Compiling estimates of East Atlantic flyway wader populations wintering in coastal Europe in the early 1990s: a summary of the 1996 WSG wader populations workshop

Nick Davidson

Davidson, N. 1998. Compiling estimates of East Atlantic flyway wader populations wintering in coastal Europe in the early 1990s: a summary of the 1996 WSG wader populations workshop. *Wader Study Group Bull.* 86: 18 -25.

Wader population size estimates need regular updating for use in flyway and site conservation. In 1996 the WSG held a workshop that produced new provisional estimates for the early 1990s, updating the previous mid-1980s figures. These new estimates were compiled from national totals, pending redevelopment of the Wader Counts Database. They reveal major changes in the size of populations, with increases in ten and decreases in three. Although it is not clear from this analysis whether the changes reflect real population trends or are at least in part due to differences in count coverage and/or handling of national population estimates, some evidence from British population trends corroborates the population change pattern. Clarification of real trends in population size awaits indexing analyses from the Wader Database, which will form part of the planned 1998 workshop. This will update European coastal populations and attempt estimation of African-wintering populations, as a first phase of the development of a wader flyway atlas.

Nick Davidson, Wetlands International, International Co-ordination Unit, PO Box 471, 6700 AL Wageningen, The Netherlands.

BACKGROUND

Migratory waders (Charadrii) are a major feature of coastal and estuarine ecosystems, and the subject of extensive conservation effort throughout their range and distribution, notably through the designation of sites supporting internationally important numbers under the Ramsar Convention (as wetlands of international importance) and flyway conservation strategies, notably the Bonn Convention African-Eurasian Waterbird Agreement, the Asia-Pacific Migratory Waterbird Conservation Strategy and the Western Hemisphere Shorebird Reserve Network. An essential basis for implementing these, and other, conservation measures is an understanding of the size and distribution of each biogeographical population of waders and trends in these populations (Davidson *et al.* 1998). Since population size varies with time a regular assessment of how these populations are changing is needed to determine conservation priorities.

Waders occurring on the eastern seaboard of the Atlantic Ocean in western Europe and North and West Africa are using the East Atlantic Flyway. Birds using this flyway breed over a large area of the arctic, boreal and temperate northern hemisphere from Canada east to mid-northern Siberia. Many subspecies and biogeographical populations using this flyway overwinter on the estuaries and open coasts of western Europe. Others pass through this region during spring and autumn to reach overwintering sites in western Africa, some reaching as far south as South Africa.

An internationally accepted criterion under the Ramsar Convention for identifying sites that qualify as internationally important is that 1% or more of their relevant biogeographical population regularly occurs there. In support of this criterion Wetlands International co-ordinates an International Waterfowl Census which collects midwinter (January) count data from wetlands worldwide. January was selected as the time of Northern Hemisphere winter when waterfowl are least mobile. Analysis of these waterfowl count data permits periodic estimation of total population sizes which in turn gives a basis for updating 1% thresholds for key site selection.

For coastal waders using the East Atlantic Flyway population estimates have been made previously in the early 1970s Prater (1976) and the early 1980s (Smit & Piersma 1989). A protocol for future updates of waterbird populations on a three-year cycle, with review of 1% thresholds on a nine-yearly cycle has been agreed (Rose & Stroud 1994). Recommendations from these reviews are then included in listings of global waterfowl population estimates provided in support of waterfowl conservation (Rose & Scott 1997).

In its role as a wader expert network for Wetlands International, the Wader Study Group undertakes the compilation and interpretation of wader population estimates, that are then incorporated into waterbird population updates provided to support flway conservation action. Since the last published estimates date from the early-mid 1980s (Smit & Piersma 1989), a major review of wader populations is overdue and to address this the WSG held a population estimates workshop during its annual conference in Belgium in October 1996.

