	98	92	95	95	97
Norway	43	3		21	71	245	18	104	24
Poland	32	37	8	26	34	90	53	84	79
Portugal	5								
Slovakia	36	195				99	7	102	179
Spain	642	788							179
Sweden	557	896	11	413	1027	1540	538	1442	755
Switzerland	86	94	3			65	42		95
Tunisia	47								
United Kingdom	1438		286	2363	2913	2112	381	1625	2756

2. Population is overlapping with another (very) small population in January; include counting data of all sites within the flyway boundary, disregarding the numbers belonging to the other population.
3. Population is overlapping with another population to a small degree (5-30%) in January; starting from West to East include all sites within the flyway boundary for the most western population; next include all sites of the flyway further to the East, excluding the sites in the overlap zone with the western flyway; next include all sites of the next flyway east of these, but not the sites in the overlap zone with the western flyways.

Additionally only sites with at least two counts in different years were used and in the case of multiple visits in January in the same year the count closest to the 15th of January was selected. Table 3 gives the number of sites per population split in the different countries.

2.3. Methods

2.3.1. Analyses of trends

For Lakes IJsselmeer and Markermeer, trend analyses are performed on yearly indices for the total area. Yearly indices are based on seasonal averages, being the sum of numbers counted plus numbers estimated for units with missing counts (very rare in this dataset) in July-June divided by 12 . The use of 12 months in these yearly indices adds robustness to the index and combines several functional periods (migration, wintering, moult) for the same species. The yearly indices are analyzed for trends in the period 1979/80-2009/10 with TrendSpotter calculating flexible trends with confidence intervals (Soldaat *et al.* 2007).

For the flyway trends and country trends (including Dutch trends), analyses are performed on yearly indices involving the January results for 1980 - 2010. UINDEX (Bell 1995) is used to account for missing counts, on the basis of site and year factors estimated from the non-missing counts (Underhill & Prys Jones 1994). As only January counts were involved the month factor was not important during this analysis. For the imputing, counted sites are grouped in regional strata. Missing counts are only imputed with data from within their stratum (see Table 4). However when no data was available in certain years from within a stratum, data from the other strata were used for the imputingl. After imputing, the numbers per stratum were added together as totals per flyway population per year. Only yearly indices with at least 30% counted numbers were used for the further analyses (van Roomen *et al.* 2011). In most cases the percentage of imputed values is much less. The yearly indices were analyzed for trends with TrendSpotter. Besides flyway trends, national trends are also analyzed (Table 4). Some countries are taken together when small sample sizes per country existed. Other countries are split when they involved a large geographical range of Europe. The yearly indices on 'country' level from 1987-2009 are also analysed for trends with TrendSpotter. These trends are only calculated if the 'country' held 0.1% or more of the flyway population of the species concerned (Table 5) and the length of the time series was at least 10 years.

2.3.2. Other analyses

To test whether the population trends on lake IJsselmeer/Markermeer are site specific or part of a broader development, we compared the trends in IJsselmeer/Markermeer with the trends at flyway level (excluding IJsselmeer/Markermeer) for

Table 4. Overview of regional strata used for imputing missing counts and the countries belonging to these strata. Only sites within the flyway-boundaries (see figure 1) and allocated to the specific flyway-population (see 2.2.3) are included in these analyses. Also the national or regional agglomerations are given on which level separate 'national' trends are calculated. These are also based on only the sites allocated to the specific flyway population concerned.

Country	Regional strata	National trends (or differences)
Belarus	North	together with Baltic states
Denmark	North	Yes
Estonia	North	together with Baltic states
Finland	North	Yes
Iceland	North	Yes
Latvia	North	together with Baltic states
Lithuania	North	together with Baltic states
Norway	North	Yes
Sweden	North	Yes
Poland	North	together with Baltic states
Austria	East	Yes
Czech	East	Yes
Germany	East	East, NW & SW Germany
Hungary	East	Yes
Slovakia	East	Yes
Belgium	Middle	Yes
France	Middle	North, South France
Luxembourg	Middle	with Belgium
Switzerland	Middle	Yes
Algeria	South	together with Tunisia
Italy	South	Yes
Morocco	South	Yes
Portugal	South	Yes
Spain	South	Yes
Tunisia	South	Yes
Ireland	West	including North Ireland
United Kingdom	West	North and South UK
Netherlands	Netherlands	Yes

Table 5. The average number per flyway population per country (or the level on which national trends will be shown, see table 4) present in the counted sites in January 1996 -2005 expressed as the percentage of the flyway population size (Wetlands International 2006). The percentage does not indicate the real importance of a country during winter for a certain population as not all sites where the population occur in that country have to be counted and be present in the material used. It also does not indicate the real importance of a country for a certain species as also another flyway population of the same species can occur in the same country.

	Great Crested Grebe	Great Cormorant	Bewick`s Swan	Common Pochard	Tufted Duck	Common Goldeneye	Smew	Goosander	Eurasian Coot
Austria	0,3	1,1	0,0	0,0	0,0	0,3	0,3	0,3	1,3
Baltic	1,5	0,4	0,8	0,1	0,0	10,9	13,6	31,9	0,7
Belgium / Luxembourg	1,2	1,7	1,0	7,8	1,8	0,1	1,0	0,7	3,1
Czech	0,1	2,3	0,0	0,0	0,0	0,1	0,2	1,2	0,7
Denmark	0,1	0,8	0,3	1,7	5,7	2,4	1,0	2,3	3,9
Finland	0,0	0,6	0,0	0,0	0,2	0,4	0,2	4,0	0,0
France N	4,0	2,6	0,3	9,3	0,6	0,2	0,9	0,4	5,9
France S	3,9	2,8	0,2	1,8	0,0	0,1	0,0	0,0	2,7
Germany E	1,7	3,4	1,6	5,9	9,8	3,3	13,9	9,3	8,2
Germany NW	3,7	4,5	8,5	7,3	7,0	1,3	5,4	4,7	6,7
Germany SW	1,5	2,9	0,0	3,9	0,1	0,8	0,5	0,3	4,5
Hungary	0,0	1,6	0,0	0,0	0,0	1,3	0,0	1,1	0,4
IJsselmeer/Markermeer	0,7	1,0	0,1	0,9	2,6	0,3	4,7	2,2	0,3
Ireland	3,6	0,0	35,4	21,7	9,2	2,4	0,9	2,2	9,2
Italy	6,5	0,2	0,0	0,0	0,0	0,2	0,1	0,0	0,0
Morocco	0,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Netherlands (without IJ/M)	4,1	2,5	19,0	10,1	6,8	1,0	4,7	0,9	7,5
Norway	0,0	0,0	0,0	0,0	0,0	0,2	0,0	0,1	0,0
Portugal	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Slovakia	0,0	2,3	0,0	0,0	0,0	0,5	0,0	0,2	0,5
Spain	1,9	6,8	0,0	0,0	0,0	0,0	0,0	0,0	0,8
Sweden	0,7	4,6	0,1	1,0	18,5	5,5	11,6	10,5	1,3
Switzerland	12,6	2,1	0,1	0,0	0,0	3,3	0,7	0,0	20,3
Tunesia Algeria	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
United Kingdom N	0,3	0,0	1,7	2,6	1,5	1,0	0,1	1,0	1,3
United Kingdom S	2,5	0,0	30,8	11,3	5,2	0,6	0,8	1,2	6,9

all species simultaneously using a paired t-test. At the species level we used a loglinear Poisson regression model to test whether the trend on lake IJsselmeer/Markermeer was different from the flyway trend. In this model, the seasonal average number of birds was the response variable. Year (as a continuous variable), site (either IJsselmeer/Markermeer or rest flyway) and the interaction term of year and site were the explaining variables. The significance of the latter interaction term indicates the difference in trends.

Finally, to test whether population trends of species differ between the Netherlands, and the countries situated to the southwest and countries situated to the northeast of the Netherlands, we performed a Fisher's exact test using the number of positive and negative population trends summarized over all species per region as input.

2.4. Presentation of results

In the species accounts in this report, local trends (Lake IJsselmeer, Lake Markermeer and Borderlakes) are compared to the total flyway trend (first graph in each species account, only the trend lines are given, the yearly indices plus confidence limits of the trend can be found in appendix A). Next in the second graph, trends per country in January are accumulated into six geographic strata (only for the flyway-population). In the map, the distribution of trends per (part of) country in January is shown as well. Finally the table in the species accounts gives the trend indications for different geographical scales. This table also gives the test results of the difference in trend between Lakes IJsselmeer/Markermeer together with the flyway trend excluding Lake IJsselmeer and Markermeer.

3. Results

3.1. Great Crested Grebe – Fuut

The Great Crested Grebe has a wide distribution in Eurasia, Africa and Oceania. The population occurring in the Netherlands belongs to the NW European flyway-population including Southern Scandinavia, Baltic States, Poland and Germany to the North and East and the British Isles, France, Swistzerland and West-Mediterranean to the West and South. Ringing recoveries links The Netherlands with Norway, Sweden and Denmark and with the UK, France and Swiss lakes (Speek & Speek1984, Wernham *et al.* 2002, Bakken *et al.* 2003, Fransson & Pettersson 2001). The species is found breeding on lakes, ponds and estuaries. The majority breeds at lakes larger than 10 ha with a combination of reedbeds and open water. Great Crested Grebe winters on larger lakes, estuaries and coastal areas and is essentially a fish feeder. Northern birds are highly migratory, but further South the species is resident except for cold-weather movements. In the 1980s, together with the Swiss lakes and the Black Sea, Lake IJsselmeer was considered the most important wintering site for the species (Hagemeijer & Blair 1997).
Both in IJsselmeer and Markermeer the trend is negative, although in IJsselmeer the seasonal mean over the five most recent seasons seems to be stabilising with respect to the period 1999-2007. In contrast, in the Borderlakes the trend is positive as is the case in the total flyway. The (negative) trend direction in IJsselmeer and Markermeer is significantly different from the flyway (p<0,001). The decrease in lake IJsselmeer is probably due to the strong decrease of Smelt. In Lake Markermeer the increased turbidity of the water is an important

Table 6. Trend indications for different geographical units and the statistical test of trend at IJsselmeer/Markermeer versus the flyway trend (excluding IJsselmeer/Markermeer).
+ = increasing, - = decreasing, 0= stable and ?=uncertain. The trends at sites are calculated on the basis of the average number present per season (July-June) and the flyway trends on the basis of January counts.

Great Crested Grebe	Trend
IJsselmeer (seasonal average)	-
Markermeer(idem)	-
Borderlakes (idem)	+
IJsselmeer/Markermeer (idem)	-
IJsselmeer/Markermeer/Randmeren (idem)	0
Flyway (January)	+
Flyway (excluding IJ/M, Jan)	+
IJsselmeer/Markermeer vs Flyway (excluding IJ/M)	<0,001

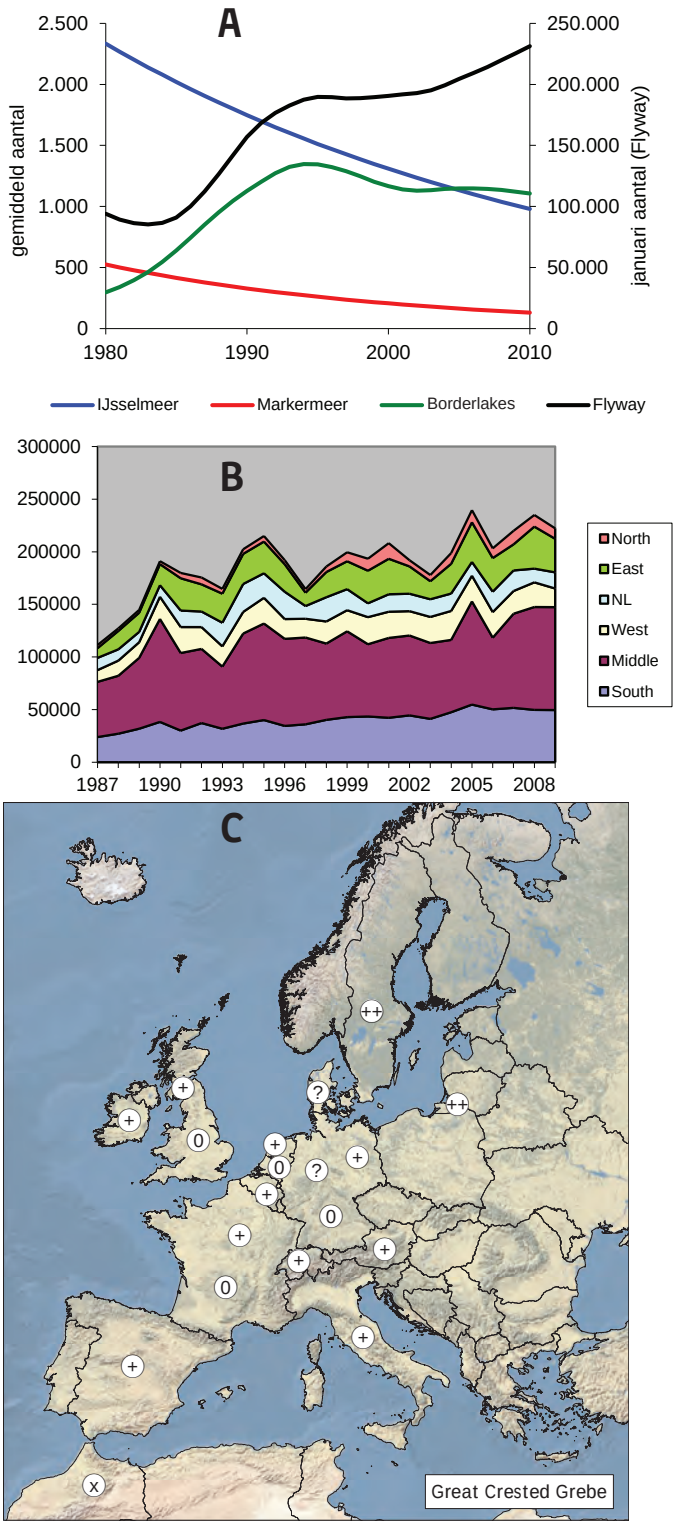
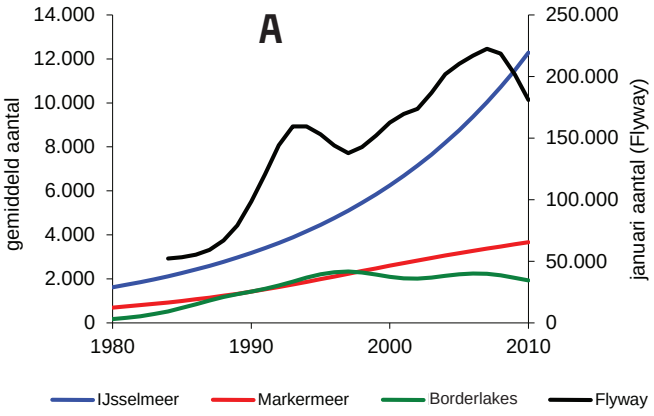


Figure 2. Results per species (Great Crested Grebe): A. comparison of trends at Lake IJsselmeer, Lake Markermeer and Borderlakes with Flyway trend. B. Change in January wintering numbers within the sites allocated to the flyway population under study subdivided in different regions from the SW to the NE within their winter distribution. C. The January trends on national level or subdivisions from that for the flyway population under study.

driver. Together with increased pressure of recreational activities and human disturbance, especially in the moulting period of July – September, this is likely to have caused the decreases in IJsselmeer and Markermeer (Noordhuis 2010). Many factors can affect the numbers in the flyway or causing redistribution in the flyway. One factor of importance seems eutrophication. Positive relations with increasing eutrophication have been described (Martinez Fernandex *et al.* 2005), but also negative impacts (Skov *et al.* 2011). On one hand increasing eutrophication could result in higher food stocks (more algae for certain fish species) but it will also affect the ability of waterbirds to catch fish, both positively through better catchability of prey and negatively through predator avoidance behaviour of fish. It seems likely that a certain level of eutrophication have increased the carrying capacity for Great Crested Grebe in the flyway but that the present influences can be rather different between sites depending on the local situation. Another factor of influence is probably global warming. This could result in redistribution in the flyway when especially the migrating populations remain further north and east (Carss *et al.* 2011, Skov *et al.* 2011). Although this phenomenon is happening it seems not to be the dominant factor as both positive trends occur in the southern and northern part of their flyway.

