RESULTS: SITES

Key sites for waders in Africa-Western Eurasia

Using a threshold of ≥ 20,000 waders to define a 'key site', a total of 207 key sites have been identified for waders in Africa-Western Eurasia (Tables 3 & 4; Figures 2 & 3). Of these, 149 are key sites for waders in midwinter, of which a minimum of 31 are known also to attain this importance during spring and/or autumn migratory periods. There are a further 58 key sites that are important only during these migratory periods and not in midwinter.

In midwinter from available data, only 97 key sites (65% of the total) could be identified as regularly supporting >20,000 waders. Of the remaining 52 sites, 19 were 'data-deficient' for the 1990s, with fewer than three years data available, and for 33 there were no recent (1990s) data available (all in Africa and the Middle East[1]). A total of 58 sites are known from regular surveys to have supported a maximum of >20,000 waders in the 1990s, although their January average is below this threshold. The quality of data is poor for the spring and autumn, partly since no regular counts for these periods are held in the IWC Wader Database, so data are less accessible for international review than for January. For the spring/autumn period, for only 43% of sites is their listing based on the known regular occurrence of >20,000 waders, with as many sites (43%) 'data-deficient' for the 1990s. Given that it is known that turnover of individuals at staging sites can be high (Frederiksen *et al.* 2001), so that many more birds are using a site than are counted at one time, it is highly likely that (many) other spring and autumn key sites may exist in the Africa-Western Eurasian region.

Over half of the midwinter (83 sites) and nearly three-quarters of spring/autumn (42 sites) key sites are in northern and western Europe, emphasising the very great significance of this part of the region for migratory wader populations. Of the other midwinter key sites, most are on the Atlantic coast of Africa and in western or south-western Africa (35 sites), with very few known for the Mediterranean/Black Sea region (7 sites) and Middle East and east/central Africa (24 sites). For the Middle East and Africa, however, this is likely to partly reflect the paucity of survey coverage, and identification of further key sites can certainly be anticipated with improved coverage.

Most key sites in midwinter are coastal, with only 31% (47 sites) known from inland areas. There are, however, more inland sites amongst more southerly wintering areas: 45% in West and Atlantic coastal Africa and 62% in the Middle East/ East and Central Africa, compared with in 18% in North and West Europe. There is a similar pattern of predominantly coastal key sites known for spring/autumn, but with a higher proportion (57%) inland, this being reflected in both North and West Europe and also in the presence of mostly inland staging sites in central and eastern Europe – a region for which no midwinter key sites are known. It is worth noting that within Europe, coastal sites are generally much better monitored (more frequently and comprehensively) than are inland sites.

Of midwinter key sites, 74% (111 sites) involve wader populations using the East Atlantic Flyway, with far fewer inland sites identified for the Black Sea/Mediterranean Flyway (27 sites – 18%) or the W Asia/East Africa Flyway (32 sites – 21%). Although this is probably in part a consequence of poorer survey coverage it may also reflect the fact that the populations using these flyways are generally more dispersed across many inland freshwater areas than are those on the East Atlantic Flyway, which tend to be coastal and more localised on particular key sites.

There is a similar predominance (64%) of spring/autumn key sites being on the East Atlantic Flyway. Only four migration period key sites were identified on the West Asia/ East Africa Flyway, but this may largely reflect that populations on this flyway stage in spring and autumn in inland Central Asia,

[1] Note, however, that this assessment relates to the first half of the 1990s and that there have been more recent major developments in waterbird census developments activities in some of these areas, notably of the scope of the African Waterbird Census.

Figure 2. Key sites for waders (those holding > 20,000 individuals) in Africa. Round symbols indicate use in the mid-winter, non-breeding period, square symbols indicate use in the pre- and post-breeding migration periods.

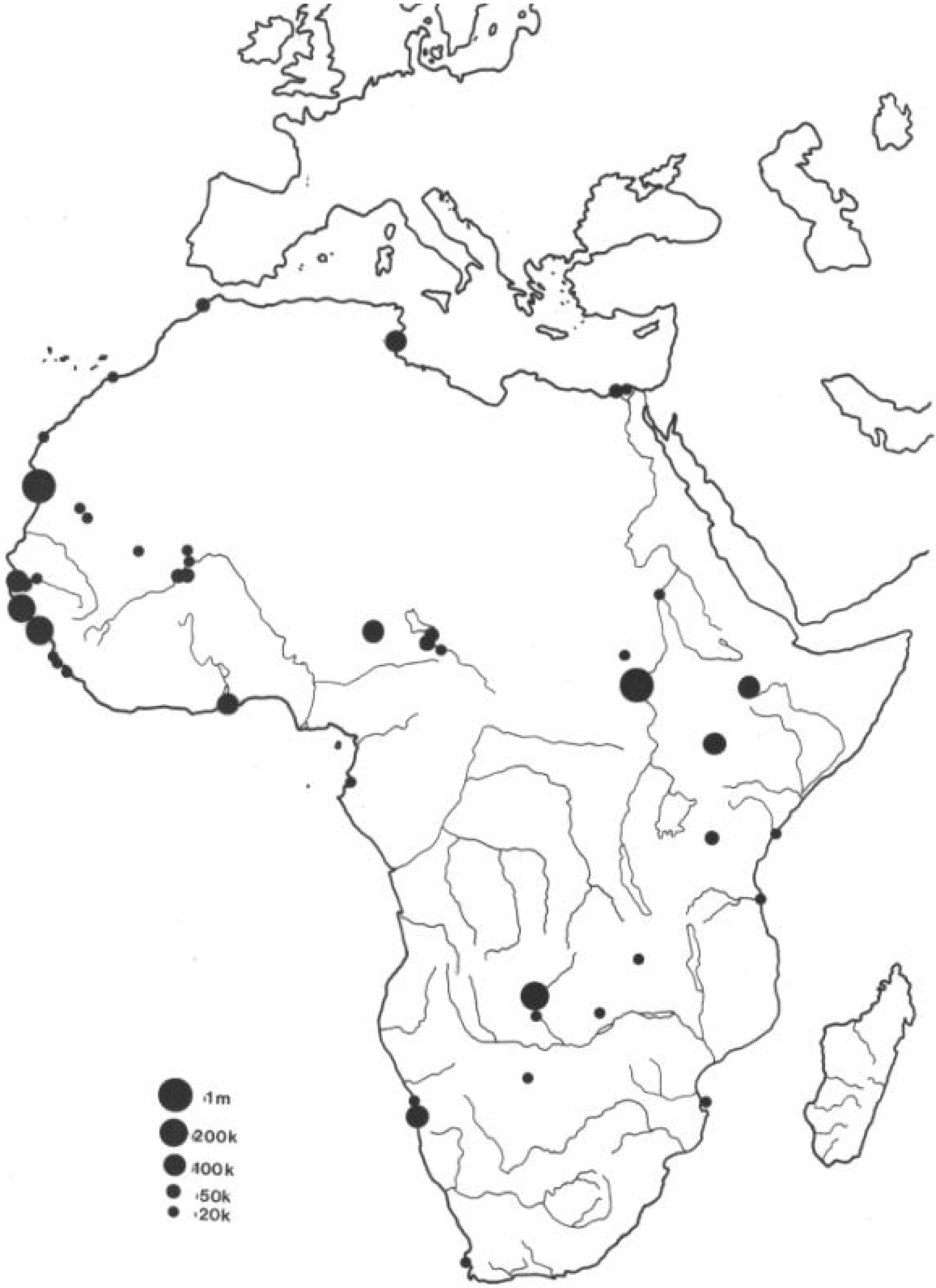


Figure 3. Key sites for waders (those holding > 20,000 individuals) in Europe. Round symbols indicate use in the mid-winter, non-breeding period, square symbols indicate use in the pre- and post-breeding migration periods. Key to symbol sizes as Figure 2.

which is outside the geographical coverage of this paper.

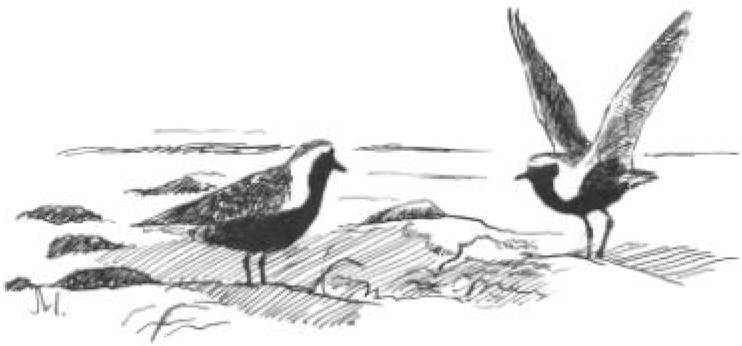
This analysis has extended the knowledge of key sites for migratory wader populations beyond that of Smit & Piersma's (1989) study, which was restricted to listing key sites on the East Atlantic Flyway, and for midwinter only. But has our knowledge of the location and distribution of waders wintering on the East Atlantic Flyway improved since Smit & Piersma's 1980s analyses? Direct comparison between their 1980s data and the 1990s data presented in this study is difficult owing in part to different approaches to the grouping of localities as a "site", which for some of Smit & Piersma's sites are more akin to an "ecounit" as defined in this study. Furthermore, Smit & Piersma listed only sites that "regularly supported" over 20,000 waders whilst in Tables 3 & 4 we also list sites known to have supported over 20,000 waders in at least one recent (1990s) year. Ten sites are known to have supported these numbers prior to the 1990s but for which there is no more recent survey available.