Techniques have recently been developed for estimating population sizes and trends that include imputed values for sites that were not counted in particular years. This "Underhill index" method (Underhill & Prys-Jones 1994) is an

increasingly-widely used technique for indexing waterbird populations (*e.g.* Prys-Jones *et al.* 1994; Rose 1994; Cayford & Waters 1996), and permits the inclusion in indexes and population estimates of the maximum proportion of available counts. For population size estimates the method requires, however, computerised time-series data from as many sites as possible throughout the populations range. At the time of the workshop, the Wader Database, managed by the IBN-DLO institute in the Netherlands as part of Wetlands Internationals International Waterfowl Census (IWC), was beginning a major reconstruction and could not be used to reliably generate population sizes and trends. Therefore we adopted an alternative approach of compiling international data from expert interpretation of national population sizes.

This paper reports the outcomes and findings of the 1996 workshop, updated with recent information from the redeveloped Wader Database for countries for which national information was not available during the workshop, and then outlines current plans for further updating and refining these estimates during the planned October 1998 workshop to be held during the WSG conference in Hungary.

Since the 1996 workshop, and at the request of Wetlands International, plans have been developed for the preparation of a *Wader Flyway Atlas* in support of the African-Eurasian Waterbird Agreement, designed as a companion volume to the Anatidae atlas already completed (Scott & Rose 1996). Since this would incorporate the population estimates along with more detailed analysis and interpretation of population sizes and distributions, it was agreed that full publication of the population results of the 1996 workshop, shortly before a more detailed and updated analysis for the wader atlas would serve only to confuse those seeking to use population estimates. Therefore this paper provides only summary information rather than full results, and the 1998 workshop marks a first phase analysis in preparation for wader atlas development.

THE 1996 WADER POPULATIONS WORKSHOP

The one-day 1996 workshop had three objectives:

1. to compile population size estimates for the early 1990s, and to interpret population trends, for those wader species and populations covered by Smit & Piersma (1989) for which sufficient recent midwinter count data are available. Since at that time there had been few counts undertaken in major west African wetlands since Smit & Piersmas (1989) analysis, the workshop concentrated on those populations overwintering wholly or predominantly on the coasts of Europe and north Africa. These populations, and the countries for each population from which estimates have been compiled, are listed in Table 1. The selection of countries to include for each population followed Smit & Piersma (1989) except where more recent evidence, *e.g.* from ringing analyses, suggested a clarification or change to the population distribution.
2. to redevelop the network of national wader count co-ordinators who provide annual January count data for incorporation into the Wader Database; and
3. to begin the development of a network of wader species experts whose role is to help in the interpretation and validation of population information for each species covered in the population analyses.

The workshop proved highly successful in compiling new estimates and in beginning the process of establishing co-ordinators and expert networks. Updated population information was presented and compiled for all East Atlantic flyway countries in Europe with major wintering wader populations, except for Spain, Morocco and Tunisia. Information was provided at or shortly after the workshop for the Danish, German and Dutch Wadden Sea, the Baltic coast of Germany, the Netherlands coast and Delta region, Belgium, Ireland, Northern Ireland, Great Britain, France, Portugal, and Italy. Population information was not available from the northern extremes of the wintering range of some waders - Sweden, Norway and Iceland - but wintering populations of most species in these countries is known to be small. A possible exception is the Purple Sandpiper *Calidris maritima* but since this overwinters mostly on rocky coasts for which there is generally poor census coverage this species was not included in the analysis.

To aid national co-ordinators in compiling and interpreting recent wader count information for presentation during the workshop a *pro-forma* questionnaire was supplied in advance of the workshop. This permitted both those attending and those unable to attend to provide consistent information on recent wader populations for each country. The forms asked co-ordinators to compile information, where possible, for the years 1991-1995 - a period of five years is considered necessary to allow for the variations in wintering population size due to annual differences in breeding success, particularly in those species that breed in the high arctic. Co-ordinators were asked for the following:

- total January counts for each species for the most recent five years of data available;
- a summary of the weather conditions during each count, to help identify years (*e.g.* of ice winters) when conditions may have affected distribution or detectability;
- an estimate of the amount of wader habitat not covered by the counts; and
- an estimated average total population on each species, based on the first three pieces of information.

Co-ordinators were also asked to identify any published reports of midwinter wader populations in their area during the last ten years.

During the workshop each co-ordinator briefly presented their results, noting any issues that they considered might affect interpretation of the population figures. National results were compiled and summed during the workshop, and the workshop then discussed the international population size estimates and their interpretation for each species.