3.2. Great Cormorant - Aalscholver

The Great Cormorant has a very wide distribution, occurring in Europe, Asia, Australia and Africa. Two subspecies, *carbo* and *sinensis* occur in Europe, which have a striking difference in habitat preference. *Carbo* breeds on sea cliffs on the Atlantic and North Sea coast and remains in this habitat during the non-breeding season and *sinensis* breeds in trees or on the ground in wetlands in the rest of Europe and winters from the southern Baltic to the Mediterranean in estuaries, lagoons, lakes and rivers. The population occurring in The Netherlands and using Lakes IJsselmeer and Markermeer, belong to the western European flyway-population of *sinensis* which breeds in South Sweden, Poland, Denmark, Germany and the The Netherlands and winters in inland France, inland Spain, the West Mediterranean coast and increasingly further North ,e.g. in The Netherlands itself (van Eerden & Gregersen 1995, Lindell *et al.* 1995).
Both in IJsselmeer and Markermeer, the Cormorant numbers have increased for a long time, though the population seems to have stabilised in recent years. In the Borderlakes the number of Cormorants increased until 1995, since when the population has stabilised. The flyway trend also shows an increase, though with a drop in numbers in the last few years. In Lakes IJsselmeer and



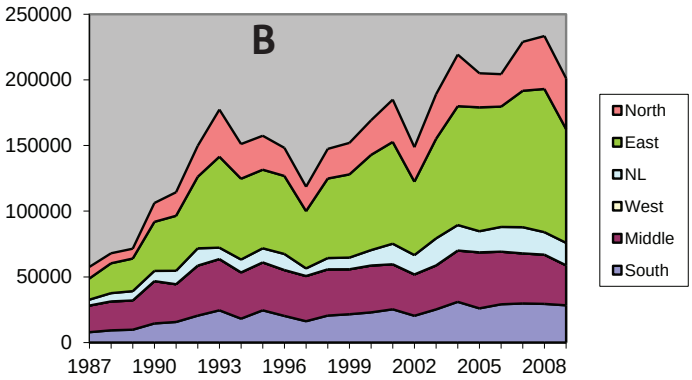


Figure 3. Results per species (Cormorant):
A. comparison of trends at lake IJsselmeer, lake Markermeer and Borderlakes with Flyway trend.
B. Change in January wintering numbers within the sites allocated to the flyway population under study subdivided in different regions from the SW to the NE within their winter distribution.
C. The January trends on national level or subdivisions from that for the flyway population under study.

Table 7. Trend indications for different geographical units and the statistical test of trend at IJsselmeer/ Markermeer versus the flyway trend (excluding IJsselmeer/Markermeer).
+ = increasing, - = decreasing, 0= stable and ?=uncertain. The trend at sites are calculated on the basis of the average number present per season (July-June) and the flyway trends on the basis of January counts.

Cormorant	Trend
IJsselmeer (seasonal average)	++
Markermeer (idem)	+
Borderlakes (idem)	++
IJsselmeer/Markermeer (idem)	++
IJsselmeer/Markermeer/Randmeren (idem)	++
Flyway (January)	+
Flyway (excluding IJ/M, Jan)	+
IJsselmeer/Markermeer vs Flyway netto (excluding IJ/M)	<0,001

Markermeer the increase is significantly stronger than the flyway trend (p<0,001). The initial steady growth of Cormorants in the flyway and also the Netherlands is probably due to decreased hunting and persecution, with much better protection of breeding sites. Since 1980, good food availability (perhaps enhanced by eutrophication), will also have played a role.

3.3. Bewick's Swan – Kleine Zwaan

Bewick's Swan breeds on Arctic tundra across northern Russia, from the west coast of Cheshskaya Bay (East of the Kanin Peninsula) to Kolyuchin Bay in the Chukchi Sea. Three populations of Bewick's Swan have been identified, based on their wintering grounds. The focus here is on the NW European

Table 8. Trend indications for different geographical units and the statistical test of trend at IJsselmeer/ Markermeer versus the flyway trend (excluding IJsselmeer/Markermeer).
+ = increasing, - = decreasing, 0= stable and ?=uncertain. The trend at sites are calculated on the basis of the average number present per season (July-June) and the flyway trends on the basis of January counts.

Bewicks Swan	Trend
IJsselmeer (seasonal average)	++
Markermeer (idem)	?
Borderlakes (idem)	0
IJsselmeer/Markermeer (idem)	++
IJsselmeer/Markermeer/Randmeren (idem)	0
Flyway (January)	-
Flyway (excluding IJ/M. Jan)	-
IJsselmeer/Markermeer vs Flyway netto (excluding IJ/M)	<0,001

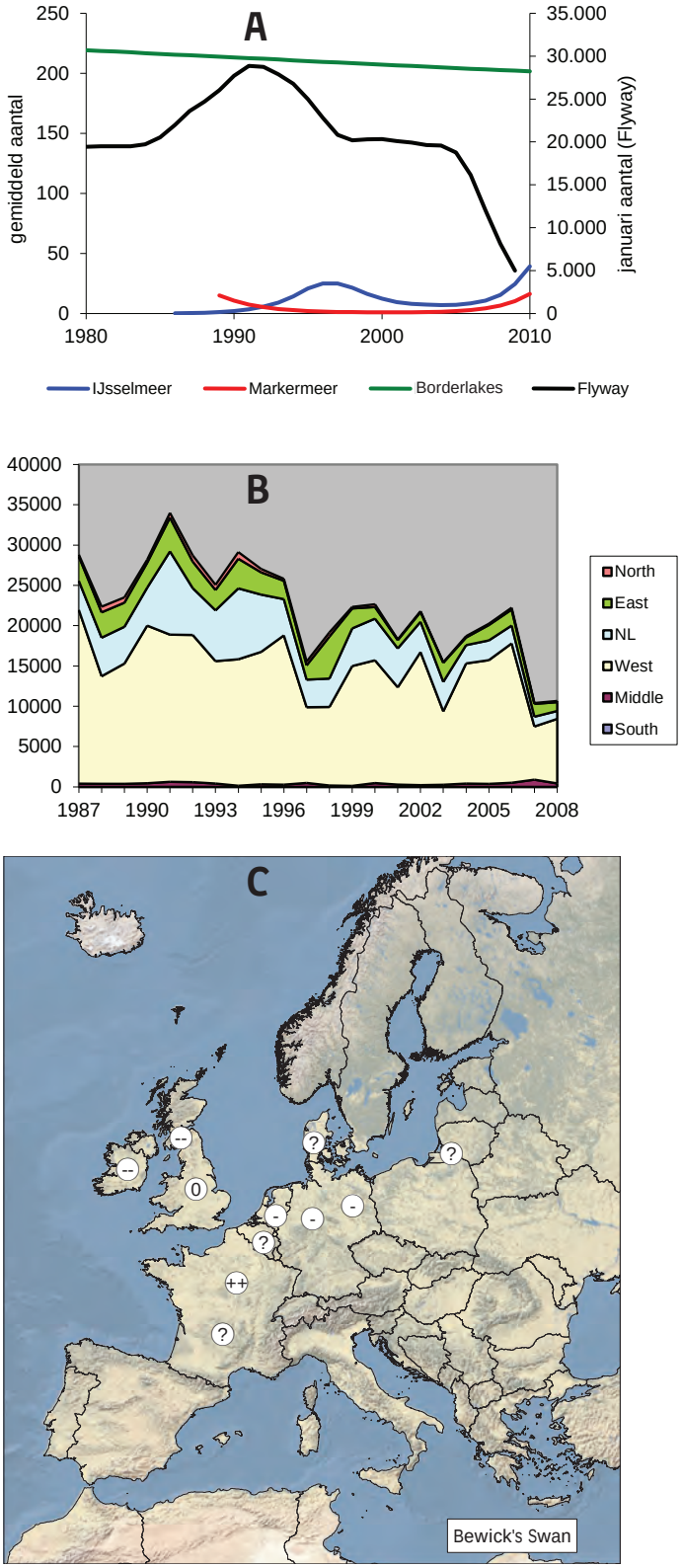


Figure 4. Results per species (Bewick's Swan):
A. comparison of trends at lake IJsselmeer, lake Markermeer and Borderlakes with Flyway trend.
B. Change in January wintering numbers within the sites allocated to the flyway population under study subdivided in different regions from the SW to the NE within their winter distribution.
C. The January trends on national level or subdivisions from that for the flyway population under study.

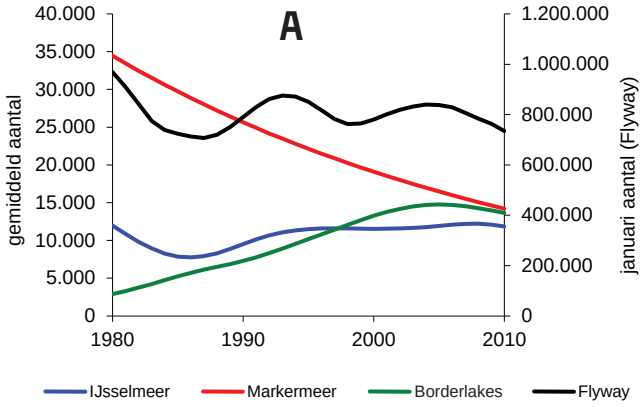
flyway population, breeding in northeast European Russia and wintering mainly in the Netherlands, Britain and Ireland . The main stop-over sites are in Russia, the Baltic States, Poland, Germany and Denmark. Stop-over sites are crucial for rapid replenishment of the fat reserves needed for migration. (Rees & Beekman 2010, Nagy *et al.* 2012).
In winter the species traditionally occupies shallow tidal waters, coastal lagoons, inland freshwater lakes and marshes, where they mostly feed on the tubers and rhizomes of *Potamogeton* spp., and on *Zostera* spp. and *Chara* spp. Flooded pastures are also preferred, where they graze on grasses. An increasing proportion of the birds are also feeding on arable land (e.g. stubble fields, root crops and oilseed rape) from the 1970s onwards. Feeding sites are located in close proximity to permanent waters serving as (disturbance-free) roost sites (Rees & Beekman 2010, Nagy *et al.* 2012).
Numbers of Bewick's Swan are relatively low both in IJsselmeer and Markermeer. Recently however, the numbers increased in both areas after a period of more or less stable population size. This increase is a response to increasing waterplant resources especially in the NE of Lake IJsselmeer. Densities of macrophytes (*Potamogeton, Chara*) in the shallower parts, which also peaked in the mid-1990s, are now strongly increasing after a minimum around 2004. The increasing trend at IJsselmeer is in contrast with the flyway trend where a sharp decrease in numbers has occurred. The Borderlakes has always been a more important site for Bewick's Swans. Although numbers there are fluctuating from year to year, overall trend in the Borderlakes is stable. Here too, numbers seem to have responded to developments in water quality and increasing density of submerged macrophytes. Fluctuations can often be linked to changes in waterlevel and associated availability of these plants to the swans. In contrast, the trend in the Netherlands as a whole reflects the flyway trend with an overall decrease, especially in the last ten years. The general reasons for the decrease on national and international levels are considered to be low breeding success and survival rate. The drivers of these decreases are not fully understood but could include illegal hunting as still high levels of lead shot are found in birds caught alive (Newth *et al.* 2011), deteriorating conditions on important winter and stop-over sites which are depending on the right level of water depth, enough submerged waterplants and absence of human disturbance. Feeding competition with Mute Swans can also play a role. An international species action plan has been prepared under AEWA to react to the decreasing population trend (Nagy *et al.* 2012).

3.4. Tufted Duck - Kuifeend

The Tufted Duck has a Palearctic breeding distribution, ranging from Iceland in the West to the Bering Sea in the East. The species is partially migratory, with Northern populations being highly migratory and populations in the South mostly resident. Birds breeding in western Eurasia winter from the southern range of their breeding distribution and then further South. Tufted Ducks in The Netherlands belong to the NW European flyway population.
Over the whole period Tufted Duck shows a stable trend in Lake IJsselmeer and a decreasing trend in Lake Markermeer. Taken together the trend is decreasing. In the Borderlakes the long term trend is positive but with a decline in recent years. There is no unequivocal conclusion about the decrease in both lakes, but decreases in numbers of mussels, their main prey and an increase of this food source in the Borderlakes is a likely cause (Noordhuis 2010). There are indications that not only mussel abundance but also density of other alternative prey like Pisidium and Potamopyrgus molluscs are involved (Noordhuis 2010).Within the whole flyway, the trend is also negative but significantly less than the IJsselmeer/Markermeer trend. Declines in winter have also been detected in Southern Germany and Northern United Kingdom and an increase in Sweden. However based on our analyses no clear pattern exists yet of a population increase towards the North East. In contrast Skov *et al.* 2011 describes a major increase in Tufted Duck numbers wintering in the Baltic based on two total counts in 1993 and 2009. The reasons behind this increase are not clear.
Numbers of Tufted Ducks are probably influenced by local feeding conditions which in turn will

Table 9. Trend indications for different geographical units and the statistical test of trend at IJsselmeer/Markermeer versus the flyway trend (excluding IJsselmeer/Markermeer).
+ = increasing, - = decreasing, 0= stable and ?=uncertain. The trend at sites are calculated on the basis of the average number present per season (July-June) and the flyway trends on the basis of January counts.