For Europe, Tables 3 & 4 lists three estuarine sites in the UK (Lough Foyle, Breydon Water and Berney Marshes, and Hamford Water) not listed by Smit & Piersma but which now regularly support >20,000 waders. Since coverage of UK estuarine sites has been comprehensive throughout this period, this will reflect a real change in numbers using these key sites. Conversely Smit & Piersma (1989) list three open-coast UK sites (effectively "ecounits": Uists, Strathclyde Coast and Orkneys) for which no new survey data was available for our 1990s listings. (These areas were surveyed in the 1997/8 Non-Estuarine Coastal Waterfowl Survey but these data are not yet available.) One inland site, Loughs Neagh and Beg in Northern Ireland also appears to have declined in importance for waders with a winter peak mean of 11,000 in the 1990s. Improved survey coverage in the 1990s is likely to be reason for the identification of 23 further coastal key sites on the Atlantic Coast of Europe: Ireland (seven sites), France (ten sites), Portugal (two sites) and Spain (four sites).

For the Atlantic Coast of Africa, improved survey coverage is the most likely reason for the addition of eight further key sites that have regularly supported >20,000 waders in the 1990s. These are sites in Morocco, Western Sahara, Ghana (two sites), Gabon (two sites), Namibia (two sites) and South Africa. Of the three sites listed for Atlantic coast of Africa by Smit & Piersma (1989) but not in our 1990s listing, one site in Morocco (Sebka Tazra) has not been monitored under this name in the 1990s, there is no more recent information available for Sherbo River (Sierra Leone) nor for the whole coast of Liberia.

In addition to coastal sites, we include information on 17 inland wetlands holding >20,000 waders.

Tables 3 & 4, together with the key sites listings for each species and biogeographic population, using the 1% population thresholds in this paper, to be published in WSG's *Atlas of Wader Populations in Africa and western Eurasia*, provide a comprehensive listing of sites that it is vital to safeguard for the maintenance of wader populations in Africa and Western Eurasia.



RESULTS: MONITORING AND FLYWAYS

Adequacy of international monitoring

For 78 populations (60% of those considered) monitoring provision is not adequate to provide even the most basic information on trends in abundance (Table 5). For 37 (28%) populations, monitoring provides some information on the direction of population trends, although this is usually far from adequate either in extent or quality. Only in 16 populations (12%) is there a sound basis for assessing changes in population sizes. For no biogeographical population, however, is it currently possible to assess trends with any defined degree of statistical precision.

Table 5. Adequacy of international monitoring of 131 migratory wader populations in Africa and Western Eurasia. Includes information on 11 sedentary populations of otherwise migratory species (see text).

	No monitoring at international scale in either breeding or wintering periods. Trends unknown. **No idea**	Some international monitoring in either breeding or wintering periods although inadequate in quality or scope. Trends assumed through partial information. **Poor**	International monitoring in either breeding or wintering periods that is adequate in quality or scope to track direction of population changes. **Reasonable**	International monitoring in either breeding or wintering periods that is adequate in quality or scope to track direction of population changes with defined statistical precision. **Good**
East Atlantic Flyway	11	12	16	0
Black Sea/Mediterranean Flyway	13	15	0	0
West Asia/African Flyway	42	7	0	0
Sub-Saharan Africa	9	1	0	0
Other migration systems	3	2	0	0
African-Western Eurasian Region	**78**	**37**	**16**	**0**

Comparison of flyway populations

Number of species and populations covered

A total of 55 African-Western Eurasian migratory species with a total of 120 migratory biogeographic populations were identified as occurring in Africa-Western Eurasia during the non-breeding season. Information was compiled for all populations.

A further 11 non-migratory African resident populations of four otherwise migratory species were also identified. These were three Black-winged Stilt and two Avocet populations, two Canary Islands races of Stone Curlew *Burhinus oedicnemus,* two races of Cream-coloured Courser *Cursorius cursor* occurring in eastern Africa, and two further races of this species occurring in the Cape Verde Islands and the Canary Islands. Brief summary information on these populations is included for the sake of completeness. Excluded from this analysis is the extinct Canary Islands Oystercatcher *Haematopus meadwaldoi* for which no recent evidence suggests that this species survives (BirdLife International 2000).

A number of differences in the treatment and separation of populations have been made on the basis of improved information and new analyses of population movements and distribution since *WPE2*. These changes in population treatment are described in detail in each species account above and include the identification of 18 new populations of Black-winged Stilt, Stone Curlew, Eurasian Golden Plover, Greater Sand Plover, Eurasian Woodcock, Whimbrel, Eurasian Curlew, Common Redshank, Purple Sandpiper and Dunlin.

Quality of, and improvements to, population size and trend estimates

Population size

A population estimate (or size population size range) is provided for 124 of the 131 populations covered. Precise population size estimates (or estimates with a size range) are given for 94 populations (72% of all populations). A broad range estimate is provided for 21 populations, and a very wide range estimate (two population range codes) for the remaining nine populations (Annex 2).

This reflects a substantial improvement over the number and precision of estimates reported by *WPE2* (although note that nearly all of these reported estimates derived from prior evaluations). A first precise size estimate is made for 29 populations (for 26 of which *WPE2* provided only a size range estimate) and a revised precise estimate for 38 populations. A first population range estimate is made for a further 11 populations and a new and/or more precise size range estimate for a further eight populations. For only 18 populations has no change in size estimate been made to those provided in *WPE2* and for six of these, numbers are completely unknown.

There are considerable differences between flyways in the quality and extent of improvement of the population estimates. For almost all populations (98%) that wholly or primarily use the East Atlantic Flyway, a precise or range estimate is made, compared with only 85% of populations on the Black Sea/Mediterranean Flyway and 49% on the West Asian/East African Flyway. Since earlier (*WPE2*) information quality was better for the East Atlantic than other flyways, most improvements to population size estimates on the East Atlantic Flyway are new size estimates (23 populations). However, for this flyway a precise size estimate is made for the first time for a further 14 populations and for a further population better information now allows a precise range to be reported rather than the *WPE2*'s broad range estimate.

Improved estimate quality has also been possible for the other flyways, with four first and nine new precise size estimates for Black Sea/Mediterranean populations and three first and six new such estimates for West Asian/East African populations, and first or improved size range estimates for two Black Sea/Mediterranean populations and 11 West Asian/East African populations.

1% thresholds

Precise 1% population thresholds are now provided for 116 of the 131 biogeographic populations in the region. This includes a first precise 1% threshold for 39 populations and a changed 1% for a further 40 populations. In addition, provisional 1% thresholds (for populations with only a size range estimate of population size) are provided for the first time for a further 33 populations. For only four populations with 1% thresholds are these unchanged (three of these being populations of greater than 200,000 individuals such that the 1% threshold is a nominal 20,000 individuals).

As is to be expected from the quality of population size estimates, it has been possible to establish 1% thresholds for a much larger proportion of East Atlantic Flyway populations (94% of populations) with two populations having just a provisional 1% threshold and only one with no 1% threshold at all. By comparison, the other flyways have lower precision of estimates: there are precise 1% thresholds for 76% of populations on the Black Sea/ Mediterranean Flyway and only 63% of populations on the West Asian/East African Flyway).

Population trends

Information on population trends is poorer than on population sizes. It has been possible to establish precise trends for fewer populations than for population size. Furthermore, it should be noted that all trends established in this analysis are derived from best expert interpretation of changes in population sizes and are not statistically-based as would be preferable. Overall, clear population trends are provided for only 54 (41%) of the 131 populations. For a further 26 populations (20%), possible trends are suggested.

This reflects an improvement to the quality of information on trends in *WPE2*. A first trend assessment is provided for 43 populations, and new or improved trends for a further 30 populations. For nine populations, trends remain unchanged or there is no improved information on which to base a trend assessment. There remain, however, 51 populations in the region (39%) for which it has not been possible to establish even a provisional population trend.

As for population sizes, population trend information is much better for populations on the East Atlantic Flyway than for other flyways in the region: it has now been possible to assess precise trends for 72% of East Atlantic Flyway populations, but for only 52% of the Black Sea/ Mediterranean populations and just 10% of West Asian/East African populations.