Table 1. Countries included in the estimation of sizes of 1990s East Atlantic European-wintering wader populations

Species	Wadden Sea	Neths. ex W.S.	Belgium••	Ireland••	UK	France	Spain	Portugal	Morocco*	Italy	Tunisia	Comments
Oystercatcher	✔	✔	✔	✔	✔	✔	✔	✔	✔	-	-	Med. birds believed to be of Black Sea origin so excluded.
Avocet	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	Tunisian popn. may be mixture
Ringed Plover	✔	✔	✔	✔	✔	✔	✔	✔	✔	-	-	Smit & Piersma (1989) give reasons for excl. Italy/Tunisia.
Grey Plover	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	One flyway popn. - trend and popn. est. for northern part of range only
Knot	✔	✔	✔	✔	✔	✔	✔	✔	-	-	-	see Smit &Piersma (1989) for southern exclusion case.
Sanderling	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	One flyway popn. - popn. est. for northern part of range only. Also caution in interpretation: open coast popns. poorly covered.
Dunlin	✔	✔	✔	✔	✔	✔	✔	✔	-	✔	-	Tunisia excluded (see recent WIWO surveys)- note included by Smit & Piersma (1989), excl. Morocco (see Smit & Piersma (1989). Note that estimates will include some temperate schinzii - popns. Overlap in SEurope/ Africa
Black-tailed Godwit	✔	✔	✔	✔	✔	✔	✔	✔	✔	-	-	see Smit & Piersma (1989) for Med. Exclusion. NB recent large increase in Portugal may be breeders from further east
Bar-tailed Godwit	✔	✔	✔	✔	✔	✔	✔	✔	-	-	-	
Curlew	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	One flyway popn. - popn.est. for northern part of range only. Also caution in popn. interpretation: inland pops. poorly covered.
Redshank (NWE)	✔	✔	✔	✔	✔	-	-	-	-	-	-	Countries match Smit & Piersma (1989) coverage, but note that Britain has mixed popn. & rest of Europe only Icelandic breeding birds.
NW												
Redshank (SE/NA)	-	-	-	-	-	✔	✔	✔	✔	✔	✔	Northern part of S Europe/W African popn. - note popn. est. is for part of range only.
Turnstone	✔	✔	✔	✔	✔	✔	✔	✔	-	✔	-	Also caution in popn. interpretation: open coast popns. poorly covered.

* excludes Dahkla Bay

PROVISIONAL ESTIMATES OF 1990s EUROPEAN COASTAL WINTERING POPULATIONS

Population estimates compiled during and shortly after the 1996 workshop have been supplemented by data now available from the Wetlands International Wader Database for Spain (1993-94), Morocco (1993-94) and Tunisia (1992-94) - years for which there was good count coverage in these countries.

Table 2 summarises the changes in total population size derived from this analysis in comparison with Smit & Piersmas (1989) analysis. The total size of these populations was estimated in the early 1990s at 3,944,000, an overall increase of 5% since the 1980s analysis. There appear, however, to have been substantial changes in the species composition of the wintering population of this part of the East Atlantic flyway, since estimates for most populations were substantially higher than those produced by Smit & Piersma (1989), notably in Oystercatcher, Grey Plover, Ringed Plover, Sanderling, Curlew and Redshank. This was counterbalanced by an apparent decrease in the most abundant species, Dunlin. The analysis implies that, if verified by the 1998 analyses, there will be recommendations for substantial changes in 1% thresholds for most species - one of the main objectives of the analysis.