Tufted Duck	Trend
IJsselmeer (seasonal average)	0
Markermeer (idem)	-
Borderlakes (idem)	+
IJsselmeer/Markermeer (idem)	-
IJsselmeer/Markermeer/Randmeren (idem)	0
Flyway (January)	-
Flyway (excluding IJ/M, Jan.)	-
IJsselmeer/Markermeer vs Flyway netto (excluding IJ/M)	<0,001



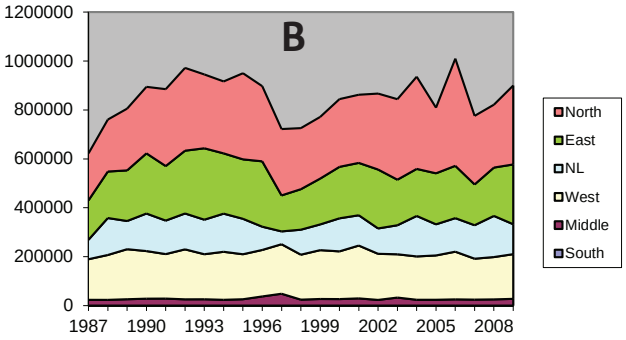


Figure 5. Results per species (Tufted Duck):
A. comparison of trends at lake IJsselmeer, lake Markermeer and Borderlakes with Flyway trend.
B. Change in January wintering numbers within the sites allocated to the flyway population under study subdivided in different regions from the SW to the NE within their winter distribution.
C. The January trends on national level or subdivisions from that for the flyway population under study.

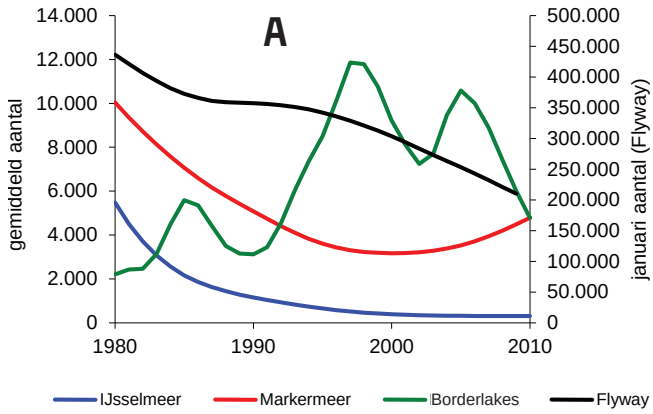
be influenced by water quality parameters. Also disturbance from recreation or hunting can play a role at certain sites along the flyway (Evans & Day 2001). Especially the moulting period, in which the species simultaneously loose its flight-feathers, is energy demanding requiring good feeding conditions and safety (Fox & King 2011). Despite the recent decreasing flyway trend, the population must have increased substantially from 1900 onwards. It was a scarce breeding bird in Western Europe before and is widespread now. It was first recorded in Iceland in 1895 and is now more numerous there than Scaup (Einarsson *et al.* 2004).

3.5. Pochard - Tafeleend

Pochard has a wide Palearctic breeding distribution at temperate latitudes across Eurasia to South-Eastern Russia and North-Eastern China. The species is originally a bird of steppe lakes, but it has expanded its range across Central and Western Europe after 1900. The species is partially migratory and Northern populations are particularly migratory, wintering in NW Europe, Central Europe and around the Mediterranean. Pochard is monotypic and no discrete populations can be identified within its range. However, birds wintering in Western Europe (Ireland, Britain & Netherlands) are generally believed to originate from breeding grounds in Scandinavia in the West to areas in Russia as far East as 70°E (Scott & Rose 1996). This biographic population, to which also the IJsselmeer/Markermeer birds belong, are distinguished from wintering populations further to the East.
In Lake IJsselmeer, Pochard shows a strong decreasing trend since 1980, however from the late

Table 10. Trend indications for different geographical units and the statistical test of trend at IJsselmeer/Markermeer versus the flyway trend (excluding IJsselmeer/Markermeer).
+ = increasing, - = decreasing, 0= stable and ?=uncertain. The trend at sites are calculated on the basis of the average number present per season (July-June) and the flyway trends on the basis of January counts.

Pochard	Trend
IJsselmeer (seasonal average)	--
Markermeer (idem)	?
Borderlakes (idem)	+
IJsselmeer/Markermeer (idem)	-
IJsselmeer/Markermeer/Randmeren (idem)	-
Flyway (January)	-
Flyway (excluding IJ/M, Jan.)	-
IJsselmeer/Markermeer vs Flyway netto (excluding IJ/M)	<0,001



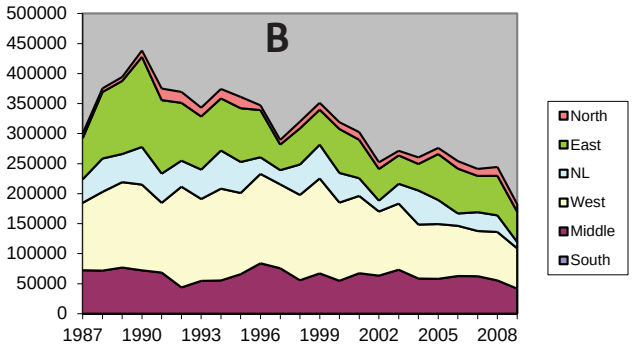


Figure 6. Results per species (Pochard):
A. comparison of trends at lake IJsselmeer, lake Markermeer and Borderlakes with Flyway trend.
B. Change in January wintering numbers within the sites allocated to the flyway population under study subdivided in different regions from the SW to the NE within their winter distribution.
C. The January trends on national level or subdivisions from that for the flyway population under study.

1990's the trend has stabilized at a much lower level. In Markermeer the trend is uncertain in the 1980-2010 period during which it first declined parallel with IJsselmeer until the late 1990's and increased slightly again since then, in contrast with IJsselmeer. At the Borderlakes an obvious increase has taken place with some periods of smaller decreases and increases again. Since 2006 the numbers are declining again but they are still larger than around 1980. Taken together, the numbers at IJsselmeer/Markermeer and also including the Borderlakes has decreased since 1980. Elsewhere in the flyway the Pochard numbers are declining but at a significantly lower rate than in Lake IJsselmeer/Markermeer. In some Northern countries (Denmark, Sweden) Pochard wintering trend is positive, while they have decreased in Ireland and Britain. This could indicate a range shift to the North (however Skov *et al.* 2011 describes a small decline for the Baltic Sea in total). This shift, which might be caused by climate change, has also been demonstrated by Lehikoinen *et al.* (*in prep*). This could partly explain the decreasing trend in IJsselmeer/Markermeer but not the fact that it is decreasing in a higher rate there or that the overall flyway trend is decreasing. Noordhuis (2010) suggests that the improving feeding conditions of the Borderlakes has attracted birds away especially from IJsselmeer, where its favourite prey Zebra Mussel decreased. The recent partial recovery in Lake Markermeer is limited to shallow areas with increasing densities of macrophytes, suggesting a response to developments in availability of other types of prey than Zebra Mussel.

3.6. Smew - Nonnetje

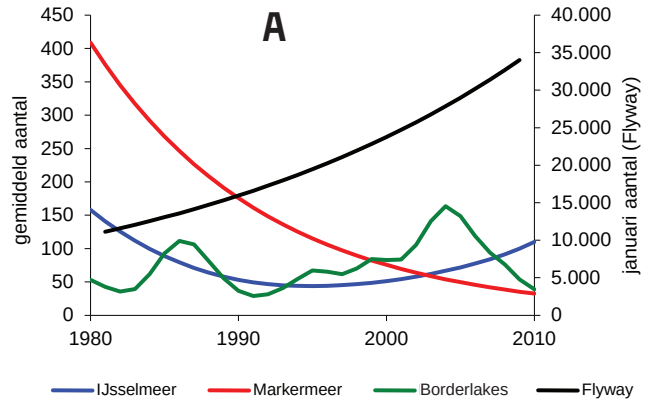
The Smew is a Palearctic species with a breeding range from Norway and Northern Sweden to Kamchatka. It breeds in the taiga and the forest tundra zone. The European wintering range extends South to the North Sea and the Black Sea. Within Europe three main wintering groups exist. The focus here is on the westernmost group which breeds from Norway to the Pechora Delta and winters mainly in the Baltic Sea and The Netherlands. The trend of Smew in Lake IJsselmeer is unclear with a decrease until the mid-1990's and a small increase after that. In Lake Markermeer, where numbers dominated in the past, an obvious decrease took place and nowadays only small numbers remain. In IJsselmeer, the unclear trend is mainly caused by the big difference in numbers between winters, where numbers are strongly correlated with the severity of the winter (e.g. Noordhuis 2010, Hornman 2011): peak numbers occur in severe winters when most parts of the Baltic Sea are covered with ice and moderate numbers occur

in mild winters. In Lake Markermeer these peak number also used to occur during severe winters. However, in recent cold winters no clear peaks occurred in Markermeer anymore, indicating that factors other than winter severity play a role there. Smew seems to have changed its preference from Markermeer to IJsselmeer when severe winters push them to our waters. When focussing on the rest of The Netherlands, the Borderlakes show stable or moderately declining numbers between 1980 and 2001, and steep declines hereafter. Also, in the rest of The Netherlands declines predominate. In contrast the flyway trend of Smew shows a moderate increase from the 1980s onwards. The trend at the combined IJsselmeer/ Markermeer compared with the flyway trend is significantly different .

In general numbers seem to have dropped in the Netherlands, with less lower peak numbers in colder winters. In the Baltic Sea numbers seems to have decreased when comparing two total counts around 1993 and 2009 (Skov *et al.* 2011), however time series analyses of selected sites show an increase like our analyses (Skov *et al.* 2011). So there seems to be a range shift in a Northern direction. However, in Markermeer this shift is not the only cause of the declining trend. The occurrence of peak numbers during recent cold winters in Lake IJsselmeer but not in Markermeer, indicate that Markermeer has become less suitable for the species.

Table 11. Trend indications for different geographical units and the statistical test of trend at IJsselmeer/Markermeer versus the flyway trend (excluding IJsselmeer/Markermeer).
+ = increasing, - = decreasing, 0= stable and ?=uncertain. The trend at sites are calculated on the basis of the average number present per season (July-June) and the flyway trends on the basis of January counts.

Smew	Trend
IJsselmeer (seasonal average)	?
Markermeer (idem)	-
Borderlakes (idem)	0
IJsselmeer/Markermeer (idem)	-
IJsselmeer/Markermeer/Randmeren (idem)	-
Flyway (January)	+
Flyway (excluding IJ/M, Jan.)	+
IJsselmeer/Markermeer vs Flyway netto (excluding IJ/M)	<0,001



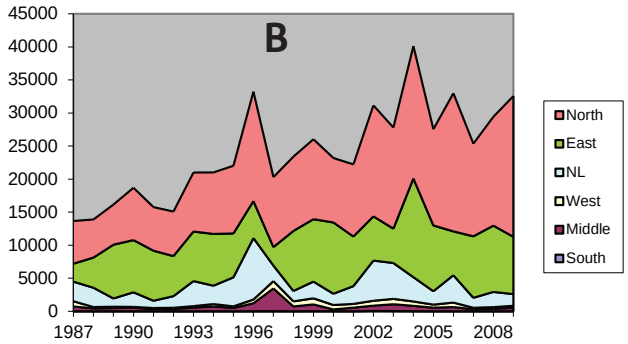


Figure 7. Results per species (Smew):
A. comparison of trends at lake IJsselmeer, lake Markermeer and Borderlakes with Flyway trend.
B. Change in January wintering numbers within the sites allocated to the flyway population under study subdivided in different regions from the SW to the NE within their winter distribution.
C. The January trends on national level or subdivisions from that for the flyway population under study.

3.7. Goosander – Grote Zaagbek

The Goosander is a Holarctic species with a circumpolar breeding range and some fairly isolated more Southerly located areas (e.g. Central Europe and Balkans). The wintering range extends South to Western France, the Adriatic Sea, Turkey and the Caspian region. Birds from the isolated breeding locations are mainly sedentary. The same applies to the (quite isolated) populations from Iceland and Britain. The species breeds on freshwater lakes, pools, and upper reaches of rivers generally close to trees. Goosanders winter on large lakes and brackish lagoons, less regularly in estuaries and rarely along sea coasts. Normally the species occurs in small flocks but in severe winters flocks of thousands can be formed. Three subspecies are identified, with the nominate form occurring from Eurasia to Kamchatka. Within the nominate form, several discrete groups have been identified from which the West European group is important for the Netherlands. It breeds from Norway eastwards and winters mainly in the Baltic Sea and the countries bordering the North Sea. .

The trend of Goosander in lake IJsselmeer is unclear, a freasonably strong decline took place in the 1980's and 1990's followed by a smaller recovery in recent years. In Lake Markermeer the species shows a decline from 1980 onwards which continues today. In Lake IJsselmeer the unclear trend is mainly caused by the big differences in numbers between winters, where numbers are correlated with the severity of winters (Noordhuis 2010). In Lake Markermeer peak numbers used to occur in severe winters as well, but in recent cold winters no peaks were observed . The rest of The Netherlands also shows a decreas in

Table 12. Trend indications for different geographical units and the statistical test of trend at IJsselmeer/Markermeer versus the flyway trend (excluding IJsselmeer/Markermeer).
+ = increasing, - = decreasing, 0= stable and ?=uncertain. The trend at sites are calculated on the basis of the average number present per season (July-June) and the flyway trends on the basis of January counts.

Goosander	Trend
IJsselmeer (seasonal average)	?
Markermeer (idem)	--
Borderlakes (idem)	-
IJsselmeer/Markermeer (idem)	?
IJsselmeer/Markermeer/Randmeren (idem)	-
Flyway (January)	+
Flyway (excluding IJ/M, Jan.)	+
IJsselmeer/Markermeer vs Flyway netto (excluding IJ/M)	<0,001

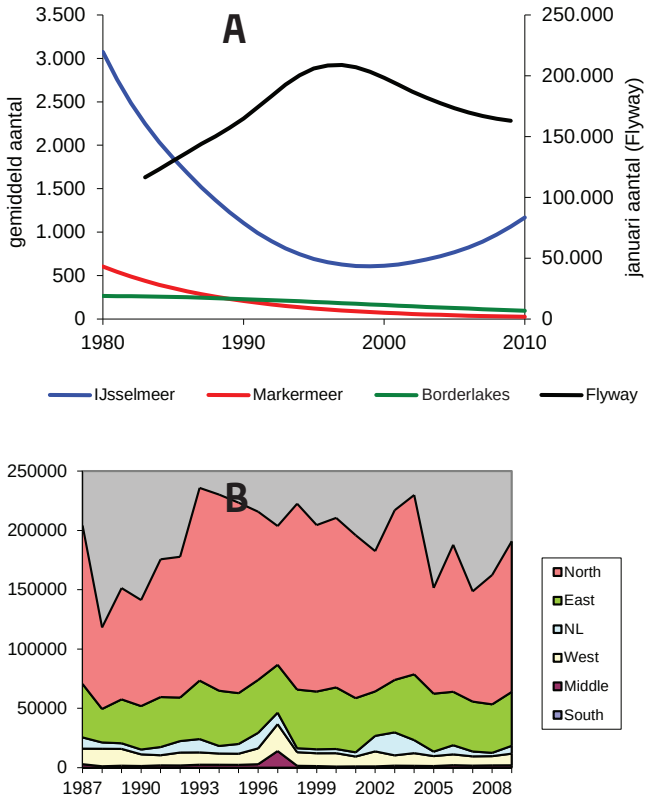


Figure 8. Results per species (Goosander):
A. comparison of trends at lake IJsselmeer, lake Markermeer and Borderlakes with Flyway trend.
B. Change in January wintering numbers within the sites allocated to the flyway population under study subdivided in different regions from the SW to the NE within their winter distribution.
C. The January trends on national level or subdivisions from that for the flyway population under study.