Status of populations in Africa and Western Eurasia

Current population trends

It is difficult to draw conclusions on the overall status of waders in Africa/Western Eurasia, since reliable estimates of population trends can be made for only 54 of the 131 populations using the region. There are, however, over four times as many populations that are definitely or probably in decline as those that are definitely or probably increasing: there is a decrease or possible decrease in 37 populations and an increase or possible increase in just nine, with 33 being stable or possibly stable (Table 7). Furthermore, some populations are known to be severely threatened and in decline, notably Slender-Billed Curlew and Sociable Lapwing, and the two Canary Islands populations of Stone Curlews. Several other populations are of high conservation concern, either because they have small populations or because they are known to be in long-term and or rapid decline (Table 6; see also Table 11).

Table 6. Wader populations of high conservation concern identified by this review.

Species	Population	Cause for concern		IUCN status
		Small population size	Rapid decline	
Black-winged Stilt *Himantopus himantopus*	5. Madagascar	✓	✓	
Stone Curlew *Burhinus oedicnemus*	3. *distinctus* Western Canary islands	✓	✓	
	4. *insularum* Eastern Canary islands	✓	✓	
Cream-coloured Courser *Cursorius cursor*	3. *exsul* Cape Verde Islands	✓		
	4. *bannermani* Canary islands	✓	✓	
Black-winged Pratincole *Glareola nordmanni*	1. W & Central Asia/E & southern Africa		✓	**DD**
Madagascar Practincole *Glareola ocularis*	1. Madagascar/E Africa coast	✓	✓	
Greater Sand Plover *Charadrius leschenaultii*	1. *columbinus*	✓		
Brown-chested Plover *Vanellus superciliosus*	1. W, C & E Africa	✓		
Sociable Plover *Vanellus gregrarius*	1. W Asia/Northeastern Africa	✓	✓	**VU**
	2. S Asia	✓	✓	**VU**
Great Snipe *Gallinago media*	2. W Siberia/NE Europe	✓		**NT**
Black-tailed Godwit *Limosa limosa*	1. *limosa* W Europe/W Africa		✓	
Bar-tailed Godwit *Limosa lapponica*	2. *taymyrensis* W & SW Africa (wintering)		✓	
Whimbrel *Numenius phaeopus*	4. *alboaxillaris* SW Asia/E Africa	✓		
Slender-billed Curlew *Numenius tenuirostris*	1. Mediterranean/ North Africa/Middle East (wintering)	✓	✓	**CR**
Great Knot *Calidris tenuirostris*	1. SW Asia & Western S Asia (wintering)	✓		
Red Knot *Calidris canutus*	1. *canutus* W & Southern Africa (wintering)		✓	
	2. *islandica* NE Canada & Greenland/Iceland/NW Europe		✓	
Dunlin *Calidris alpina*	3. *schinzii* (Baltic breeding)	✓	✓	

The section analysing population trends in different breeding areas provides further information on this issue.

For those populations for which trends are available, a comparison between flyways likewise shows no clear pattern. For the East Atlantic Flyway, 14 populations are in decline, 18 are stable and six are increasing. On the Black Sea/Mediterranean Flyway 11 are decreasing, eight are stable and only one increasing. For populations on the West Asian/East African flyway, nine are decreasing, seven are stable and one is increasing.

On the available evidence it appears however, that the overall pattern is of decline rather than increase, that populations on the West Asian/East African Flyway are most under pressure, and that those on the East Atlantic Flyway are under relatively less pressure (Table 7). Improved statistical trend information is, however, urgently needed to clarify such interpretation, as is more detailed analysis of trends within different regions of widespread populations. For example, for a number of populations breeding in both temperate and boreal regions of western Europe, widespread declines are being reported for West European farmland breeding populations but this is masked by the large and apparently stable parts of those populations breeding in Fennoscandia or in eastern Europe where processes of agricultural intensification have (so far) had less effect.

Table 7. Summary of wader population trends by flyway. Proportions are of the total of populations with known or probable trend in each flyway.

	Unknown trend	**Known or probable decrease**	**Known or probable stability**	**Known or probable increase**
East Atlantic Flyway	1	14 **(37%)**	18 **(47%)**	6 **(16%)**
Black Sea/ Mediterranean Flyway	8	11 **(55%)**	8 **(40%)**	1 **(5%)**
West Asia/African Flyway	32	9 **(53%)**	7 **(41%)**	1 **(6%)**
Sub-Saharan Africa	7	1 **(33%)**	0	2 **(67%)**
Other migration systems	3	2 **(100%)**	0	0
African-Western Eurasian Region	**51**	**37** **(46%)**	**33** **(41%)**	**10** **(13%)**

Population changes in different breeding areas

An analysis of geographical patterns of population trends was undertaken. The African/Western Eurasian region was split into 22 areas based on major habitat and landscape formations, geography and flyway systems (Figure 4) and each population allocated to one or more area (Annex 5). Numbers of wader populations in each area varied between none (the Sahara) and 36 (Eurasian taiga regions) (Table 8).

Patterns of trends were not uniform across the region as a whole. Regions with the greatest proportion of wader populations with unknown trend status are West and Central Africa (all populations), East Africa (five of six populations unknown), the Iranian Plateau (four of five), Central Asia (Caspian and Aral Basins: 10 of 16), Madagascar (one of two) and the Eurasian taigas (16 of 36). These are areas largely within the poorly known Black Sea/Mediterranean and West Asian/East African Flyway systems.

Highest proportions of decreasing (or probably decreasing) populations occur within the Atlantic Islands (75% - three of four), temperate NW and W Europe (55% -

12 of 22), temperate E and C Europe (41% - 7 of 17), Iberia and the northern part of the Mediterranean (40% - four of ten), and the Black Earth steppe region north of the Black Sea (35% - six of 17).

Regions with the most stable (or probably stable) migratory wader populations are Iberia and the northern part of the Mediterranean (60% - six of ten), Iceland and the Faeroes (58% - seven of 12), Arabia (one of two) and high arctic Greenland and Canada (42% - three of seven).

Those areas where most migratory waders are increasing (or probably increasing) are Southern Africa (both of two populations) and high arctic Russia (27% - four of 15 populations).

Table 8. Trends of population by breeding area. Allocation of each population to the various regions are shown in Annex 5.

Breeding area	Population trend				Total populations in region
	Definitely or probably increasing	Definitely or probably stable	Definitely or probably declining	Unknown trend	
High arctic Canada/Greenland	1	3	1	2	**7**
High arctic (polar desert) Russia	4	4	3	4	**15**
Low arctic tundra of Russia & Fennoscandia	2	9	6	9	**26**
Eurasian taiga regions	2	9	9	16	**36**
Sub-arctic Iceland/Faeroes	2	7	0	3	**12**
Upland/montane Britain and Fennoscandia	3	12	8	4	**27**
Temperate (lowland) NW & W Europe	3	6	12	1	**22**
Temperate C & E Europe	3	6	7	1	**17**
Black Earth Region (E European steppes)	0	3	6	8	**17**
Iberia and northern Mediterranean Basin	0	6	4	0	**10**
Central Asia (Caspian and Aral Basins)	0	1	5	10	**16**
Russian Far East	0	0	0	1	**1**
Anatolia and W (Mediterranean) Middle East	1	4	2	5	**12**
Atlantic Islands (Canary/Cape Verde Islands)	0	0	3	1	**4**
Iranian Plateau	0	1	0	4	**5**
Arabia	0	1	0	1	**2**
Coastal North Africa	0	2	2	3	**7**
Sahara	0	0	0	0	**0**
West & Central Africa	0	0	0	5	**5**
East Africa	0	1	0	5	**6**
Southern Africa	2	0	0	0	**2**
Madagascar	0	0	1	1	**2**

Figure 4. Areas selected for analysis of differential population trends on the basis of their broad habitat and landscape formations, geography and flyway systems.

Figure 4a. Africa and southern Europe

Key: WE = W & NW Europe; NM = Iberia & N Mediterranean Basin; AI = Atlantic Islands; AN = Anatolia; AR = Arabia; NA = coastal North Africa; S = Sahara; WCA = W & C Africa; EA = E Africa; SA = Southern Africa; M = Madagascar.