It is important, however, to distinguish between changes in estimated population size and the interpretation of these as trends in population sizes. For several reasons, changes in estimated population size cannot readily be treated as reflecting

Species	**Population (from Rose & Scott 1997)**	**% change from 1980s estimates**	**Expert assessment of probable reasons for trend**
Years			
Oystercatcher	Europe & NW Africa wintering	+19	increase, but may be due to different treatment of Wadden Sea counts
Avocet	W European & W Med breeding	+15	possible increase, but problems in coverage
Ringed Plover	Europe & northern Africa wintering	+25	increase, notably due to improvement in coverage (large numbers in Morocco in 1994 & 1995)
Grey Plover	E Atlantic wintering	+46	genuine increase
Knot	*islandica*	+15	genuine increase
Sanderling	E Atlantic & W&S Africa wintering (part)	+34	probable increase, but may be partly improved coverage *e.g.* Spain
Dunlin	*alpina* (N Siberia /Europe)	-14	probable decrease, but current estimate lies within the 24-year variation in numbers (900,000 - 1.6m)
Black-tailed Godwit	*islandica* (Iceland breeding)	+62	apparent increase, but this may be largely due to a change in the distribution of subspecies (*e.g.* in Portugal)
Bar-tailed Godwit	W Palearctic (wintering)	-6	stable or small decrease
Curlew	Europe (breeding)	+22	increase
Redshank (NW Europe)	*robusta* (Iceland/Faroe Islands breeding)	+34	increase
Redshank (SW Europe /N Africa)	*totanus* E Atlantic (wintering)	-55	probable decrease, but possible problems in coverage
Turnstone	W Palearctic (wintering)	+16	increase, but open coast populations not well covered
TOTAL		**+5**	

Table 2. Estimated changes in the population sizes of European East Atlantic Flyway coastal wader populations. Note that, in the light of recent knowledge of population distributions, the totals for the mid-1980s have been recalculated to cover the same geographical range as the early 1990s analysis and so in some cases differ from the figures given in Table 11 of Smit & Piersma (1989).

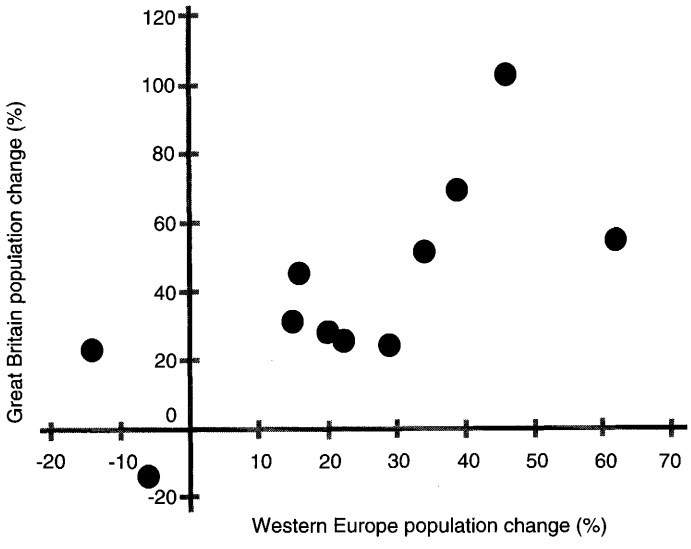

Figure 1. Correlation between the mid-1980s to early 1990s changes in population size for different wader species overwintering in Western Europe and Great Britain. Data from this analysis and Cayford & Waters (1996).

Figure 2. There is no correlation between the percentage of the Western European population wintering in Britain and the similarity of the 1980s-1990s change in population size for Great Britain and Western Europe.

real trends in population sizes. Changes in observed population size can arise for several reasons, and these cannot be fully disentangled without more detailed analysis using techniques for assessing population trends involving the estimation of numbers on sites missing from the counts in some years. The population changes reported in Table 2 may be due to one or more of the following:

- *genuine changes in the size of the population*;
- *differences in count coverage within countries between the two periods;*
- *differences in the selection of sites and countries included for each population.* For some species the countries included in the 1990s analysis differ from analyses by Smit & Piersma (1989), but for the comparison Smit & Piersma's figures have been recalculated to allow for this;
- *changes in the distribution of different populations of the same species.* Much of the increase in total numbers of Black-tailed Godwits *Limosa limosa* is due to large increases in numbers wintering in Portugal, which may reflect changes in the wintering distribution of birds breeding in continental Europe (R. Rufino, pers. comm.);
- *differences in the analysis of count data at national level.* For the Wadden Sea, Smit & Piersma (1989) used totals of birds counted (*i.e.* not taking into account gaps in count site coverage) whereas the 1990s data for the Wadden Sea is for estimated populations derived from analyses that include imputation of numbers present on sites for which counts were missing for some years. A rough indication of the effect that such differences may have on the apparent changes in population size between the 1980s and 1990s can be gained from recalculating Smit & Piersma's (1989) figures by the addition of the average differences between actual and inferred counts for the Wadden Sea for January 1988-91 given in Meltofte *et al.* (1994). For most species this results in a difference in change of only a few percentage points (decreasing apparent increases and increasing apparent declines) but for Oystercatcher this approach reduces the estimated change in international population size from +19% to only +1%, and alters the total wader population from a small increase to a small decrease. This emphasises the pitfalls in attempting to interpolate trends from apparent changes in national population data, and the importance of making such interpretations based on statistically sound index-based trend analyses.

So how reliable overall are the new provisional estimates of changes in population size? Some confirmation that the 1990s analyses represent real change in observed population sizes since the 1980s comes from comparison of these international estimates (not adjusted for differences in Wadden Sea count treatment) with recent population trends for Great Britain (Cayford & Waters 1996). Cayford & Water's results were derived from a full population index analysis from estuaries, combined with an updated interpretation of populations wintering on non-estuarine shores, and therefore provide reliable assessment of changes in population size for this country. Figure 1 shows a strong correlation between the British and international analyses. The datasets are not, however, independent since Great Britain is a major part of the wintering range for many of these populations. Based on this comparison, Britain holds, for example, 74% of the wintering Turnstones and Redshanks, 71% of Knots, 53% of Sanderlings and 51% of Bar-tailed Godwits, so trends would be expected to be closely similar particularly for these species.

Figure 2 shows, however, that there is no link between the similarity of the population changes for Britain and the international population and the percentage of the population that overwinters in Britain. It therefore appears that the changes in population size for the 1990s international populations will prove to be real, although the magnitude of the apparent changes may be larger than the real population trends owing to the difference in count treatment and improvements in count coverage in some parts of the wintering range. Confirmation of the magnitude trends in these populations

must await more detailed trend analysis of the international count data once the Wader Database is fully developed.

These results emphasise two important points for the conservation of migratory waders. First, the major changes in population size of many species over the last ten years identified in this analysis highlight the importance of continuing international population monitoring schemes such as the International Waterfowl Census if conservation action for wetlands and waterbirds is to be appropriately focussed. Second, the difficulty of disentangling the various possible causes of the apparent changes in population size (see above) stresses the vital need to apply statistically-sound indexing analyses to count data to establish real trends in population size. Such trend information is vital for identifiying populations in decline, and hence in need of priority action for their conservation. Furthermore in areas, such as much of Africa, where count coverage is incomplete trend analyses become particularly important in the absence of good estimates of population size. For such trend analyses it is essential to repopulate the Wetlands International Wader Database with as long as possible time-series of counts (most data currently held is for only 1991 onwards), and it is hoped that this will be achieved in the next few months.

ISSUES THAT NEED FURTHER EXAMINATION

The 1996 workshop discussions identified a number of issues important for the interpretation of population sizes and trends for particular species from national-scale compilations, in addition to those general points described above. These will need further consideration during the 1998 exercise, and include:

- The redistribution of populations in years when there is a cold spell in January (during the count period) in continental north-west Europe. This particularly affects count information from the Wadden Sea. At such times many waders are known to move from the Wadden Sea to coasts further south and west, but there is an added problem of Wadden Sea counts further underestimating the remaining population sizes owing to the difficulty of reaching and counting many areas. This does not greatly affect 1991-95 counts since these were relatively mild winters: although in the Netherlands there was a short cold spell just before the January 1993 count which may have led to lower numbers especially of Dunlin and Curlew, and a short cold spell in early January 1995 for which no differences in numbers were noticed. There were also low numbers of Dunlin and Curlew counted in Britain in 1993, although numbers of Knot increased. Cold weather will, however, affect the inclusion of January 1996 data since this was during a particularly cold spell.
- The treatment of Wadden Sea counts is complex since although the data are supplied to the wader database separately for a large number of sites it may be better to handle the international analyses by treating the area as four megasites (Netherlands, Germany: Niedersachsen, Germany: Schleswig-Holstein, Denmark) for which well established missing data imputation routines have already been applied - see *e.g.* Meltofte *et al.* (1994).
- There is a need to understand more about the methods used by each national co-ordinator for compiling national estimates, since imputation routines may differ.
- Counts for Knots may pose a particular problem for interpretation especially in the Wadden Sea because their populations are both localised and highly mobile: Wadden Sea counts are not totally synchronous so at times Knots may have been double-counted whilst flocks may have been missed in other years.
- Open coasts are not generally well covered and populations for which large proportions overwinter outside estuaries will be underestimated, especially in some years. For example for Sanderling there was good coverage in the Netherlands in 1993-95 but poor coverage in 1991 and 1992. The Europe-wide Non-estuarine Wader Survey (NEWS), co-ordinated by the British Trust for Ornithology in midwinter 1997/8 should help to remedy this gap in available data.
- Low population size, especially in arctic-breeding species, in some years may be a consequence of poor breeding success rather than poor coverage or difficulties in counting during cold spells. For example for Dunlins there was a very poor breeding season in summer 1992, with the flyway index in winter 1992/3 down by 24% compared with 1991/2 (H.-U. Rosner, pers. comm.).
- Recent changes in inland/coastal distribution may be an issue to consider in some species, notably Golden Plover (not included in the current analyses) and Curlew (M. Engelmoer and N. Clark, pers. comm.).
- Information is needed for wintering populations from Denmark non-Wadden Sea coasts, Sweden and other Baltic coast countries, Norway and Iceland (and possibly also southern Greenland) to give complete coverage of the range of wintering populations.
- It will be important to include 1994 and 1995 Wadden Sea totals in the analysis, because of the continuing population increases in Grey Plover, otherwise total numbers and the size of the population increase will be underestimated.
- The identity of populations wintering in Italy need clarification: Avocet are probably not all East Atlantic flyway birds, and this may be the case for all species (R. Tinarelli, pers. comm.)
- For Avocet, there are coverage and distribution problems: Italy and Tunisia should be excluded from the East Atlantic data, the identity of the population in Algeria is not clear, and in Senegal there is probably a mix of birds from SE as well as NW Europe (H. Hotker, pers. comm.). There are also significant gaps in coverage for Spain and North Africa. It may prove more accurate for Avocet to derive population size from breeding bird counts, with the inclusion of non-breeding population (H. Hotker, pers. comm.).
- It may be appropriate to include Algeria in the East Atlantic estimates for some species - this needs clarification.

NEXT STEPS: PLANS FOR THE 1998 WORKSHOP

The Wader Populations workshop to be held during the October 1998 WSG conference in Hungary will form a key part of a WSG project to provide new population distribution, size and trend estimates for waders in as many of the Bonn Convention African-Eurasian Waterbird Agreement range states as possible. The workshop will draw on the information compiled from 1996 population re-estimates, reported here, and will refine and update these using information from the Wader Database and other sources including recent one-off surveys of major African coastal wetlands.

The project will deliver these new estimates for use in Waterfowl Population Estimates 3rd Ed. and in the expanded AEWA Action Plan. In addition this project aims to compile provisional lists of important sites for each population/species which, together with the population information, will provide a draft analysis for these selected species towards the planned AEWA *Wader Flyway Atlas*.

The analysis derived from the 1996 workshop reported here forms part of the preparation and background material for the workshop, and identification of sources on which to base population estimates for African and Mediterranean wintering populations has already begun. Compilation of wader count data for African coastal non-breeding populations may also be faciliatated through the WSG meeting in South Africa in August 1998.