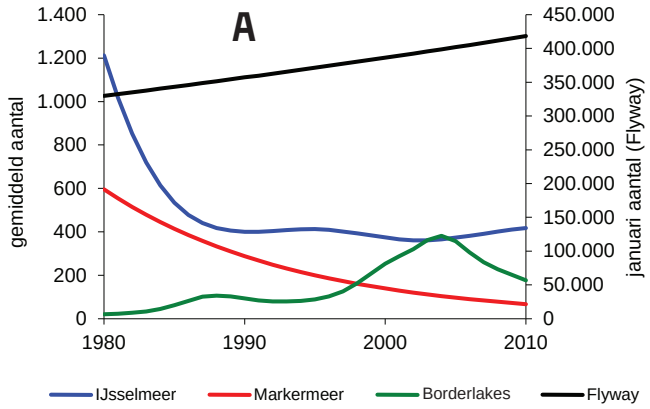
Goosander numbers, with the Borderlakes showing a very comparable trend with Markermeer. The Goosander flyway trend shows an increase in the 1980's and early 1990's followed by a moderate decrease. The trend of the combined IJsselmeer and Markermeer numbers is significantly different from the flyway trend. The trend in the Baltic is unclear. Despite a change in winter distribution within the Baltic, with relatively more birds wintering in the North and Northeast, a decrease in overall numbers seems to have taken place there between 1993 and 2009 (Skov *et al.* 2011). Based on the time series from the Baltic both increases and decreases are present (Skov *et al.* 2011, this study). So although it seems likely that a shift in wintering range has taken place, causing different trends at sites further North and South in the flyway this is less clear for Goosander than Smew.

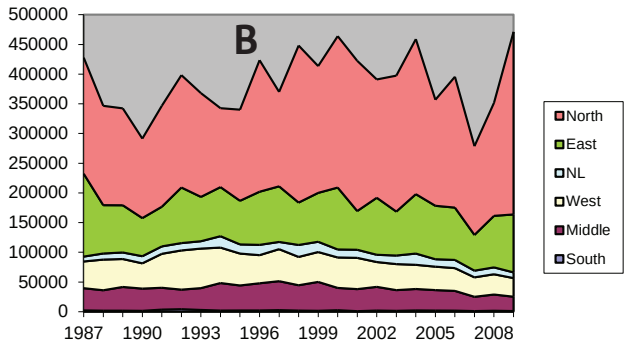
3.8. Goldeneye - Brilduiker

The Goldeneye is a Holarctic species with a circumpolar breeding range. Two subspecies have been identified, with the nominate form occurring in Europe. In Europe the species breeds in the coniferous forest belt mainly from western Norway Eastwards with some scattered breeding populations further South. Birds breeding in Northern Europe winter mainly in the Baltic Sea, Denmark, The Netherlands, Britain and Ireland.
Since 1980, Goldeneye has decreased in Lake IJsselmeer and Lake Markermeer. In Lake IJsselmeer especially in the 1980's, there was a steep decrease while from the 1990's onwards the numbers were fluctuating, far below the level of the 1980's. In Lake Markermeer the trend has decreased more gradually during the study period. Contrary to the

Table 13. Trend indications for different geographical units and the statistical test of trend at IJsselmeer/Markermeer versus the flyway trend (excluding IJsselmeer/Markermeer).
+ = increasing, - = decreasing, 0= stable and ?=uncertain. The trend at sites are calculated on the basis of the average number present per season (July-June) and the flyway trends on the basis of January counts.

Goldeneye	Trend
IJsselmeer (seasonal average)	-
Markermeer (idem)	-
Borderlakes (idem)	++
IJsselmeer/Markermeer (idem)	-
IJsselmeer/Markermeer/Randmeren (idem)	-
Flyway (January)	+
Flyway (excluding IJ/M, Jan.)	+
IJsselmeer/Markermeer vs Flyway netto (excluding IJ/M)	<0,001





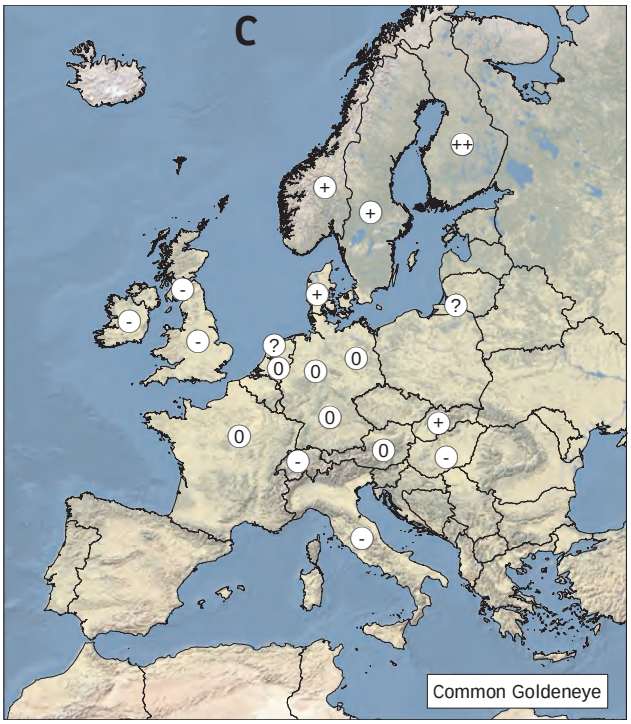


Figure 9. Results per species (Goldeneye):
A. comparison of trends at lake IJsselmeer, lake Markermeer and Borderlakes with Flyway trend.
B. Change in January wintering numbers within the sites allocated to the flyway population under study subdivided in different regions from the SW to the NE within their winter distribution.
C. The January trends on national level or subdivisions from that for the flyway population under study.

trend of both Dutch lakes, the flyway trend is continuously increasing from the 1980's onwards. The obvious contradiction in trends is highly significant. Also in the Borderlakes the trend is positive, with an increase in numbers until 2005, but a decrease after that. During recent severe winters in the Netherlands numbers of Goldeneye were hardly higher than normal contrary to before the 1990's when influxes occurred during cold winters. The same pattern is occurring in Switzerland. When focusing on the numbers within the flyway, it becomes clear that numbers on the southern end of the wintering range are dropping whereas numbers in the northern areas are increasing. This indicates a range shift which is probably caused by changes in climate (Skov *et al.* 2011, Lehikoinen *et al. in prep.*). The differences in trend between the Border lakes and the IJsselmeer and Markermeer lakes indicate that local factors play a role as well.

3.9. Coot - Meerkoet

The Coot is a widespread species across Eurasia, India and Australia. It has a patchy distribution in the Near and Middle East. Four subspecies have been identified. In Europe and Asia the nominate form occurs. The species is not very demanding in habitat choice and it occupies a broad range of water bodies where a good cover of emergent and floating vegetation is present, such as eutrophic and mesotrophic lakes, all kind of smaller pools and ponds, both saline or freshwater, fishponds, reservoirs, creeks, floodplains and wetlands. Coot is a partial migrant with Eastern and Northern populations being highly migratory, whereas Western and Southern populations are sedentary and only migratory during colder weather. Main

Table 14. Trend indications for different geographical units and the statistical test of trend at IJsselmeer/Markermeer versus the flyway trend (excluding IJsselmeer/Markermeer).
+ = increasing, - = decreasing, 0= stable and ?=uncertain. The trend at sites are calculated on the basis of the average number present per season (July-June) and the flyway trends on the basis of January counts.

Coot	Trend
IJsselmeer (seasonal average)	0
Markermeer (idem)	0
Borderlakes (idem)	++
IJsselmeer/Markermeer (idem)	0
IJsselmeer/Markermeer/Randmeren (idem)	+
Flyway (January)	0
Flyway (excluding IJ/M, Jan.)	0
IJsselmeer/Markermeer vs Flyway netto (excluding IJ/M)	0,015

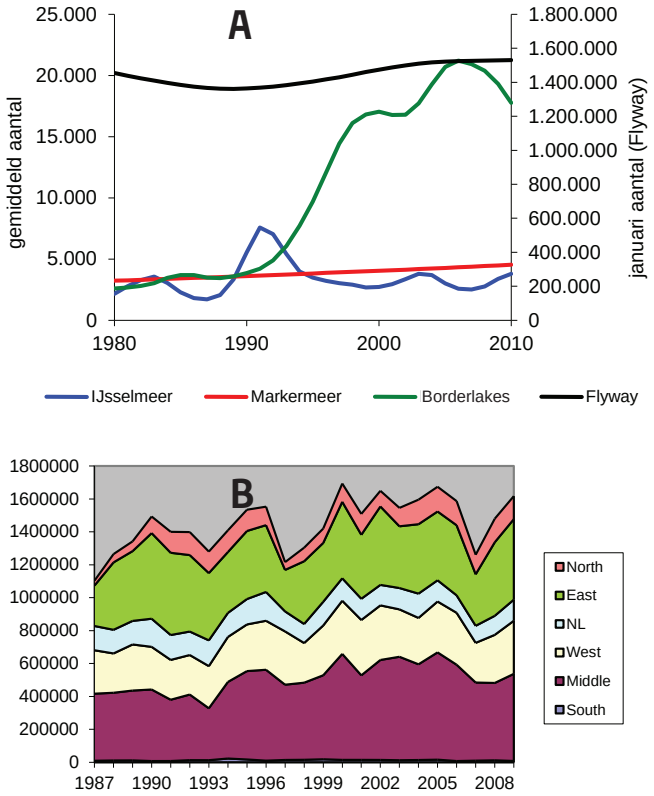


Figure 10. Results per species (Coot):
A. comparison of trends at lake IJsselmeer, lake Markermeer and Borderlakes with Flyway trend.
B. Change in January wintering numbers within the sites allocated to the flyway population under study subdivided in different regions from the SW to the NE within their winter distribution.
C. The January trends on national level or subdivisions from that for the flyway population under study.

wintering areas of Coot are situated in Western Europe, Tunisia, the Southern Balkans, Asia Minor, Mesopotamia and around the Caspian Sea.
Coot numbers are stable at Lake IJsselmeer and Lake Markermeer. The total flyway trend is stable too, although in the initial study period numbers dropped and started to increase again from the 1990's onwards. Coot population in the shallower Borderlakes strongly increased when water quality improved and submerged macrophytes increased. The recent drop in numbers there is not yet effecting trend direction calculations.

3.10. Other relevant species

Scaup – Topper
Numbers of Scaup in Lake IJsselmeer have markedly increased during the end of the 1980's and decreased again during the 1990's. Present numbers are on average as high as in the beginning of the 1980's (www.sovon.nl). In Lake Markermeer the number of Scaups have decreased since 1980, although the numbers were never high there. Taken together the trend at these sites show a decrease with presently lower numbers than in the 1980's (www.sovon.nl). The rather obvious peak numbers at the beginning of the 1990's in the Netherlands is very similar to the pattern found at the Baltic coast of Germany (Wahl *et al.* 2011), suggesting a common cause. The trend of the flyway population is not that well known but it is likely to decrease (Wetlands International 2012, Birdlife International 2004).

Little Gull – Dwergmeeuw
Numbers of Little Gull are fluctuating a lot at Lake IJsselmeer and Markermeer, however since 2000 much lower numbers are occurring than in the 1980's and 1990's and a decrease is apparent (Noordhuis 2010). The trend of the flyway population is not known but based on an increase in breeding numbers at source countries for the birds using the Netherlands during migration and winter, an increase seems likely (Birdlife International 2004). Also during migration an increasing number of little Gulls are passing the coast of the Netherlands (Camphuysen 2009). So the number of Little Gulls using the Netherlands outside Lake IJsselmeer and Markermeer are increasing, while the usage of IJsselmeer/Markrmeer is decreasing. There is some circumstantial evidence that the flyway trend is also increasing.

Black Tern – Zwarte Stern
The combined numbers using roosting sites around Lake IJsselmeer and Markermeer and foraging at these sites show a strong decrease (van der Winden & Klaassen 2008).
The trend of the flyway population is not known but it seems likely that it is decreasing considering decreases at the breeding grounds (Birdlife International 2004, van der Winden 2008).

4. Discussion, conclusions and recommendations

4.1. Trends in IJsselmeer/Markermeer compared with flyway trends

To test whether the population trends on Lake IJsselmeer/Markermeer level are site specific or part of a broader development, we compared the trends in IJsselmeer/Markermeer with the trends at flyway level (excluding IJsselmeer/Markermeer). Species population trends on IJsselmeer/Markermeer are significantly less favorable than the population trends in the total flyway, at least for the core species of the ANT-study (Fig. 11, n=6, paired t-test, t=4.59, p=0.006).
Four species with increasing trends at the flyway level have decreased in Lake IJsselmeer/Markermeer (Great Crested Grebe, Goldeneye, Goosander, Smew). In Pochard and Tufted Duck the decline in IJsselmeer/Markermeer is significantly stronger than the flyway trend (p<0.001).
For the non-core species population trends in IJsselmeer/Markermeer are significantly more favorable (p<0.001): in Cormorant, and to a much lesser extent also in Coot (populations rather stable), the increase is stronger than the flyway trend. In Bewick's Swan the small IJsselmeer population is increasing, whereas the flyway population is declining. If also including these three additional species (test statistics are as follows: n=9, paired t-test, t=2.23, p=0.056.