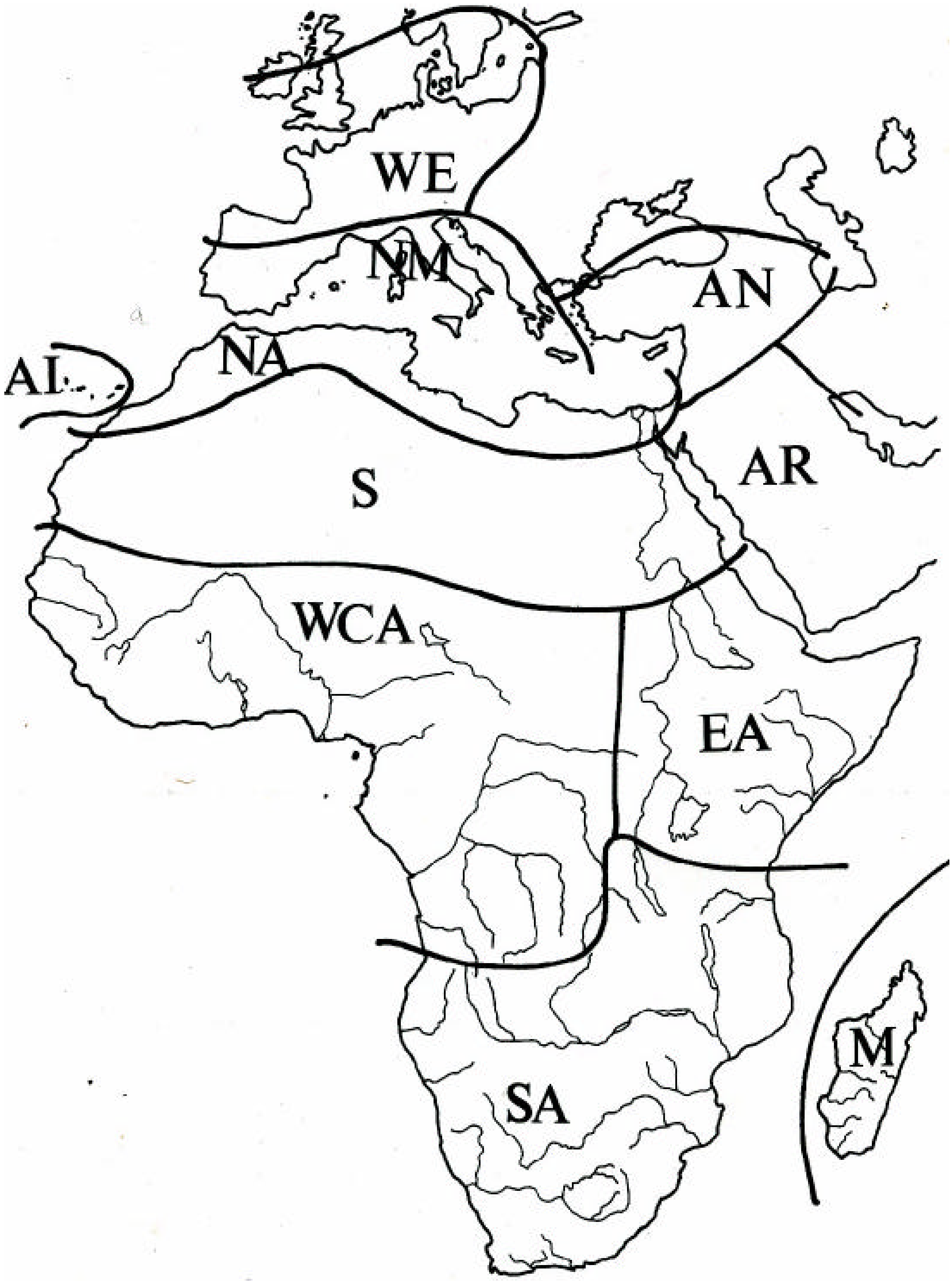
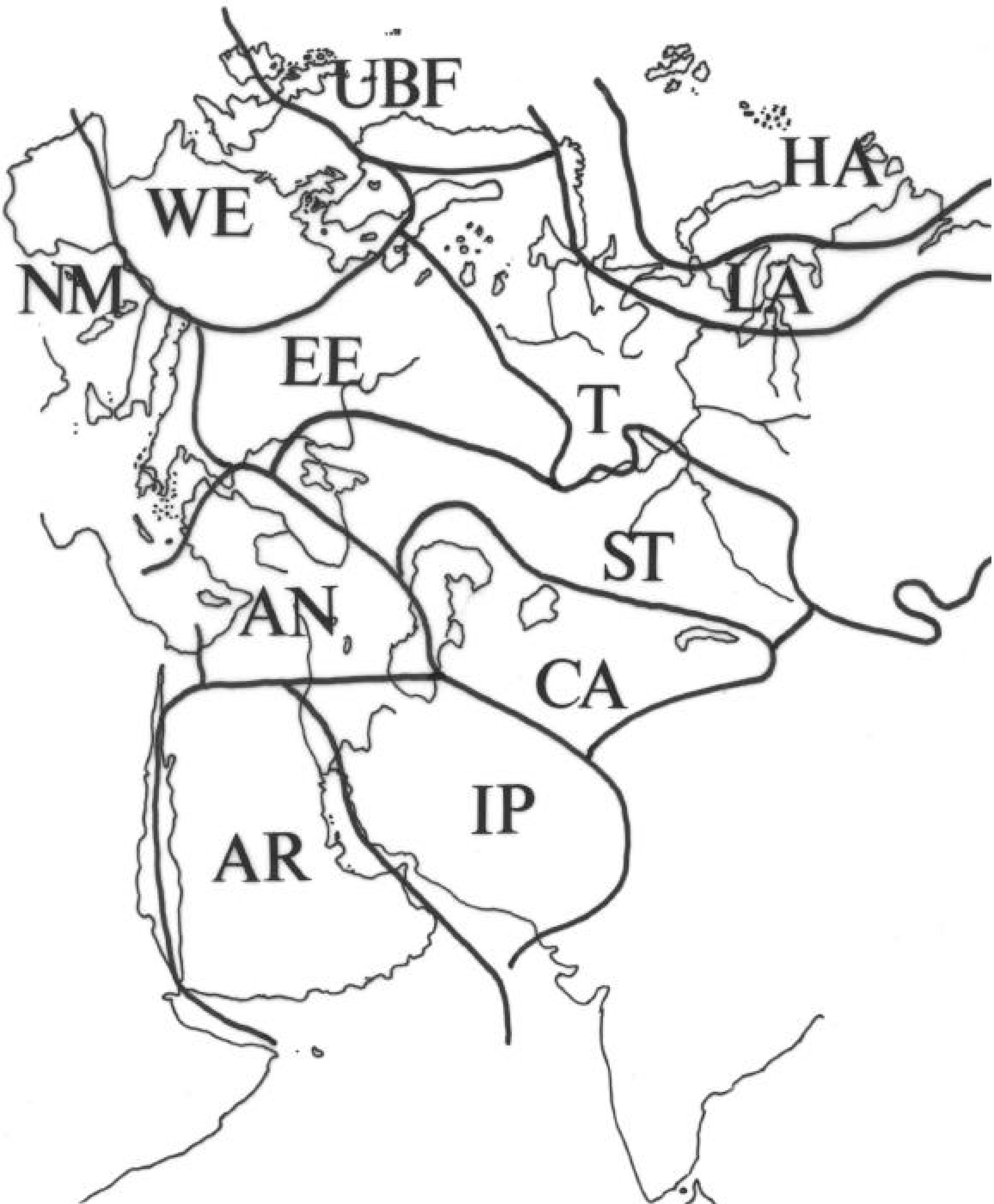


Figure 4b. Western Eurasia

Key: HA = Russian high arctic; LA = Russian/Fennoscandian low arctic; UBF = Upland Britain & Fennoscandia; T = Eurasian taiga; WE = W & NW Europe; EE = E & C Europe; ST = Black Earth region (E European steppes); CA = Central Asia (Caspian & Aral basins); NM = Iberia & N Mediterranean Basin; AN = Anatolia; IR = Iranian Plateau; AR = Arabia.



How have population trends changed since WPE2?

Direct comparison of reported trend information between the different editions of *Waterbird Population Estimates* is problematic since for most populations there is no international monitoring adequate to capture and report trend information. Further, flyway-scale reviews (such as those of Smit & Piersma 1989 and Perennou *et al*. 1994 are infrequent), and additionally, reported trend information on trends contained within the three editions of *Waterbird Population Estimates* all derive from various different reporting periods.

Nonetheless, despite these caveats, a simple comparison of the results of this review against previously reported knowledge (Table 9) is instructive. Broadly, *WPE2* can be considered to report trend status as known in the 1980s, whilst this review (and *WPE3*) reports the situation as known in the mid-1990s.

Of 27 populations previously with unknown trend and now with better knowledge, most (48%) are either definately or probably decreasing, whilst just two populations (7%) are definately or probably increasing. Of 16 populations previously thought to be stable, four are now thought to be decreasing, in contrast to two that are increasing (Table 9).

Table 9. Comparison of changes in reported trends between the second and third editions of *Waterbird Population Estimates*.

Population trend reported by this review (& *WPE3*)	Population trend reported by *WPE2*					
	Unknown trend	Definitely or probably decreasing	Definitely or probably stable	Definitely or probably increasing	Population unrecognised	Total
Unknown trend	42	1	2		7	52
Definitely or probably decreasing	13	13	4		6	36
Definitely or probably stable	12	5	8	2	6	33
Definitely or probably increasing	2	1	2	4	1	10
Total	69	20	16	6	20	131

Population distribution on African-Western Eurasian Flyways

How well do populations fit the defined flyways?

Flyways have been defined as biological systems of migration paths that directly link sites and ecosystems in different countries and continents.