The 1998 workshop aims to:

- Compile population estimates for European East Atlantic populations based on national totals compiled at the 1996 WSG conference workshop;
- Update these figures with national information from 1996-1998, including counts held by the Wader Database and (if available) data on non-estuarine populations from the NEWS project;
- Compile definitive population estimates for African East Atlantic flyway coastal populations, from sources incl. Wader Database, and recent 'one-off' surveys of important localities (*e.g.* Banc d'Arguin, Guinea Bissau, Cameroon);
- Attempt, as far as possible, estimates for populations using the Mediterranean-East African flyway;
- Attempt to establish population trends by comparison with Smit & Piersma's 1980s population sizes (but mindful of the difficulties outlined in this paper of making such comparisons);
- Test the capacity of the newly re-established Wetlands International IWC Wader Database to generate population size and trend estimates for these populations, using all data and reduced site-list approaches with 'Underhill indexing'; and
- By comparison between the Wader Database and 'national totals' generated data, agree definitive population estimates for the mid-1990s;

As part of the follow-up to the workshop WSG will also compile lists of key sites for each species/population. These lists will give population size, and indication of whether site totals exceed 1% of flyway population. They will form the basis for mapped distributions in preparation for future Wader Flyway Atlas development.

How can you help? We hope that, like the 1996 workshop, the 1998 workshop will be attended by as many national wader count co-ordinators as possible to present and discuss updated national count information. We will be contacting national co-ordinators shortly and supplying *pro-formas* similar to those used in 1996 to aid preparation of national summary information. A summary of the more detailed population size estimates compiled from the 1996 workshop will also be provided to participants as briefing for the workshop. We also hope that the workshop will be attended by as many WSG members as possible to contribute their expert knowledge on different wader populations and the interpretation of their population sizes.

ACKNOWLEDGEMENTS

The new population estimates could not have been compiled without the hard-work of the many dedicated wader and waterbird counters throughout the coasts of Europe, and the network of national Wader Count Co-ordinators, and thanks go to Hans Wolfgang Nehls, Bernd Struwe-Juhl, Ray Waters, Patrick Meire, Peter Südbeck, Marc van Roomen, Simon Delany, Rui Rufino, Renato Neves, Roger Mahéo and Nicola Bacetti for providing regional or national population data. Thanks also to the many WSG members who participated in the workshop and contributed invaluable comment and advice on the interpretation of the population estimates. Lieuwe Haanstra provided data from the Wader Database for several additional countries. Bart Ebbinge and Barbara Ganter helped lead the workshop in their then role as Wader Database co-ordinators. Patrick Meire and his team hosted the 1996 conference and provided excellent facilities for the workshop. Thanks go also to David Stroud, Theunis Piersma, Simon Delany and Janine van Vessem for comments on drafts of this paper.

REFERENCES

Cayford, J.T,, & Waters, R.J. 1996. Population estimates for waders Charadrii wintering in Great Britain, 1987/88-1991/92. *Biological Conservation* 77: 7-17.

Davidson, N.C., Stroud, D.A., Pienkowski, M.W. & Rothwell, P.I. 1998. Towards a flyway conservation strategy for waders. *International Wader Studies* 10: in press.

Meltofte, H., Blew, J., Frikke, J., Rösner, H.-U., & Smit, C.J. 1994. Numbers and distribution of waterbirds in the Wadden Sea. *IWRB Publication* 34/*WSG Bulletin* 74, *Special Issue.*

Prater, A.J. 1976. The distribution of coastal waders in Europe and North Africa. *In*: M. Smart (ed.), *Proc. 5th International Conference on Conservation of Wetlands and Waterfowl,* pp. 255-271. IWRB, Slimbridge.

Prys-Jones, R., Underhill, L.G., & Waters, R.J. 1994. Index numbers for waterbird populations. II. Coastal wintering waders in the United Kingdom, 1970/71-1990/91. *J. Appl. Ecol.* 31: 481-492.

Rose, P.M. (ed). 1994. *Western Palearctic and South-west Asia Waterfowl Census 1994. IWRB Publication 35.*

Rose, P.M. & Scott, D.A. 1997. *Waterfowl population estimates. 2nd edition. Wetlands International Publication* 44.

Rose, P.M., & Stroud, D.A. 1994. Estimating international waterfowl populations: current activity and future directions. *WSG Bull.* 73: 19-26.

Scott, D.A., & Rose, P.M. 1996. *Atlas of Anatidae populations in Africa and Western Eurasia. Wetlands International Publication* 41.

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