4.2. Differences in wintering trends between countries

Table 15 gives an overview of winter trends in different countries or sub-countries per species. For all species the trends between countries vary. However in Great Crested Grebe, Cormorant and Smew they are rather similar and in Bewick's Swan, Pochard and Tufted Duck a greater heterogeneity exists. In general it is expected that in species with more heterogeneity in trends more (local) factors play a role as driver. However heterogeneity can also be the result of a range shift from changing climate, which causes negative trends in the South and positive trends in the North. To investigate this, the species in Table 15 are arranged from those wintering more to the South to those more to the North and the countries more or less from Northeast to Southwest. To test whether population trends of species differ between countries situated to the Southwest or the Northeast of the Netherlands, we performed a Fisher's exact test using the number of positive and negative population trends per region, both per species and over all species together. For all species together the trends Northeast of the Netherlands differ significantly from the ones Southwest (p<0,01) with many more positive trends in the Northeast compared with negative ones and a more equal distribution between positive and negative trends in the Southwest (Table 15). On a species level this is also significant for Goldeneye and close to significance

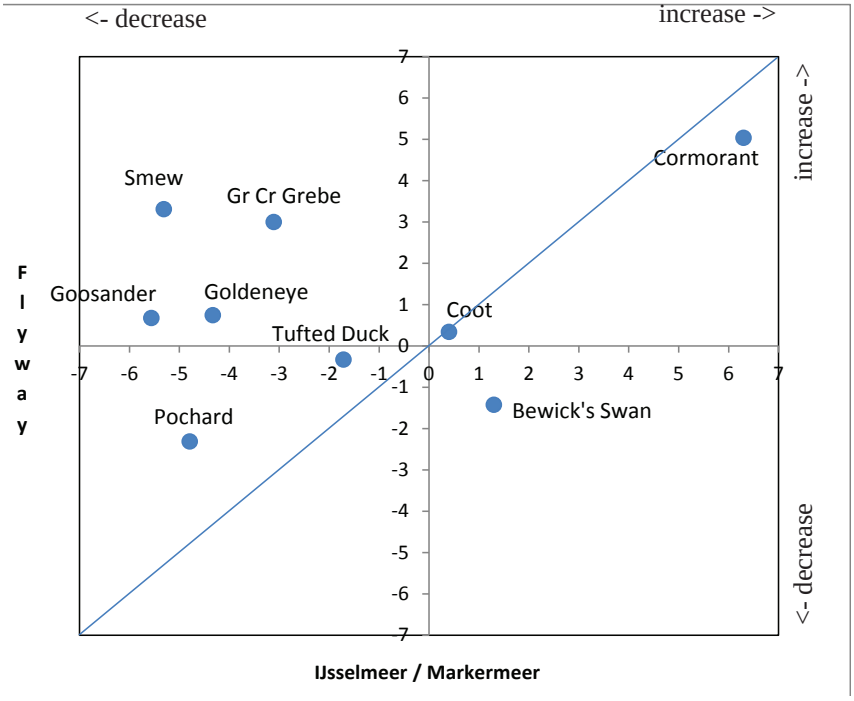


Fig. 11. The average rate of population change (expressed as percentage per year) within Lake IJsselmeer/Markermeer (horizontal axis) compared with the rate of change of the flyway population (vertical axis) for the period 1980-2010. Positive values indicate population increases, negative values indicate population decreases. Species above the line y=x have less favorable population trends on Lake IJsselmeer/Markermeer than in the total flyway. Species in the upper left quadrant decrease on Lake IJsselmeer/Markermeer, but increase in the flyway.

Table 15. January trends per species per country. The species are more or less arranged according to their wintering distribution from more South (left) to more North (right). Countries are arranged from more Northeast (top) towards more Southwest (bottom) of the Netherlands. The results of the Fisher's exact test and the significance (see text) are given as well.

	Great Crested Grebe	Cormorant	Coot	Bewick's Swan	Pochard	Tufted Duck	Goldeneye	Goosander	Smew
Finland		?				x	++	x	++
Sweden	++	++	++		+	+	+	x	++
Norway							+		
Baltic-Poland	++	++	x	?	x		?	+	+
Slovakia		x	x				+	x	
Czech		++	-					0	+
Hungary		x	0				-	x	
Austria	+	++	-				0	+	0
Germany southwest	0	++	0		-	-	0	?	+
Germany east	+	++	0	-	?	0	0	+	?
Denmark	?	++	++	?	+	0	+	0	++
Germany northwest	?	++	0	-	-	0	0	0	+
NL: IJsselmeer/Markermeer	+	++	?		?	?	?	?	?
NL: Other sites	0	+	-	-	?	0	0	-	0
Belgium, Luxembourg	+	0	0	?	0	0		?	-
France north	+	+	+	++	-	0	0	?	?
Switzerland	+	-	0				-		?
United Kingdom north	0		0	0	-	-	-	-	
Ireland	+		+	--	-	0	-	-	?
United Kingdom south	+		+	--	-	0	-	0	?
France south	0	+	+	?	0				
Italy	+	x					-		
Spain	+	+	0						
Portugal									
Algeria,Tunisia									
Morocco	x								
Fishers's Exact Test	x	7.29	0.11	0.12	9.00	3.00	40.3	35.0	45.0
sign.		0.33	0.43	0.40	0.43	1.00	0.02*	0.10	0.13

for Goosander and Smew. It seems likely that these three species are undergoing range shift, which strongly influences the distribution of wintering trends across Europe. In the other species other factors are more likely to influence the trends.

4.3. Patterns for ANT core species summarized and the possible causes

Most benthos and fish eating species are decreasing in Lake IJsselmeer and Markermeer (Table 16). From the species of this study only Coot (feeding on combination of benthos and plants), Great Cormorant (fish) and Bewick's Swan (plants) are exceptions to this pattern. Of the decreasing species (the ANT core species) more than half are increasing in the flyway as a total and the contrast in trend is obvious. In an additional two species the trend at IJsselmeer/Markermeer is more negative than the negative flyway trend (Table 16), meaning more than $\frac{3}{4}$ of the ANT core species show a less favourable trend at IJsselmeer/Markermeer compared to the flyway trend (this could not be determined for two species) This suggest a strong link with local drivers influencing the trends at Lake IJsselmeer and Markermeer. However also range shifts could result in decreasing trends at the IJsselmeer/Markermeer region and increasing trends at other sites resulting in stable flyway trends or even increasing ones. This seems the case in Goldeneye and possibly also Smew and Goosander. It could play a role in some of the other species as well but there it is not the dominant driver of the trends.

In general it seems that the negative trends at IJsselmeer/Markermeer are partly due to local factors and partly to range shifts probably related to global warming. Other factors having influences locally or on broader geographical scale elsewhere in the flyway are summarized in Table 16. For a

Table 16. Summary of trends of ANT Core species, the regions where they occur outside Lake IJsselmeer and Markermeer and overview of factors causing change in numbers. Only trends which are significant are given. Negative trends at IJsselmeer/markermeer can both be effected by local factors or by range shifts. The evidence for range shifts per species (see 4.2) is given as well.

	Pochard	Tufted Duck	Scaup	Goldeneye	Smew	Goosander	Great Crested Grebe	Little Gull	Black Tern
Food type	Benthos	Benthos	Benthos	Benthos	Fish	Fish	Fish	Fish	Fish
Observed patterns									
Flyway trend	–	–	(-)	+	+	+	+	(+)	(-)
IJsselmeer/Markermeer trend	–	–	-	-	-	?	-	-	-
more negative than flyway trend?	yes	yes	?	yes	yes	yes	yes	yes	?
evidence for recent range shift?	no	no	?	yes	yes	yes	no	?	?
Important non-breeding sites outside IJsselmeer									
Baltic Sea		x	x	x	x	x			
German lakes and rivers	x	x	x	x	x	x			
UK & Ireland lakes and rivers	x	x							
Coastal France	x						x		
Central European lakes							x		
Italian & Spanish lakes and rivers							x		
North Sea, Mediterranean and East Atlantic.								x	
Atlantic Coast Africa ofshore									x
Possible drivers outside IJsselmeer region	1 having effect, 2 likely no effect								
Decreasing quantity or quality breeding sites	1	1	2	2	2	2	1	1	1
Recreation and tourism	1	1	2	2	2	2	1	2	1
Fisheries	2	2	2	2	1	1	1	1	1
Hunting and by-catch	1	1	1	1	1	1	1	2	2
Eutropication/Oligotropication	1	1	1	1	1	1	1	1	1
Global warming	1	1	1	1	1	1	2	2	2

better understanding of the influences of these other factors more data on site usage of sites in the flyway are needed and data on extent and trends in these environmental factors.

4.4. Flyway monitoring of relevant species and recommendations for the future

Correct assessment of the status of the target populations at lakes IJsselmeer and Markermeer requires reliable information about the sizes and trends of these populations on flyway level. Flyway population size estimates are important to assess relative importance of particular sites to the populations of each species and flyway trend estimates are important to provide context for the interpretation of local or national trends. Population sizes and trends at the level of the flyway can be estimated either through internationally coordinated monitoring schemes or through aggregating national population size estimates. The population estimates presented in the Birds in Europe books are examples of the latter, while the population estimates derived from the International Waterbird Census are examples of the former. Summing up the results of national counts is generally appropriate in case of breeding data because the year-to-year distribution of birds tend to be more stable in this season. On the other hand, weather conditions have a much stronger and continuous influence on the distribution of bird populations in winter in the temperate zone, i.e. cold weather movements and short stopping. Therefore, aggregation of the results of partial counts of wintering populations would not provide a reliable basis to estimate either their size nor their trend. The recognition of the need of synchronized counts has led to the development of the International Waterbird Census in the late 1960s. The International Waterbird Census is using synchronized total counts of waterbirds in the middle of the wintering period (i.e. January) when waterbirds congregate mostly at wetlands in the temperate or tropical zones and are easier to count than during the breeding season when they occur in low densities and often in inaccessible areas.

Table 17 shows the possible sources of international population estimates for the Natura 2000 species for the IJsselmeer area. In case of 24 of the 38 species (63%), the IWC serves as the basis of

Table 17. Sources of international population size and trend estimates for waterbird species important in lake IJsselmeer and Markermeer. BiE = the Birds in Europe project as organized by Birdlife International and the European Bird Census Council, IWC= the International Waterbird Census as organized by Wetlands International.

Target species	Source of population Estimate Size	Trend	Comments
Podiceps cristatus	BiE	IWC	
Phalacrocorax carbo sinensis	BiE	BiE/IWC	European survey is being organised by the Cormorant Specialist Group
Botaurus stellaris	BiE	BiE	
Platalea leucorodia	BiE	BiE/IWC	Eurosite Spoonbill Working Group
Cygnus bewickii	IWC	IWC	Complemented by special swan counts
Anser serrirostris	IWC	IWC	Complimented by special goose counts
Anser brachyrhynchus	IWC	IWC	Complimented by special goose counts
Anser albifrons	IWC	IWC	Complimented by special goose counts
Anser anser	IWC	IWC	Complimented by special goose counts
Branta leucopsis	IWC	IWC	Complimented by special goose counts
Tadorna tadorna	IWC	IWC	
Anas penelope	IWC	IWC	
Anas strepera	BiE/IWC	IWC	
Anas crecca	BiE/IWC	IWC	
Anas platyrhynchos	BiE/IWC	IWC	
Anas acuta	IWC	IWC	
Anas clypeata	BiE/IWC	IWC	
Aythya ferina	IWC	IWC	
Aythya fuligula	IWC	IWC	
Aythya marila	IWC	IWC	Special additional sea counts needed
Bucephala clangula	IWC	IWC	
Mergus albellus	IWC	IWC	
Mergus merganser	IWC	IWC	
Fulica atra	IWC	IWC	
Porzana porzana	BiE	BiE	In most countries, breeding populations are not monitored systematically
Recurvirostra avosetta	BiE/IWC	BiE/IWC	
Charadrius hiaticula	BiE/IWC	BiE/IWC	
Pluvialis apricaria	IWC	IWC	Special periodic farmland counts needed
Limosa limosa	BiE	BiE/IWC	Wintering populations are partly in poorly covered areas and overlapping with other populations
Numenius arquata	BiE/IWC	BiE/IWC	Both breeding and wintering populations are partly in poorly covered areas (Eastern Europe and Africa respectively)
Philomachus pugnax	BiE/IWC	BiE/IWC	Population size and trend estimates are likely to remain uncertain because of poor estimates from Russian breeding grounds and mixing of populations at poorly covered wintering grounds
Hydrocoloeus minutus	BiE	BiE	Uncertainties due to poor coverage of breeding populations in Eastern Europe
Hydroprogne caspia	BiE	BiE	
Sterna hirundo	BiE	BiE	
Chlidonias niger	BiE	BiE	Estimates are likely to remain uncertain due to poor coverage in Eastern European breeding grounds

flyway population size and trend estimates.

Although the basic collection, management and analysis of data from the January counts are running routinely, there are a number of factors that hampers the quality of the results of the IWC counts. These include the following:

(a) Coverage: the site network covered by synchronized January counts is not fully representative. Wetlands are better covered in the countries with large observer networks such as the UK or The Netherlands, while they are more sparsely covered in countries with fewer observers such as e.g. Poland or Portugal and coverage is even more of an issue in the African part of the flyway. The consequences of this are that:

(i) national totals, even the ones adjusted for missing counts (imputed), represent only a variable part of the population present in the country;

(ii) counts from the better covered NW European

countries bias the flyway population trends;
(iii) consequently, shifts in distribution may cause apparent population changes even if in reality the population has not changed.

(b) Trend analysis methodology: traditionally, the IWC data has been analysed without stratification, which made it impossible to address (ii) and (iii) above.

(c) Data availability for international analyses: some countries are late with their reporting or report irregularly. The consequence of this is higher degree of imputing, especially in later years, which leads to broader confidence intervals.

To improve the population size and trend estimates generated through the IWC the following measures are needed:

1. Develop statistical procedures for estimating national totals across the entire flyways of all relevant populations from counts following the methodology described in Flink *et al.* (2012) to address the problems arising from the incomplete coverage (a) above.
2. Develop methodology for weighting that removes the geographic bias from the flyway population trend estimates (b).
3. Ensure regular and timely data flow from national schemes into the international analyses to reduce the need for imputing (c). This requires (i) maintaining and increasing the capacity for coordination and data analyses both at Wetlands International and its national partners particularly in Africa and Eastern Europe.

Assessing the use of other sites across Europe by IJsselmeer populations

Improvements to the analysis of data from the January counts can only address the issues related to population size and trend estimates. However, to diagnose the likely causes will require a better understanding of the changes in the site network throughout the year as well. Traditionally, the IWC has played an important role in identifying internationally important sites (IBAs, Ramsar Sites and SPAs under the Birds Directive). However, while the redistribution of wintering populations can be detected using the IWC data, there is no similar international scheme in place yet for assessment of sites during migration (or moult). Consequently, international waterbird monitoring is not yet able to fully highlight emerging problems in the network of key sites. In Resolution 4.2 of the African-Eurasian Waterbird Agreement the Meeting of Parties 2 *"Urges Contracting Parties and other Range States, which do not comprehensively monitor waterbirds at key sites for waterbirds to initiate monitoring programmes involving regular visits to the sites, and to subsequently submit compiled data on bird numbers to the international databases..."* and *"4. Encourages Contracting Parties and other Range States to develop comprehensive monitoring of waterbirds at key sites used at other stages of the annual cycle (migratory staging and moulting periods), and to submit these data to the IWC".*

We have investigated the current extent of the monitoring programs in other months than January

Table 18. Frequency of waterbird counts in countries relevant for target waterbird species for the IJsselmeer (see annex B for details).