Three wader flyways are generally recognised in Africa-Western Eurasia: the East Atlantic Flyway, the Black Sea/ Mediterranean Flyway and the West Asian/ East African Flyway (see Figure 1). Most populations as defined in this analysis have migration patterns that fall within one or other of these flyways.

A small number (14) of populations do not, however, fit precisely into these pre-determined flyways. These are largely wader populations that breed broadly across north-west and northern Europe, the majority of which migrate on a broad front south through Europe but some of which overwinter on the coastlines of western and eastern Africa. In all, seven Black Sea/Mediterranean flyway populations also occur on parts of the East Atlantic Flyway, and two on the West Asian/ East African Flyway. A smaller number of populations occur chiefly on the two predominantly coastal flyways but parts of which spread inland across Europe and Africa. It should be noted however that for the West Asian/East African Flyway, some populations also occur, sometimes predominantly, on the Central Asian Flyway but this has not been included in the analyses.

We conclude that the broad delimitation of flyways fits well with our more detailed assessment of how each population migrates, but there may be a case for considering the species/populations that breed and migrate over a broad front across temperate and boreal Europe, including north-western Europe as forming a distinct flyway population group. Nevertheless whatever flyway separations are distinguished it is important to keep in mind that each individual of each population migrates according to its own history and survival priorities. Thus, the observed commonality of individuals and populations on similar flyways is largely a human interpretation, chiefly for conservation management purposes, of the general similarity of purpose of each of the millions of individual waders migrating through the region.

How many migratory waders use African-Western Eurasian Flyways and where are they?

From the population size estimates in Annex 2 we have derived a best estimate of population size for each population. For populations for which only a size range was available, a mid-point of the range was used as the estimate unless additional information suggested that a higher or lower numerical estimate was appropriate. A population size estimate could not be made for only five populations, although some, *e.g.* Common Snipe on the West Asian/East African Flyway, may be large. When a population was identified to occur on two flyways, in the absence of more precise information the population size was divided as two-thirds occurring on the primary flyway used, and one-third on the other (secondary) flyway.

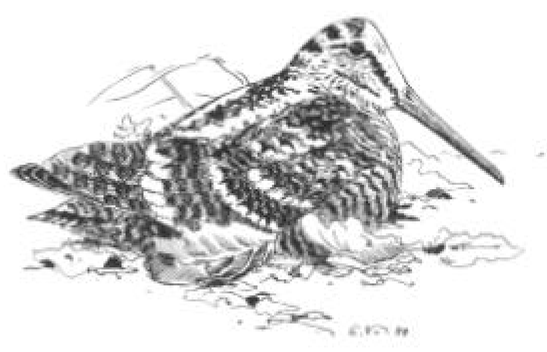
From the best estimates available for each population the total (minimum) estimated population size in Africa – Western Eurasia is 66.7 million migratory waders in this region during the non-breeding season (Table 10). Estimates within WPE3 indicate that a further 8.2 million non-migrant waders also occur in this area, mainly found in Africa. To these totals, should be added six migratory populations of five species, and ten non-migratory populations of two species with completely unknown population sizes. Making allowance for these populations suggests totals of about 67 million migrant and about 9 million non-migrant waders in African and Western Eurasia.

Table 10. Estimated numbers of migratory and non-migratory waders in Africa and Western Eurasia.

Flyway system	Total numbers
Migratory waders	
East Atlantic Flyway	15,464,120
Black Sea / Mediterranean Flyway	25,877,200
West Asia / East Africa Flyway	22,180,615
Sub-Saharan Africa	1,254,300
Other migration systems	1,931,100
+ six populations of five species of completely unknown size	?,???,???
African-West Eurasian migrants	**66,707,335**
Non-migratory waders	
Distributed mainly in Africa	8,228,010
+ ten populations of two species of completely unknown size	???,???
Total of all waders	**>74,935,345**

The most numerically abundant taxonomic group of migrant waders is the Snipes and Woodcock with 28.9 million birds (*i.e.* over 40% of the total number occurring in this region), followed by Tringid sandpipers (10.4 million), Calidridine sandpipers (10.2 million), plovers (9.6 million) and curlews/ godwits (3.0 million). The least abundant are oystercatchers, stilts, avocets, Stone Curlews, coursers, pratincoles and allies (2.7 million).

Although the total number of waders in this region may seem large, they occur in a very large part of the world, and the total is for 55 species. By comparison, this total is broadly similar to the total human population of just one country, Turkey, on these flyways.



Numbers of species, populations and individuals using each flyway

Species diversity is greatest on the West Asian/East African Flyway, with 44 of the 55 species, and similar but lower on Black Sea/ Mediterranean (31 species) and East Atlantic (29 species) Flyways. Similarly, more populations that depend on the West Asian/ East African Flyway (51 populations) compared with the East Atlantic (46 populations) and Black Sea/Mediterranean (33 populations) Flyways.

By total numbers, 14.4 million waders (22%) use the East Atlantic Flyway, 25.9 million (39%) the Black Sea/Mediterranean Flyway and 22.8 million (34%) the West Asian/East African Flyway. The predominance of birds on the Black Sea/Mediterranean Flyway is in large part due to the very large population size estimates for Woodcock and snipes on this flyway, which account for 68% of waders on the flyway. Few birds of these taxa occur on the East Atlantic Flyway, but numbers of these species may be underestimated on the West Asian/East African Flyway.

Differences in the taxonomic composition between the three flyways are summarised in Figure 5. Numerically, most Oystercatchers, Avocet and Black-winged Stilts and other related taxa use the East Atlantic flyway, as do plovers, godwits and curlews, and Calidrine sandpipers. Tringid sandpipers occur on all flyways but most use the West Asian/East African Flyway. Although Calidridine sandpipers use all flyways they are predominantly found on the more coastal East Atlantic and West Asian/East African flyways.

The most abundant taxa on the East Atlantic Flyway are: Plovers and Calidrine sandpipers (31% and 33% of all waders respectively), the former largely owing to the very large Lapwing population (2.3 million birds) estimated as wintering in Western Europe, and Woodcock and snipes (11%). Snipes and Woodcock (69 %) predominate on the Black Sea/Mediterranean flyway followed by Tringid sandpipers (16%). The West Asian/ East African flyway is also dominated by Woodcock and snipes (43%) with Tringid (23%) and Calidridine sandpipers (16%) and plovers (13%) also relatively abundant.

The distribution of each taxonomic group varies between flyways. Oystercatchers and allies, godwits and curlews are numerically the smallest group, but over 49% of Oystercatchers and allies occur on the East Atlantic flyway, with approximately one-quarter each on the other two flyways. Likewise, nearly half (49%) of godwits and curlews use the East Atlantic Flyway with the remainder fairly equally divided between the other two flyways. Calidridine sandpipers mostly use the East Atlantic (50%) and West Asian/East African (35%) flyways, with relatively few (14%) on the Black Sea/Mediterranean Flyway, and plovers have a similar distribution: East Atlantic (49%), West Asian/East African (30%) and the Black Sea/Mediterranean Flyway (15%).

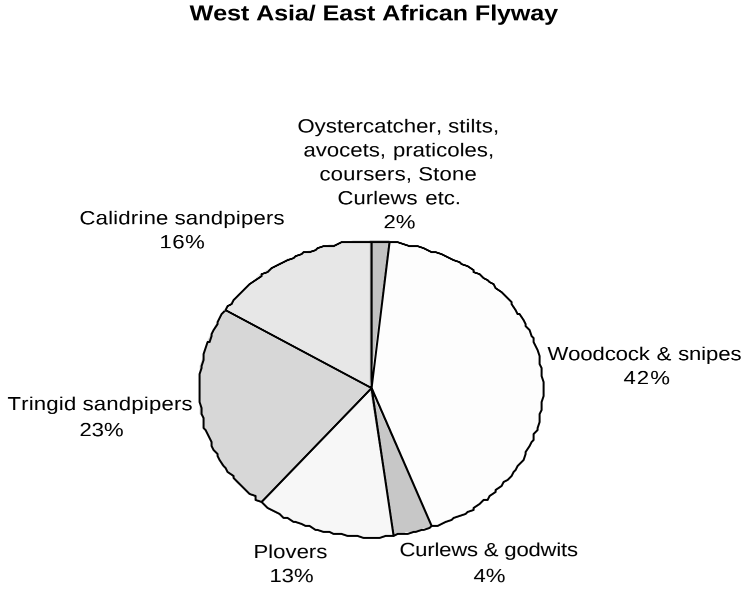
In contrast, more Tringid sandpipers (43%) use the predominantly inland Black Sea/ Mediterranean (41%) and West Asian/East African (49%) Flyways, with a smaller proportion (11%) on the coastal East Atlantic flyway. Likewise, 62% of snipes and Woodcock use the Black Sea/ Mediterranean Flyway with significant numbers on the West Asian/East African Flyway (33%) but far fewer on the East Atlantic Flyway (6%).