Country	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Austria							X					
Belgium				X	X	X	X	X	X			
Czech							X					
Denmark				X	X	X	X	X	X			
Estonia							X					
Finland							X					
France				X	X	X	X	X	X			
Germany			X	X	X	X	X	X	X			
Hungary		X	X	X	X	X	X	X	X	X		
Ireland			X	X	X	X	X	X	X			
Italy							X					
Morocco							X					
The Netherlands	X	X	X	X	X	X	X	X	X	X	X	X
Norway							X					
Poland							X					
Portugal							X					
Spain							X					
Sweden				X	X	X	X	X	X			
Switzerland				X	X	X	X	X	X			
Tunisia							X					
United Kingdom	X	X	X	X	X	X	X	X	X	X	X	X

in countries holding waterbird populations making use of lake IJsselmeer and Markermeer as well (see Table 18 and appendix B). At least half of the 21 relevant European and North African countries have already got monthly monitoring between October and March, in five of these, monthly counts happen even also in other months (Table 18). This means that there is a great potential to study site use across Europe if this data is also coming together in one international database. Because of different data systems and the time to get the data together this is not happening today. With some extra international coordination effort this could be achieved as well and more complete analyses of the usage of IJsselmeer species of other sites can be performed.

References

Adriaensen F., Ulenaers P. & Dhondt A.A. 1993. Ringing Recoveries and the Increase in Numbers of European Great Crested Grebes *Podiceps Cristatus*. Ardea 81(2): 59-70.

Aurigi S., Focardi S., Hulea D. & Renzoni A. 2000. Organochlorine contamination in bird's eggs from the Danube Delta. Environmental Pollution 109(1): 61-67.

Bakken V., Runde O. & Tjorve E. 2003. Norsk ringmerkingsatlas Vol. 1. Stavanger Museum, Stavanger.

Bell M.C. 1995. UNIDEX4. A computer programme for estimating population index numbers by the Underhill method. The Wildfowl and Wetlands Trust, Slimbridge, UK. 9p.

Bezzel E. & Hashmi D. 1989. Fluctuation in Numbers of Migrating and Wintering Waterfowl - Trends of Indexes in Mallard (*Anas-Platyrhynchos*), Tufted Duck (*Aythya-Fuligula*) and Coot (*Fulica-Atra*) in Southern Bavaria. Journal fur Ornithologie 130(1): 35-48.

Blums P., Clark R.G. & Mednis A. 2002. Patterns of reproductive effort and success in birds: path analyses of long-term data from European ducks. Journal of Animal Ecology 71(2): 280-295.

Carss D., Spears B.M., Quinn L. & Cooper R. 2012. Long-term variations in waterfowl populations in Loch Leven: identifying discontinuities between local and national trends. Hydrobiologia 681(1): 85-104.

Catry T., Alves J.A., Andrade J., Costa H., Dias M.P., Fernandes P., Leal A., Lourenco P.M., Martins R.C., Moniz F., Pardal S., Rocha A., Santos C.D., Encarnacao V. & Granadeiro J.P. 2011. Long-term declines of wader populations at the Tagus estuary, Portugal: a response to global or local factors? Bird Conservation International.

Cave A.J. & Visser J. 1985. Winter Severity and Breeding Bird Numbers in A Coot Population. Ardea 73(2): 129-138.

Camphuysen C.J. 2009. The use of seawatching data to monitor population fluctuations (2): Little Gulls in nearshore waters. Sula 22 (2): 49-66.

Crivelli A.J., Grillas P., Jerrentrup H. & Nazirides T. 1995. Effects on Fisheries and Waterbirds of Raising Water Levels at Kerkini Reservoir, A Ramsar Site in Northern Greece. Environmental Management 19(3): 431-443.

Crowe O., Austin G.E., Colhoun K., Cranswick P.A., Kershaw M. & Musgrove A.J. 2008. Estimates and trends of waterbird numbers wintering in Ireland, 1994/95 to 2003/04. Bird Study 55, 66-77.

Desgranges J.L. & Gagnon C. 1994. Duckling Response to Changes in the Trophic Web of Acidified Lakes. Hydrobiologia 280, 207-221.

van Eerden M. R. & Gregersen J. 1995. Long-term changes in the northwest European population of Cormorants *Phalacrocorax carbo sinensis*. Ardea 83: 61-79.

van Eerden M.R., van Rijn S.H.M. & Roos M. 2005. Ecologie en Ruimte: gebruik door vogels en mensen in de SBZ's IJmeer, Markermeer en IJsselmeer. RIZA rapport 2005.014. Lelystad.

Einarsson A., Stefánsdóttir G., Jóhanneson H., Ólafsson J.S., Gíslason G.M., Wakana I., Gudbergsson G. & Gardarsson A. 2004. The ecology of lake Myvatn and the River Laxà: variation in space and time. Aquatic Ecology 38: 317-348.

Elmberg J., Dessborn L. & Englund G. 2010. Presence of fish affects lake use and breeding success in ducks. Hydrobiologia 641(1): 215-223.

Evans D.M. & Day K.R. 2001. Does shooting disturbance affect diving ducks wintering on large shallow lakes? A case study on Lough Neagh, Northern Ireland. Biological Conservation 98(3): 315-323.

Evans D.M. & Day K.R. 2002. Hunting disturbance on a large shallow lake: the effectiveness of waterfowl refuges. Ibis 144(1): 2-8.

Feltham M.J. 1995. Consumption of Atlantic Salmon Smelts and Parr by Goosanders - Estimates from Doubly-Labeled Water Measurements of Captive Birds Released on 2 Scottish Rivers. Journal of Fish Biology 46(2): 273-281.

Fernandez J.M., Selma M.A.E., Aymerich F.R., Saez M.T.P. & Fructuoso M.F.C. 2005. Aquatic birds as bioindicators of trophic changes and ecosystem deterioration in the Mar Menor lagoon (SE Spain). Hydrobiologia 550, 221-235.

Flink S., Langendoen T., Mundkur T., Nagy S., van Roomen M., Schekkerman H., van Winden E. & Zoetebier, D. (2012) Strengthening the International Waterbird Census within the African-Eurasian region. Sovon, Nijmegen, & Wetlands International, Ede, The Netherlands. Report to the Dutch Ministry of Economics, Agriculture and Innovation.

Fransson T. & Petersson J. 2001. Svensk ringmärkingsatlas. Vol. 1. Stockholm.

Galassi S., Saino N., Melone G. & Croce V. 2002. DDT homologues and PCBs in eggs of great crested grebe (*Podiceps cristatus*) and mallard (*Anas platyrhynchos*) from Lake Maggiore (Italy). Ecotoxicology and Environmental Safety 53(1): 163-169.

Green R.E. 2008. Assessing the impact of culling on population size in the presence of uncertain density dependence: lessons from a great cormorant population. Journal of Applied Ecology 45(6): 1683-1688.

Hahn S., Bauer S. & Klaassen M. 2008. Quantification of allochthonous nutrient input into freshwater bodies by herbivorous waterbirds. Freshwater

Biology 53(1): 181-193.
Harris C.M., Calladine J.R., Wernham C.V. & Park K.J. 2008. Impacts of piscivorous birds on salmonid populations and game fisheries in Scotland: a review. Wildlife Biology 14(4): 395-411.
Holm T.E. & Clausen P. 2006. Effects of water level management on autumn staging waterbird and macrophyte diversity in three Danish coastal lagoons. Biodiversity and Conservation 15(14): 4399-4423.
Holt C.A., Austin G.E., Calbrade N.A., Mellan H.J., Mitchell C., Stroud D.A., Wotton S.R. & Musgrove A.J. 2011. Waterbirds in the UK 2009/10: The Wetland Bird Survey. BTO/RSPB/JNCC, Thetford.
Houserova P., Hedbavny J., Matejicek D., Kracmar S., Sitko J. & Kuban V. 2005. Determination of total mercury in muscle, intestines, liver and kidney tissues of cormorant (*Phalacrocorax carbo*), great crested grebe (*Podiceps cristatus*) and Eurasian buzzard (*Buteo buteo*). Veterinarni Medicina 50(2): 61-68.
Houserova P., Kuban V., Kracmar S. & Sitko J. 2007. Total mercury and mercury species in birds and fish in an aquatic ecosystem in the Czech Republic. Environmental Pollution 145(1): 185-194.
Hornman M., Hustings F., Koffijberg K., Kleefstra R., Klaassen O., van Winden E., SOVON Ganzen- en Zwanenwerkgroep & Soldaat L. 2012. Watervogels in Nederland in 2009/2010. Sovon-rapport 2012/02, Waterdienst-rapport BM 12.06. Sovon Vogelonderzoek Nederland, Nijmegen.
Ivanov B. 2008. Wintering Waterbirds in Danube Between the Towns Somovit and Silistra, Bulgaria. Acta Zoologica Bulgarica 60(3): 285-294.
Ivanov B. 2008. Wintering Waterbirds in Danube Between the Towns Somovit and Silistra, Bulgaria. Acta Zoologica Bulgarica 60(3): 285-294.
Kalisinska E., Budis H., Podlasinska J., Lanocha N. & Kavetska K.M. 2010. Body condition and mercury concentration in apparently healthy goosander (*Mergus merganser*) wintering in the Odra estuary, Poland. Ecotoxicology 19(8): 1382-1399.
Kannan K., Corsolini S., Falandysz J., Oehme G., Focardi S. & Giesy J.P. 2002. Perfluorooctanesulfonate and related fluorinated hydrocarbons in marine mammals, fishes, and birds from coasts of the Baltic and the Mediterranean Seas. Environmental Science & Technology 36(15): 3210-3216.
Keller V. 1989. Variations in the Response of Great Crested Grebes *Podiceps cristatus* to Human Disturbance - A Sign of Adaptation. Biological Conservation 49(1): 31-45.
Keller V. & Burkhardt M. 2011. Monitoring überwinternde Wasservögel: Ergebnisse der Wasservogelzählungen 2009/10. Schweizerische Vogelwarte, Sempach.
Lindell L., Mellin M., Musil P., Przybysz J. & Zimmerman H. 1995. Status and population development of breeding Cormorants *Phalacrocorax carbo sinensis* of the Central European Flyway. Ardea 83: 81-92.
Luigujõe L. 2011. Kesktalvine veelindude loendus – 2011. EOÜ, Tartu
Madsen J. 1998. Experimental refuges for migratory waterfowl in Danish wetlands. II. Tests of hunting disturbance effects. Journal of Applied Ecology 35(3): 398-417.
Madsen J. 1998. Experimental refuges for migratory waterfowl in Danish wetlands. I. Baseline assessment of the disturbance effects of recreational activities. Journal of Applied Ecology 35(3): 386-397.
Manosa S., Mateo R. & Guitart R. 2001. A review of the effects of agricultural and industrial contamination on the Ebro delta biota and wildlife. Environmental Monitoring and Assessment 71(2): 187-205.
Marsden S.J. 2000. Impact of disturbance on waterfowl wintering in a UK dockland redevelopment area. Environmental Management 26(2): 207-213.
Mateo R., Martinezvilalta A. & Guitart R. 1997. Lead shot pellets in the Ebro delta, Spain: Densities in sediments and prevalence of exposure in waterfowl. Environmental Pollution 96(3): 335-341.
Mateo R., Belliure J., Dolz J.C., Serrano J.M.A. & Guitart R. 1998. High prevalences of lead poisoning in wintering waterfowl in Spain. Archives of Environmental Contamination and Toxicology 35(2): 342-347.
Meissner W., Bzoma S., Nagórski P., Bela G., Ziecik P., Wybraniec M. & Marczewski A. 2011. Liczebnosc ptaków wodnych na Zatoce Gdanskiej w okresieod maja 2010 do kwietnia 2011. Ornis Polonica 52: 295–300
Mitterer J.M. 1998. The Geneva Lake and the birds: ornithological features and evolution of the populations. Archives des Sciences 51(1): 55-70.
Moreno-Ostos E., Paracuellos M., De Vicente I., Nevado J.C. & Cruz-Pizarro L. 2008. Response of waterbirds to alternating clear and turbid water phases in two shallow Mediterranean lakes. Aquatic Ecology 42(4): 701-706.
Musil P., Musilova Z., Fuchs R. & Polakova S. 2011. Long-term changes in numbers and distribution of wintering waterbirds in the Czech Republic, 1966-2008. Bird Study 58(4): 450-460.
Musilova Z., Musil P. & Haas M. 2011. Mezinárodní sctání vodních ptáku v Ceské republice v lednu 2011. Aythya 4: 1-14
Nagy S., Flink S., Langendoen T. & Delany S. 2012. Report on the Conservation Status of Migratory Waterbirds in the agreement area of the African-

Eurasian Waterbird Agreement, Wetlands International, Wageningen.

Newth J.L., Brown M.J. & Rees E.C. 2011. Incidence of embedded shotgun pellets in Bewick's swans *Cygnus columbianus bewickii* and whooper swans *Cygnus cygnus* wintering in the UK. Biological Conservation 144(5): 1630-1637.

Nilsson L. & Månsson J. 2011. Inventeringar av sjöfäglar, gäss, och tranor i Sverige. Biologiska institutionen, Lunds Universitet, Lund. 55pp.

Noordhuis R., Van Der Molen D.T. & Van Den Berg M.S. 2002. Response of herbivorous waterbirds to the return of Chara in Lake Veluwemeer, the Netherlands. Aquatic Botany 72(3-4): 349-367.

Noordhuis R. & van Roomen M. 2007. Het IJsselmeergebied: natuurdoelen voor een ecosysteem in beweging. De Levende Natuur 108 (6): 242-247.

Noordhuis R. (*red.*) 2010. Ecosysteem IJsselmeergebied: nog altijd in ontwikkeling. Trends en ontwikkelingen in water en natuur van het Natte hart van Nederland. Rijkswaterstaat, Lelystad.

Norris K., Atkinson P.W., & Gill J.A. 2004. Climate change and coastal waterbird populations - past declines and future impacts. Ibis 146, 82-89.

PECBMS 2012. Population trends of Common European Breeding Birds 2012. CSO, Prague.

Pfluger D. & Ingold P. 1988. Responses of Coots (*Fulica-Atra*) and Great Crested Grebes (*Podiceps-Cristatus*) to Human Disturbances Originating from Land and Waterside Respectively. Revue Suisse de Zoologie 95(4): 1171-1178.

Poysa H., Rask M. & Nummi P. 1994. Acidification and Ecological Interactions at Higher Trophic Levels in Small Forest Lakes - the Perch and the Common Goldeneye. Annales Zoologici Fennici 31(4): 397-404.

Rendon M.A., Green A.J., Aquilera E. & Almaraz P. 2008. Status, distribution and long-term changes in the waterbird community wintering in Donana, south-west Spain. Biological Conservation 141(5): 1371-1388.

Robledano F., Esteve M.A., Martinez-Fernandez J. & Farinos P. 2011. Determinants of wintering waterbird changes in a Mediterranean coastal lagoon affected by eutrophication. Ecological Indicators 11(2): 395-406.

van Roomen M. (2010) Programme, technical skills and processes needed to deliver priority products in the African Eurasian Region. SOVON, Nijmegen, The Netherlands. Report to Wetlands International.

van Roomen M., van Winden E. & van Turnhout C. 2011. Analyzing population trends at the flyway level for bird populations covered by the African Eurasian Waterbird Agreement: details of a methodology. SOVON-information report 2011/05. SOVON Dutch Centre for Field Ornithology, Nijmegen, the Netherlands.

Ronka M.T.H., Saari C.L.V., Lehikoinen E.A., Suomela J. & Hakkila K. 2005. Environmental changes and population trends of breeding waterfowl in northern Baltic Sea. Annales Zoologici Fennici 42(6): 587-602.

Salmon D.G. & Fox A.D. 1994. Changes in the Wildfowl Populations Wintering on the Severn Estuary. Biological Journal of the Linnean Society 51(1-2): 229-236.

Santoul F. & Tourenq J.N. 2002. Gravel pits in the Garonne floodplain as habitats for the Coot (*Fulica atra*). Revue D Ecologie-la Terre et la Vie 57(2): 165-180.

Scharenberg W. & Ebeling E. 1998. Organochlorine pesticides in eggs of two waterbird species (*Fulica atra, Podiceps cristatus*) from the same habitat: Reference site Lake Belau, Germany. Chemosphere 36(2): 263-270.

Schekkerman H., Meininger P.L. & Meire P.M. 1994. Changes in the Waterbird Populations of the Oosterschelde (Sw Netherlands) As A Result of Large-Scale Coastal Engineering Works. Hydrobiologia 283, 509-524.

Shchadilov Y.M., Rees E.C., Belousova A.V. & Bowler J.M. 2002. Annual variation in the proportion of Whooper Swans and Bewick's Swans breeding in northern European Russia. Waterbirds 25, 86-94.

Soldaat L., Visser H., van Roomen M. & van Strien A. 2007. Smoothing and trend detection in waterbird monitoring data using structural time-series analysis and the Kalman filter. J. Ornithol. DOI 10.1007/s10336-007-0176-7

Soldaat L., van Winden E., van Turnhout C., Berrevoets C.M., Van Roomen M. & Van Strien A. 2004. De berekening van indexen en trends bij het watervogelmeetnet. SOVON-onderzoeksrapport 2004/02, 1-100. Voorburg/Heerlen, CBS.

Speek B.J. & Speek G. 1984. Thieme's vogeltrekatlas. Thieme, Zutphen.

Svenning M.A., Fagermo S.E., Barrett R.T., Borgstrom R., Vader W., Pedersen T. & Sandring S. 2005. Goosander predation and its potential impact on Atlantic salmon smolts in the River Tana estuary, northern Norway. Journal of Fish Biology 66(4): 924-937.

Tamisier A., Bechet A., Jarry G., Lefeuvre J.C. & Le Maho Y. 2003. Effects of hunting disturbance on waterbirds. A review of literature. Revue D Ecologie-la Terre et la Vie 58(4): 435-449.

Teufelbauer N. 2011. Ergebnisse Internationalen Wasservogelzählung (IWC) in Österreich: Jänner 2009 und 2010. BirdLife Österreich, Wien

Underhill, L.G. & Prys-Jones, R. 1994. Index numbers for waterbird populations. I. Review and methodology. J. Appl. Ecol. 31:463-480.

Wahl J., Dröschmeister R., Langemach T. & Sudfeldt C. 2011. Vögel in Deutschland 2011. DDA, BfN, LAG VSW, Münster.

Ward M.P., Semel B. & Herkert J.R. 2010. Identifying

the ecological causes of long-term declines of wetland-dependent birds in an urbanizing landscape. Biodiversity and Conservation 19(11): 3287-3300.

Wernham C.V., Toms M.P., Marchant J.H., Clark J.A., Siriwardena G.M. & Baillie S.R. 2002. The migration Atlas: movements of the birds of britain and ireland. T.&A.D. Poyser, London.

Wetlands International 2006. Waterbird Population Estimates – Fourth Edition. Wetlands International, Wageningen. The Netherlands.

Wetlands International 2012. Waterbird Population Estimates – Fifth edition. Wetlands International, Wageningen. The Netherlands.

Wetlands International & UNEP/AEWA Secretariat (2012) Strategic development of the waterbird monitoring in the African-Eurasian flyways. MOP5.42. UNEP/AEWA Secretariat, Bonn, Germany.

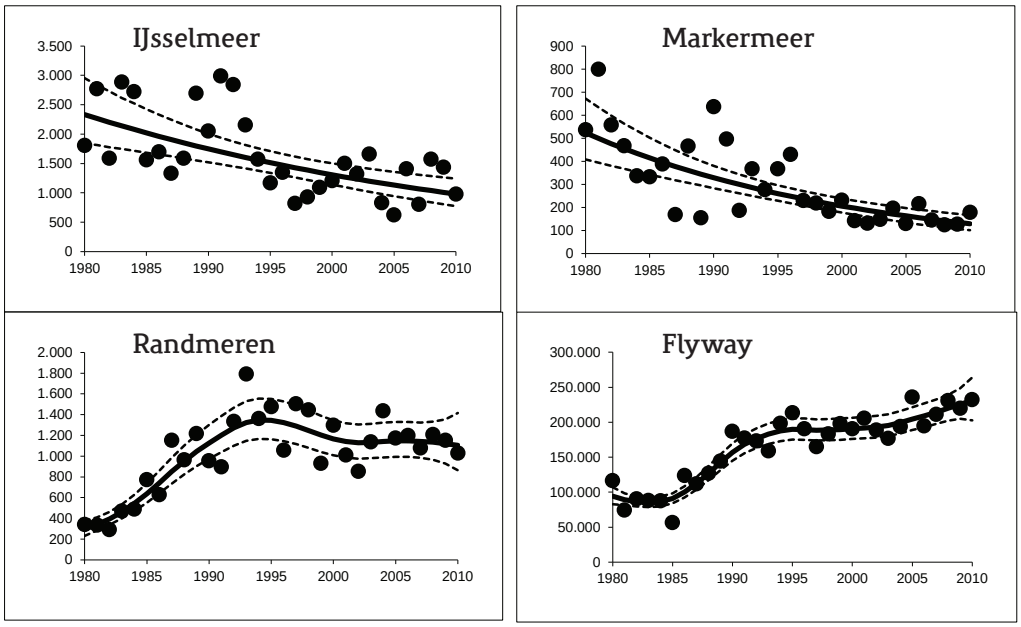
van der Winden J. 2008. A review of population estimates of the Eurasian Black Tern *Chlidonias niger niger*. Vogelwelt 129 (1): 47-50.

van der Winden J. & Klaassen O. 2008. Totaal aantallen sterns in het IJsselmeergebied in heden en verleden aan de hand van slaapplaatstellingen. Bureau Waardenburg rapport nr. 08-047/ SOVON-Onderzoeksrapport 2008/04, Culemborg.

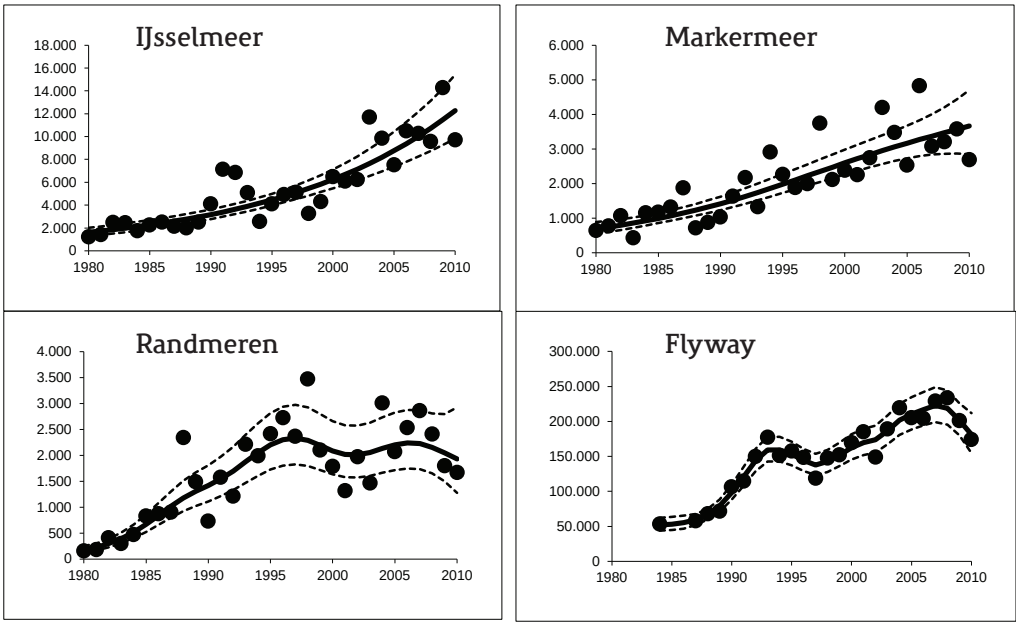
Appendix A

Yearly indices, trends and confidence limits of a selection of waterbird species at Lake IJsselmeer, Lake Markermeer, Borderlakes (Randmeren) and for the flyway population in total.