Population size distributions

Most (57%) populations for which there are size estimates are size range C or D (25,000-1 million birds) in midwinter (Figure 6). The flyways are dominated by a small number of populations (18%) that each exceed one million birds but there are also 14% of populations that are each small (<25,000).

The pattern of population sizes is broadly similar between flyways. However of the six populations that are very small (<10,000 birds each), five are on the West Asian/East African Flyway, as are two of the three populations of 10,000-25,000 birds. Nearly half of populations on the W Asian/E African Flyway are each <100,000 birds. This implies that, in terms of population sizes, this flyway may have the most vulnerable populations.

Figure 5. Taxonomic composition of each flyway. Total size of pie approximately equal to total number of waders occurring on each flyway (see Table 10).



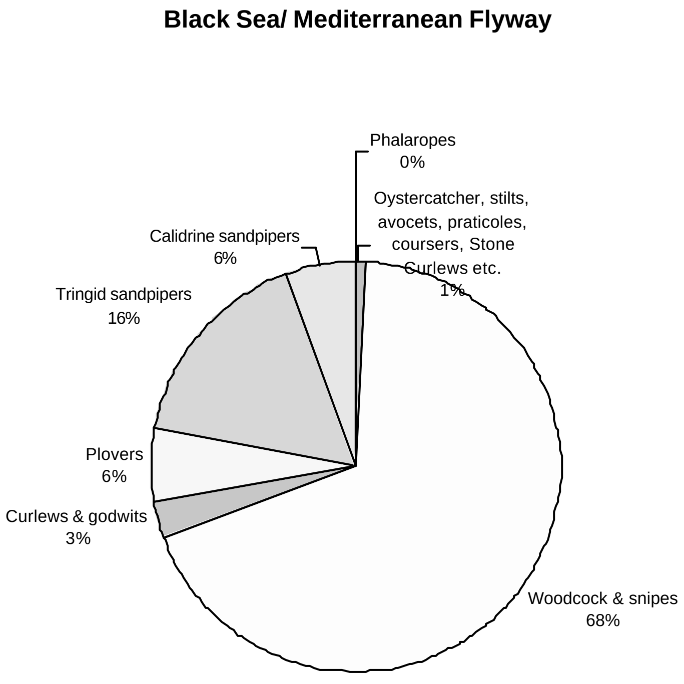


Figure 5 cont. Taxonomic composition of each flyway. Total size of pie approximately equal to total number of waders occurring on each flyway (see Table 10).

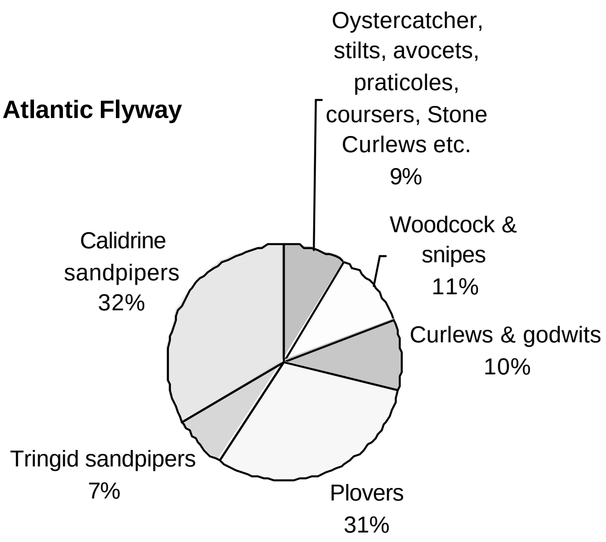
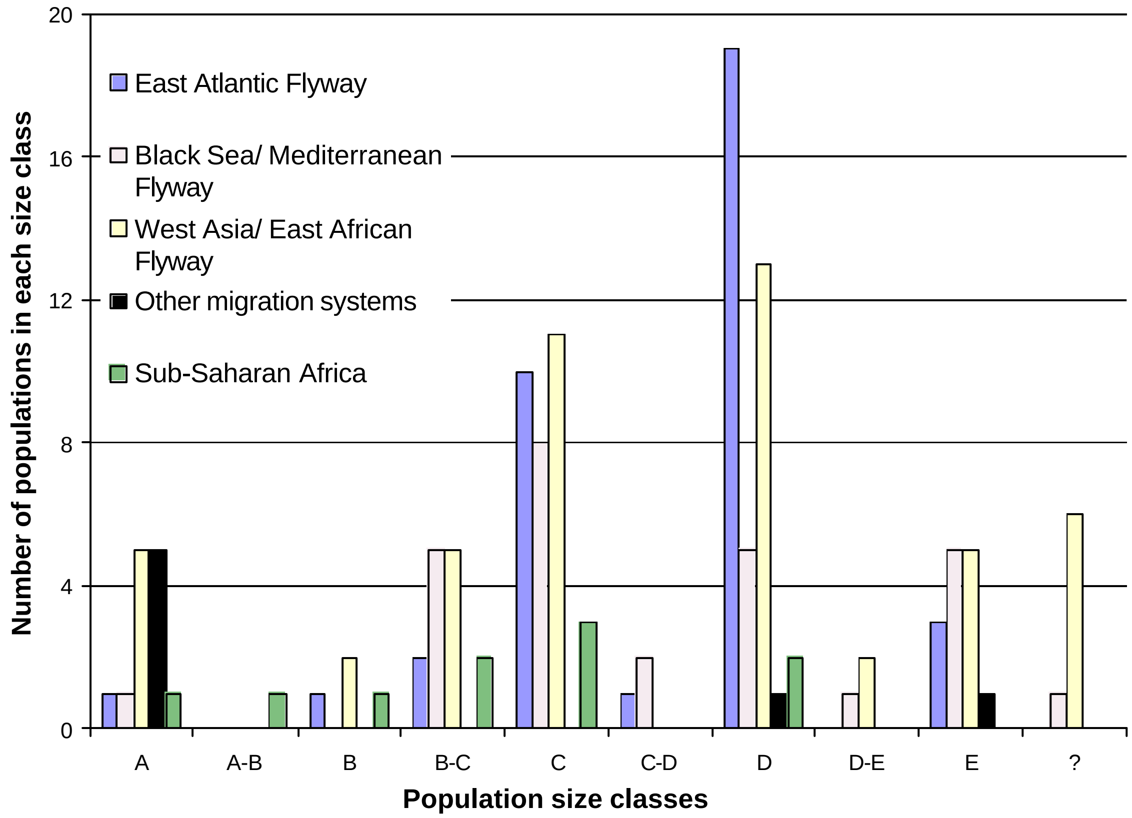


Figure 6. Number of populations in different size classes on each flyway. Size ranges are: A <10,000 birds; B 10,000-25,000 birds; C 25,000-100,000 birds; D 100,000 – 1 million birds; E > 1 million birds; ? = unknown population size.



DISCUSSION

Population changes since the 1980s

Overall numbers of populations for which sizes and trends can be estimated

Over the last decade, there has been a welcome increase in the number of wader populations for which we now have a size estimates and/or an indication of population trend. Our knowledge is best for those populations using the East Atlantic Flyway. This reflects the fact that many of these populations overwinter on the coasts of densely populated NW Europe – where there is much census activity. There has also been much recent census activity in coastal west Africa, both of an expeditionary nature by organisations such as WIWO, as well as the important development of the African Waterbird Census in many countries.

A significant new source of information has been a number of collations of estimates of breeding populations in Europe (*e.g.* Hagemeijer & Blair 1997; Heath *et al.* 2000; Thorup 2002). For those waders such as the Tringid Sandpipers which are dispersed on their non-breeding areas, international compilation of national breeding estimates provides the only realistic means of estimating the size of biogeographic populations (Annex 4).

Knowledge of wader populations is poorest for the Black Sea/Mediterranean Flyway, and especially the West Asian/East African Flyway. Waders using these migration systems typically breed in northern Russia and spend the non-breeding season in poorly developed countries with less regular waterbird census activity than the East Atlantic coasts.

Is the status of African-Western Eurasian migratory waders improving or deteriorating?

To assess whether the overall status of migratory wader populations has changed since the mid-late 1980s, we compare the trends of populations for which there is trend (or provisional trend) available in *WPE2* and from this study (Table 9). It should, however, be noted that for none of these populations are trends statistically confirmed.

For 79 populations recognised by this study, a trend was also listed in *WPE2*. However, differences in the segregation of 13 populations of seven species mean that direct comparison of trends is possible for only 66 populations.

Of these, the status of 25 is unchanged (or probably unchanged). Four – *ostralegus* Eurasian Oystercatcher, East Atlantic/West African Grey Plover, *islandica* Black-tailed Godwits and *hiaticula* Great Ringed Plover – all on the East Atlantic flyway are under-going a long-term increase. Eight populations, six of which are on the East Atlantic flyway, are stable in the long-term. Thirteen populations (six on the Black Sea/Mediterranean; four on the West Asian/ East African and three on the East Atlantic Flyways) are in long-term, and sometimes serious, decline (see Table 9).

Of those 14 populations with a changed status, eight have improved in status: five are now stable after a previous decline, and one is increasing. Two have ceased to increase and are now stable, with a further two populations now increasing after formerly being stable. Conversely, six now have a poorer status: four (both *canutus* and *islandica* Red Knot populations, European breeding Northern Lapwings and European/ West African wintering Little Stint) are now in decline after formerly being stable; whilst two populations are now stable after former increases (West and SW European Black-winged Stilt and *lapponica* Bar-tailed Godwits).

However, overall patterns of change mask substantial changes in status of individual populations. Although for some populations, notably several of those on the East Atlantic Flyway, status is improving, a significant number of other populations, spread across all flyways, are in decline or have a deteriorating status.

Population changes in different breeding areas

The geographical analysis of population trends (Table 8, Annex 5) shows clearly that patterns of trends are not uniform across the region as a whole, and that in some areas migratory waders have much poorer status than others.

It is notable that the region with the greatest number of declining wader populations is NW and W Europe (12 of 22 populations 55%) – effectively the European Union (EU15). Most of these waders are those breeding in wet grasslands or other low-intensity agricultural land. Whilst the poor status of this group of waders has been long known (Hötker 1991; Tucker & Heath 1994; Beintema *et al.* 1997), this is the first analysis to highlight the extent of these declines on such a wide geographical scale.

It is depressing that this region is also that area within Africa and Western Eurasia that has the greatest extent of species-orientated international legislation specifically requiring countries to maintain the favourable conservation status of waders (and other birds). Both the European Union's Directive on the Conservation of wild birds and the Council of Europe's Convention on the Conservation of European Wildlife and Natural Habitats have been in force since 1979. It is clear that neither of these treaties is currently proving effective in addressing the drivers of population change (see below).

The region with the highest proportion (albeit of a small total) of breeding waders in decline is the sub-tropical Atlantic islands of the Canary and Cape Verde groups. Here, three of four wader populations (75%) are declining. Whilst this analysis is restricted to populations of otherwise migratory species of waders, it is notable that the Atlantic islands also hold a number of other non-migratory populations of very high conservation concern (the globally threatened St. Helena Plover *Charadrius sanctaehelenae*, and the now extinct Canarian Black Oystercatcher *Haematopus meadewaldoi*).

Although similarly holding only a small number of waders, the island of Madagascar also has a high proportion in decline. The Madagascar Pratincole is a migratory species, but the island also holds small and/or declining populations of non-migratory Three-banded Plover *Charadrius tricollaris bifrontatus*, White-fronted Plover *Ch. marginatus tenellus*, Kittlitz's Plover *Ch. p. pecuarius*, Madagascar Plover *Ch. thoracicus* and Madagascar Snipe *Gallinago nigripennis*.

There appear to be particular problems in the Central Asia region (the Caspian and Aral Sea basins as far east as Lake Balkhash. Here, not only are most waders of unknown status (10 of 16 - 63%), but of those of known status, nearly all (five of six) are declining. These include a number of particularly threatened species and populations such as the Black-winged Pratincole, two populations of Sociable Lapwing, and the poorly known *suschkini* race of Eurasian Curlew.

There are growing indications that the increasing aridity and frequency of drought in this area – as predicted by models of climate change -– is already driving some of the observed wader declines (Shevchenko 1998). This is a region that is particularly in need of targeted conservation programmes, in particular to ameliorate and mitigate the effects of changing climate on natural habitats.

Conservation issues

Populations of significant conservation concern

Of the 131 populations of migratory wader species in Africa-Western Eurasia, 45 are of significant conservation concern, because their populations are in decline and/or are small (Table 11). A further two populations are also of concern since their population status has deteriorated (from increase to stable) since previous estimates of trends (cited in *WPE2*). Thirteen populations appear to be in long-term decline (*i.e.* they were also cited as in decline in *WPE2*).

Eleven populations can be regarded as of major conservation concern: each has a small population (<25,000 birds) that is in decline.

One, Slender-billed Curlew, is widely recognised as being on the verge of extinction and is listed by IUCN as Critically Threatened.

The status of the other ten populations has been less widely publicised as under serious threat. Recent studies have confirmed that the Sociable Lapwing (listed by IUCN as Vulnerable) is in rapid and serious decline with the total of both populations likely to now be only 600-1,800 birds (probably fewer). The Black Sea /East Mediterranean population (15,000-21,000 birds) of Collared Pratincole is in serious decline over much of its breeding range, as is thought to be the Black Sea/East Mediterranean population (10,000-25,000 birds) of Kentish Plover. The small (6,000 birds) Baltic-breeding population of *schinzii* Dunlin is considered to be at risk of total disappearance in the next 20-30 years if current trends continue (above). The small UK & Ireland population of *schinzii* is also declining. The *alboaxillaris* race of Whimbrel, occurring in the Urals is very poorly known, but this small population is thought to be in decline. The other four populations under serious threat all occur on islands. The small resident populations of Stone Curlew in the Canary Islands, together number only 3,600 birds, and on the same islands the resident population of Cream-coloured Courser. The small population of Madagascar Practincole, which migrates to non-breeding areas in east Africa, appears to be in decline.

Six further populations, on the West Asian/East African flyway or elsewhere in Africa, are of concern as their populations are small (<25,000 birds), but for which there is no information on trends. These are West-central Asian breeding Black-winged Stilts, the Black Sea/East Mediterranean (*columbinus*) breeding population of Greater Sand Plover, the White-tailed Lapwing population of central Asia, the central Africa population of Brown-chested Lapwing, the Cape Verde population of Cream-coloured Courser, and the very small (2,000-5,000 birds) SW Asian wintering population of Great Knot. Establishing the status of these populations is a priority. Should the small numbers (possible 2,000-3,000 birds) of Red Knots wintering in the Mediterranean Basin be confirmed as a distinct population, this population would also be of such concern.

Only three small (<25,000 birds) populations of African-West Eurasian migratory wader species are considered stable or increasing: West Mediterranean Collared Pratincoles (stable), West and South-west Asia/East Africa Avocets (possibly stable) and Southern African breeding Avocets (possibly increasing).

Twenty-five larger populations are declining or possibly declining and so are also of concern (Table 11). Noting that some population occur on more than one flyway, 12 occur on each of the East Atlantic and Black Sea/Mediterranean flyways, with seven on the West Asian/East African flyway (although since trends for many populations on this flyway are unknown there may be more populations in decline on this flyway).

Of these, four East Atlantic flyway populations are of particular concern as they have undergone strong declines: western European breeding Black-tailed Godwits, *taymyrensis* Bar-tailed Godwits wintering in west Africa and *canutus* and *islandica* Red Knots. Likewise the Black-winged Pratincole, breeding in the steppes of West and Central Asia, has also undergone a dramatic and rapid decline in the last decade, with global numbers perhaps as low as 29,000. It is listed by IUCN as a Data Deficient Globally Threatened Species.

Drivers of population declines

The reasons why some populations are declining whilst others using the same flyways are stable or increasing is not fully clear. However, certain common patterns do emerge (see also the analysis of trends of populations in different breeding areas).

Many of the most severely declining populations breed in the arid and semi-arid areas of the Middle East and West and central Asia, and the Mediterranean Basin. Continuing loss of steppe breeding habitat through intensification of agriculture and irrigation schemes, coupled with increasing frequency and severity of drought and desertification, has been recognised as the most likely driver of the several declining breeding populations, such as Sociable Lapwing and Black-winged Pratincole (*e.g.* Shevchenko 1998).

A second group of declining populations, notably the British/Irish and Baltic-breeding populations of Dunlin, and populations of Northern Lapwing, Common Snipe, are those breeding chiefly in wet grassland habitats, particularly those maintained through low-intensity agricultural practices. Widespread and continuing losses of such habitats in both eastern and especially western Europe are recognised as the driver of change in these populations, and this may also be affecting others such as Jack Snipe. Furthermore, recent assessments of populations breeding on wet grasslands in western Europe (International Wader Study Group 2001) have revealed serious declines in these parts of populations whose population trends overall appear stable. Thus for some waders, breeding trends in large parts of the European Union are negative although at the scale of the whole biogeographic population this is masked by favourable status in other countries.

The third group of populations in decline are certain coastal wintering populations on the East Atlantic Flyway. Of most concern are the West African wintering *islandica* and *canutus* Red Knot and *taymyrensis* Bar-tailed Godwit populations. The status of the West European wintering *lapponica* Bar-tailed Godwit population has also changed from increasing to stable. These populations breed in different arctic & subarctic regions (Nearctic, Fennoscandia, Siberia) and overwinter on different parts of Atlantic coast from western Europe to West Africa. However, other East Atlantic flyway coastal migrant populations are increasing: Grey Plover, Ruddy Turnstone, Curlew Sandpiper, Oystercatcher, Great Ringed Plover. Similarly, these increasing populations breed in different arctic and subarctic regions (Iceland, northern Europe and Siberia), and also ‘overwinter’ on different parts of Atlantic coast from western Europe to West Africa – in the same wintering areas as the populations in decline. Therefore it seems unlikely that the drivers of population change are occurring on either the breeding or overwintering areas, and it is also unlikely that climate change is a currently a major driver of change in these populations.