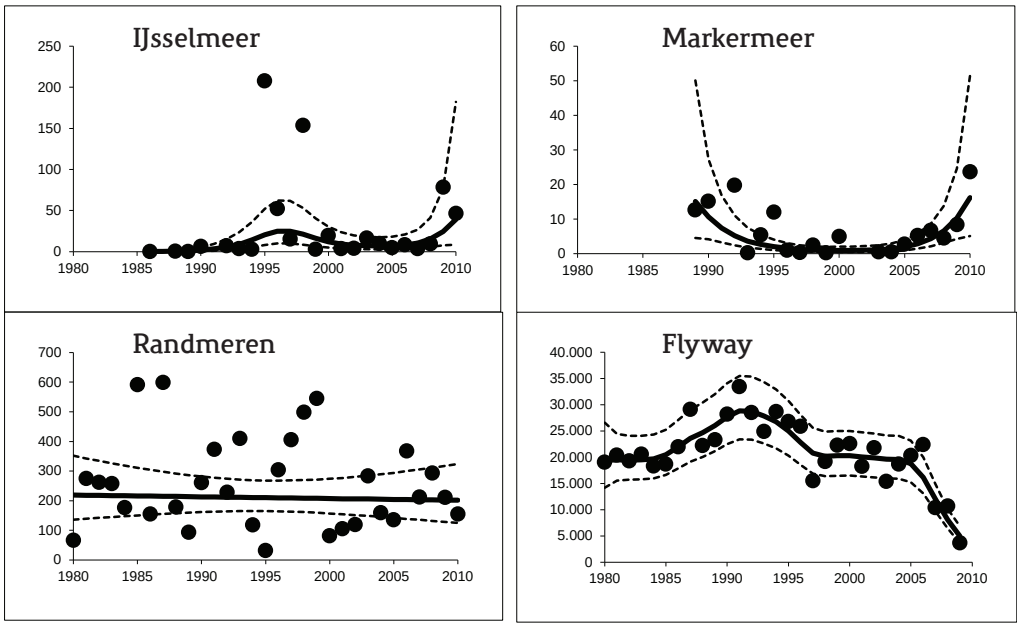
Great Crested Grebe - Fuut



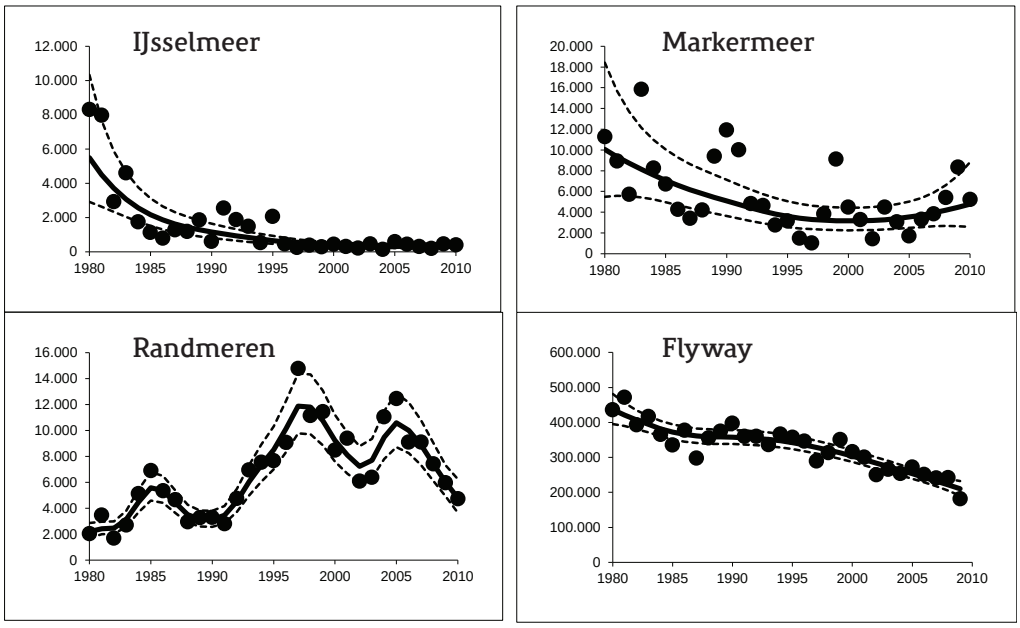
Great Cormorant - Aalscholver



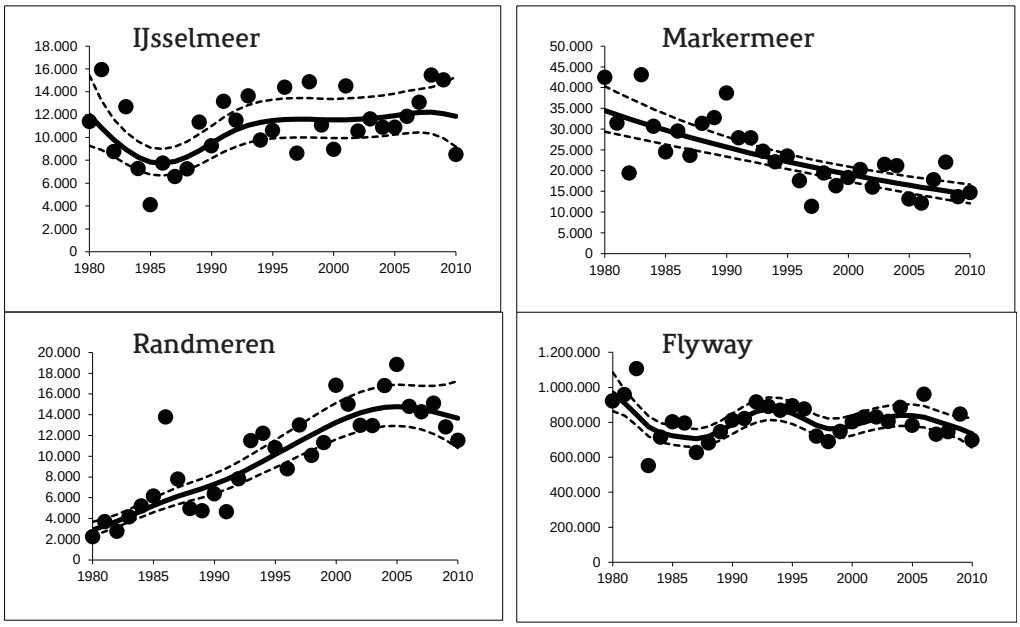
Bewick's Swan - Kleine Zwaan



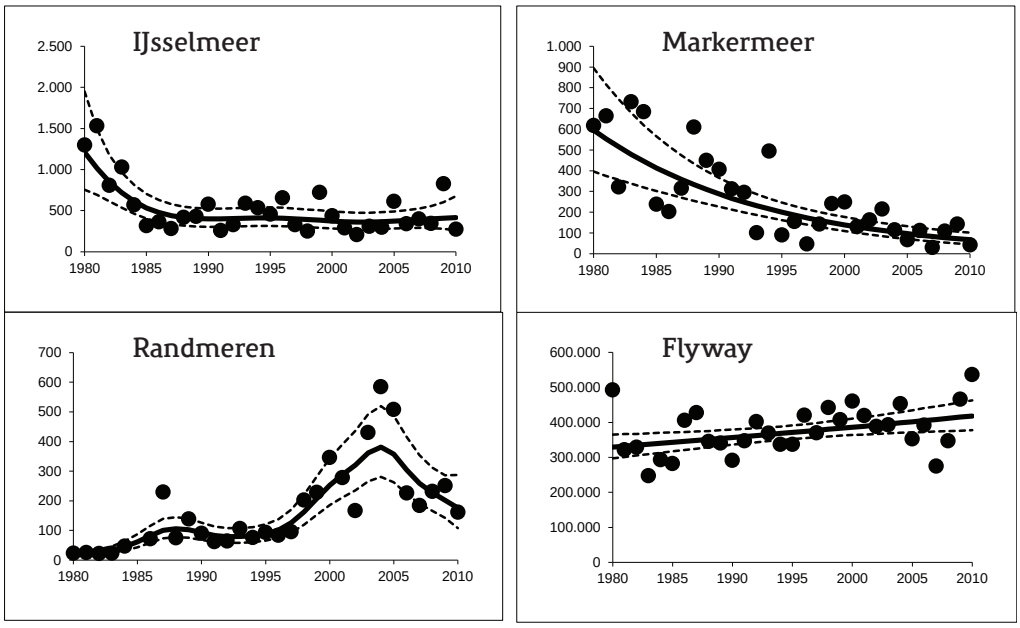
Pochard - Tafeleend



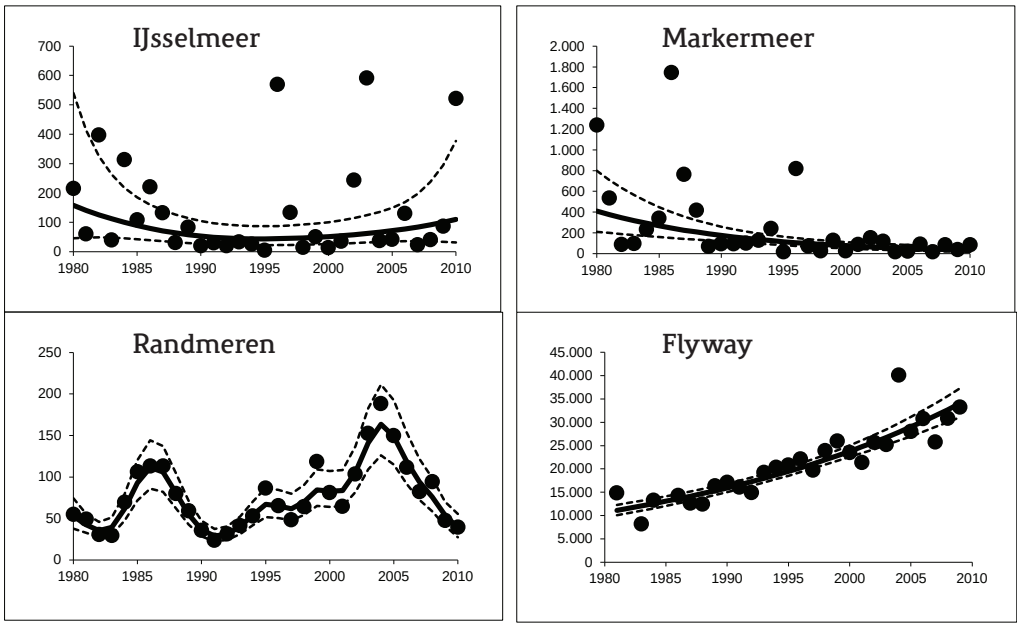
Tufted Duck - Kuifeend



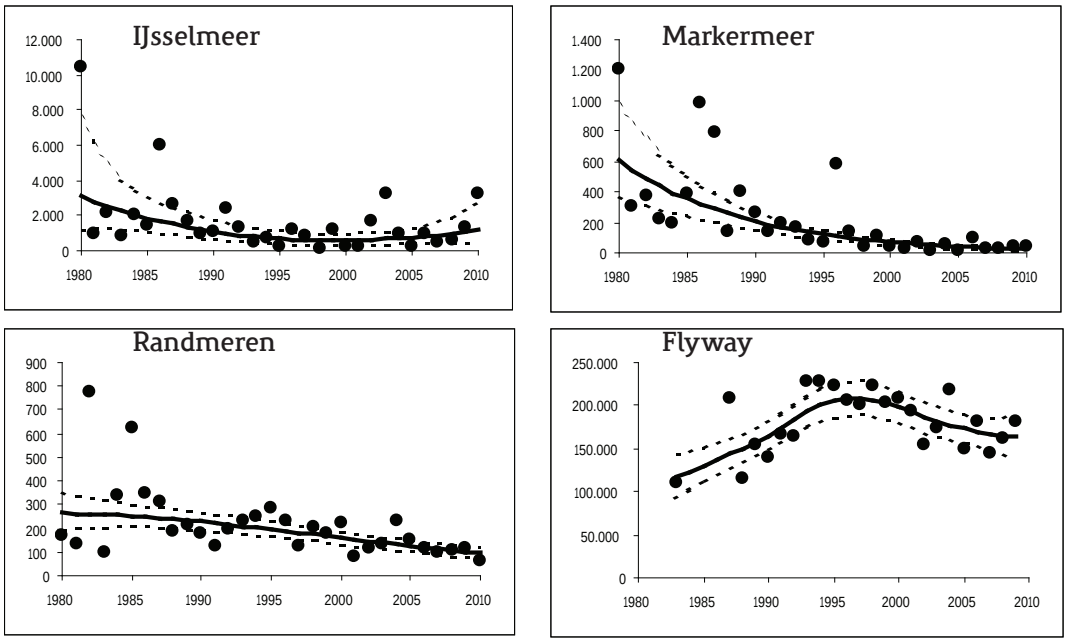
Goldeneye - Brilduiker



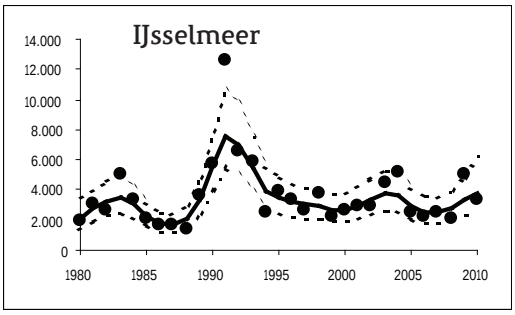
Smew - Nonnetje

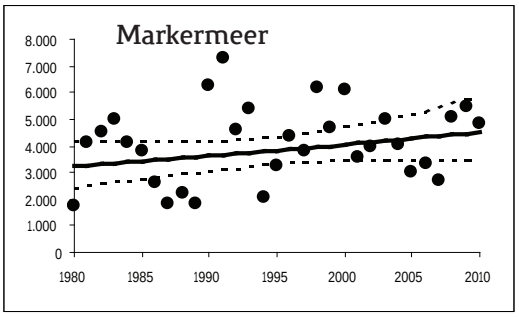


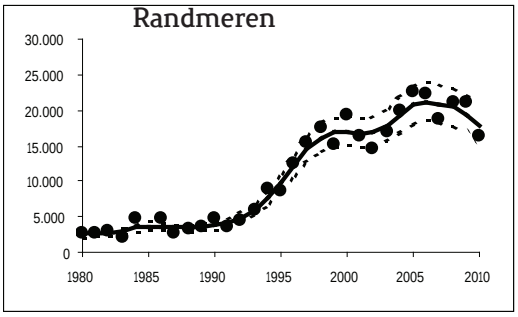
Goosander - Grote Zaagbek

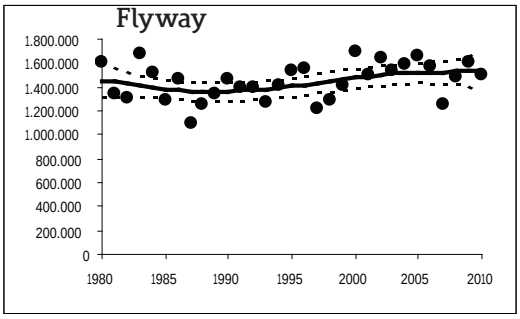


Coot - Meerkoet









Appendix B

Overview of non-breeding waterbird monitoring schemes in relevant countries.

Austria
National counts have been conducted only in January since the 1960s. Most of the Federal States conduct similar site-based counts between November and March and some from September to April. Some of these also began in the 1960s. Not all of these counts are provided to the Austrian national coordinator. The most recent report of the IWC data has been prepared by Teufelbauer (2011).

Czech Republic
The Czech Republic has contributed to the IWC since 1966 and reliable count data is available for some species back to the 1930s. The January counts were extended in 2004 to provide more complete national coverage. Other national counting schemes include non-breeding goose census (re-established in 2006 following monitoring activities first developed in 1989-1994), summer roost surveys and other wintering counts (October-March, at least from 1994 onwards). Counts have been published in Czech magazine of Aythya (Musilova *et al*. 2011).

Denmark
Since the 1980s a full national count is held every 3 years in January and every 6 years in August which include geese counts. An annual winter count is also held, covering 40 land sites and 8 aerial surveys.

Estonia
Midwinter counts in Estonia have started in 1960 and from 1967 they are also carried out in the IWC framework (Luigujõe 2011). Every 3 years since 1996 swan counts have been held March-May and September-December and geese counts February-December. The Duck Wing Survey has been running since 1974, August-December. This survey collects wings from hunters to identify species, age and sex.

Finland
Finnish national winter counts have been held since the 1957, with 3 counts per winter from 1 to 14 November, from 25 December to 7 January and from 21 February to 6 March. The data from these counts is managed by the Finnish Museum of Natural History, University of Helsinki. The Finnish Environment Institute (SYKE) and Finnish Game & Fisheries Research Institute are also involved in waterbird monitoring, and provide counts of sea transects from boats, which are usually conducted in February.

France
January is the only month of national waterbird counts in France. Specific schemes do exist for Brent geese and avocets from September to March. These later are realised on every coastal IWC site. There is also a scheme which coordinates monthly counts of waders, but only on protected coastal sites, or a sub-group of IWC sites. These monthly counts started in the early 2000.

Germany
National counts are held in most regions between September-April and in some regions year-round. Most of the Baltic Sea coast is counted only in January. These counts follow the same methods as the IWC counts. In western Germany these additional counts have been held from the same time as the IWC counts. In eastern Germany until 2003 counts were mostly conducted in November, January and March and only since 2003 have these been expanded to other months.

Hungary
Monthly counts have been conducted at some sites in Hungary since at least 1982. Full national counts are held annually between August-April, counts from October-March are provided to Wetlands International.

Ireland
In Ireland the focus of waterbird counts is September-March, though some sites are counted every month. This programme has run from 1994/5, the same period as the IWC in Ireland (HB & OC z.j.). The same methods are used as for the IWC January counts (counts from vantage points).
Italy
Waterbird counts are only conducted in January.

Morocco
Mid-winter counts in Morocco are mostly in January but quite often in December or February as well. There are currently discussions with other north-African countries on how the north-African waterbird census network can be developed and strengthened.

The Netherlands
In all important wetland sites counts are organized from September to April. In wetlands expecting to hold important numbers during the summer period as well counts are monthly year round (Hornman *et al.* 2012).

Norway
Since 1980 Wetlands International has received counts from Norway between January-April, with most counts from January or February. Counts are sometimes delayed due to extreme weather conditions.

Poland
National counts are conducted only in January. In a few areas waterbirds are counted between September and April, but these counts are organised by local ornithological groups. The Gulf of Gdansk is sometimes counted throughout the year (Meissner *et al* 2011) . The earliest of these non-January counts are from 1978/9 but more complete surveys were only held from the autumn of 1984.

Portugal
Only January counts have been provided to Wetlands International, although occasionally goose counts have been conducted in October-November.

Spain
Usually, waterbird counts are held only in mid-January and only in Doñana National Park is there a special effort to count all species.

Sweden
A national waterbird count is made in January and September (Nilsson & Månsson 2011). The September count is also a goose counts with special emphasis on the Greylag Goose also including a national survey of Cranes. The other counts during autumn (October, November) are only goose-counts. All counts are site-based counts made in the same way as the IWC. This also applies to the goose counts in September, October and November although only geese are counted (with the exception for the waterbird counts in September). The goose counts are organized to be as complete as possible for the Greylag in September, Bean Goose in October but all species of geese are counted during all surveys. September counts of waterbirds started in September 1973 and have been undertaken every year since then. Goose counts in October and November started in 1977, whereas the special Greylag count in September started in 1984.

Switzerland
Two national counts are conducted including all sites, in November and January. October to March only the waterbird reserves of international importance are counted, in a few cases also September and April, in one case all-year round. All counts follow the same methodology as the IWC counts. The November counts have been held since 1991, the other months for waterbird reserves since 1992/93.

Tunisia
In Tunisia there are usually two waterbird counts per year, the mid-winter census in about 80 wetlands (the most important for waterbirds). There are currently discussions with other north-African countries on how the north-African waterbird census network can be developed and strengthened.

United Kingdom
Wildfowl and waders have been counted since the 1960's and other waterbird families counted since the introduction of WeBS (Wetlands Bird Survey) in 1993. The concentration from WeBS is on the winter period of September-March, but counts are conducted throughout the year. Other regular breeding bird surveys are also conducted (Holt *et al.* 2011).

Lake IJsselmeer and Markermeer is the largest fresh water lake complex in the Netherlands. They have a very important function for waterbirds as breeding, moulting, migration and wintering site. Based on these functions and the numbers of birds involved the lakes are designated as Natura 2000 sites under the EU Birds Directive and as wetlands of international importance under the Ramsar Convention. In 2009 a large ecological study started focusing on several long term declining trends of waterbird species and other components of the ecosystem (ANT-IJsselmeer). This study should finalize in 2013 and aims for clear management advice to reach a resilient and sustainable ecosystem with optimal possibilities for the target species.
Within these studies it is important to know if trends within the IJsselmeer region are caused by local factors or by factors operating elsewhere or everywhere along the flyway of the species concerned. This current study, funded by the Ministry of Economic Affairs, Agriculture and Innovation, tries to answer this question and is jointly carried out by Sovon Dutch Centre for Field Ornithology and Wetlands International in cooperation with National coordinators of the International Waterbird Census.

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