Common characteristics of *islandica* and *canutus* Red Knot, and *taymyrensis* Bar-tailed Godwit populations are that they are both long distance non-stop migrants known to make direct flights between their West African wintering grounds and their major staging area of the Wadden Sea, and that both the latter two populations are almost wholly dependent on the Wadden Sea for staging in spring and autumn. Davidson (2004) has demonstrated the strong linkage between spring/autumn dependency on the Wadden Sea and patterns of current decline of long-distant migrant populations.

These populations make long distance non-stop flights and need an abundant food source for rapid major refuelling, especially in spring. They are also known to face migratory bottlenecks and to have low disease resistance (Piersma 1997, 2003). Therefore they are likely to be most vulnerable to any change in their key staging area which affects their ability to feed and refuel at the necessary rate, and to depart with the necessary amount of body reserve to both migrate and survive severe weather in the arctic (Wilson *et al.* in prep.).

The Wadden Sea has had little recent intertidal habitat loss (‘land-claim’), so has its ecological character deteriorated such that although the tidal flats are still available their quality has deteriorated? A major recent well-documented change to the Wadden Sea ecological character has occurred in the Dutch part of the area from intensification of shellfisheries, and this is known to have decreased the feeding opportunities for Red Knots (*e.g.* Piersma & Koolhaas 1997). It is not clear if there are other contributing factors in other parts of the Wadden Sea, but it may be that the recorded declines in populations are a reflection of a reduced overall capacity of the Wadden Sea to support wader populations at the critical times in spring and autumn.

However, since it is known that these two populations need favourable winds to undertake their non-stop flight from West Africa to the Wadden Sea, another possibility worthy of investigation is whether the occurrence of favourable and unfavourable winds, particularly in spring when the timing of migration is critical if birds are to reach their breeding grounds on schedule, has changed – noting that changes in oceanic wind patterns are also predicted from climate change modelling. Further assessment of these, and other possible causes of decline, should be a priority.

Table 11. Populations of African-West Eurasian migratory wader species that are of particular conservation concern. Such populations are either small and/or declining, or whose status has become worse since earlier evaluations (as cited in *WPE2*). Numbers in parentheses after the species name is the population number as listed in Annex 2. Species in square brackets […] are those for which the population trend is possible but uncertain. Species in bold text are those that are in strong or very strong decline. Populations in long-term decline (*i.e.* also cited as declining in *WPE2*) are indicated with an asterisk (*). Small populations are those defined as having fewer than 25,000 individuals.

East Atlantic flyway	Black Sea/ Mediterranean flyway	West Asian/East African flyway	African migrants and residents
1. Small declining populations			
Dunlin (3)	Collared Pratincole (2)	***Sociable Lapwing (1)**	**Stone Curlew (3)**
Dunlin (4)	***Slender-billed Curlew**	***Sociable Lapwing (2)**	**Stone Curlew (4)**
		[Whimbrel (4)]	Cream-coloured Courser (4)
			Madagascar Pratincole
2. Small populations, trend unknown			
		Greater Sand Plover (1)	Cream-coloured Courser (3)
		White-tailed Lapwing	Black-winged Stilt (5)
		Great Knot	Brown-chested Lapwing
3. Small populations, not in decline			
	Collared Pratincole (1)	[Avocet (3)]	[Avocet (5)]
3. Large declining populations			
Stone Curlew (1)	Stone Curlew (2)	***Black-winged Pratincole**	
Eurasian Golden Plover (4)	***Black-winged Pratincole**	[Caspian Plover]	
*Kentish Plover (1)	Northern Lapwing (1)	[*Great Snipe (2)]	
Northern Lapwing (1)	[Kentish Plover (2)]	[Eurasian Curlew (2)]	
*Common Snipe (1)	*Common Snipe (1)	[Eurasian Curlew (3)]	
[*Jack Snipe (1)]	[*Great Snipe (2)]	[Ruff (2)]	
***Black-tailed Godwit (1)**	[*Jack Snipe (1)]		
Bar-tailed Godwit (2)	*Black-tailed Godwit (2)		
Common Redshank (2)	Common Redshank (4)		
*Common Redshank (3)	[*Wood Sandpiper (1)]		
Red Knot (1)	[Little Stint (1)]		
Red Knot (2)	*Ruff (1)		
[Little Stint (1)]			
Deteriorating status: now declining, formerly stable			
Northern Lapwing (1)	Northern Lapwing (1)		
Red Knot (1)	[Little Stint (1)]		
Red Knot (2)			
[Little Stint (1)]			
Deteriorating status: now stable, formerly increasing			
Black-winged Stilt (1)			
Bar-tailed Godwit (1)			

Increasing populations

There are rather fewer populations that are increasing in number (Table 12). Most of these ten species occur on the East Atlantic Flyway, other than two African populations and the SE Europe/ Asia Minor population of Spur-winged Plover occurring on the Black Sea/Mediterranean Flyway.

Over half of the increasing East Atlantic Flyway populations appear to be in a long-term state of increase, having also been recorded as increasing by *WPE2*.

Amongst increasing East Atlantic Flyway populations, there appears to be no particular commonality of breeding areas: Oystercatcher, Eurasian Curlew and Great Ringed Plover breed in (different) temperate European habitats, whilst Grey Plover and Curlew Sandpiper breed on high arctic Russian tundra. Breeding of the *islandica* Black-tailed Godwit race is restricted to Iceland, whilst Ruddy Turnstones derive from high arctic Canada and Greenland.

Table 12. Populations of African-West Eurasian migratory wader species that are increasing in size. Numbers in parentheses after the species name is the population number as listed in Annex 2. Species in square brackets […] are those for which the population trend is possible but uncertain. Species in bold text are those that are showing a strong or very strong increase in numbers. Populations increasing in the long-term (*i.e.* also cited as increasing in *WPE2*) are indicated with an asterisk (*).

East Atlantic flyway	Black Sea/ Mediterranean flyway	West Asian/East African flyway	African migrants and residents
*Oystercatcher (1)	Spur-winged Plover (2)		Black-winged Stilt (6)
***Grey Plover (1)**			[Avocet (5)]
***Great Ringed Plover (1)**			
*Black-tailed Godwit (4)			
[Eurasian Curlew (1)]			
Ruddy Turnstone (1)			
Curlew Sandpiper (1)			

Table 13. Populations of African-West Eurasian migratory wader species that are stable in size. Numbers in parentheses after the species name is the population numb er as listed in Annex 2. Species in square brackets […] are those for which the population trend is possible but uncertain. Populations stable in the long-term (*i.e.* also cited as stable in *WPE2*) are indicated with an asterisk (*).

East Atlantic flyway	Black Sea/ Mediterranean flyway	West Asian/East African flyway	African migrants and residents
Black-winged Stilt (1)	[Avocet (2)]	[Oystercatcher (2)]	
*Avocet (1)	[Little Ringed Plover (1)]	[Avocet (3)]	
Collared Pratincole (1)	*Eurasian Woodcock (1)	*Eurasian Woodcock (1)	
[Eurasian Golden Plover (1)]	[Whimbrel (2)]	[Wood Sandpiper (2)]	
Eurasian Golden Plover (2)	[Spotted Redshank (1)]	[Terek Sandpiper (2)]	
[Little Ringed Plover (1)]	[Green Sandpiper (1)]	[Common Sandpiper (2)]	
[Common Snipe (3)]		[Sanderling (2)]	
Bar-tailed Godwit (3)		Curlew Sandpiper (2)	
Whimbrel (1)			
[Whimbrel (2)]			
[Spotted Redshank (1)]			
[Common Redshank (1)]			
Ruddy Turnstone (2)			
[Sanderling (1)]			
Purple Sandpiper (1)			
Purple Sandpiper (2)			
*Dunlin (5)			
*Dunlin (6)			
Improving status: now stable, formerly decreasing			
Common Sandpiper (1)	Eurasian Dotterel (1)	[Crab Plover (1)]	
Dunlin (1)	Great Snipe (1)		
	Common Sandpiper (1)		
Deteriorating status: now stable, formerly increasing			
Black-winged Stilt (1)			
Bar-tailed Godwit (1)			

Stable populations

Table 13 lists those populations that are stable or apparently so. Notable is the degree of uncertainty as to the status of populations on the West Asian/East African Flyway where there is a poor quantitative basis for these assessments.

As with increasing populations (above), there is little apparent commonality in the breeding and wintering areas used by these populations.

Conservation responses

Action Plans

The action planning process has been recognised as an effective means of focussing conservation actions to address the causes of poor conservation status. The Conservation Guidelines developed by AEWA give guidance on preparation and implementation of action plans.

For waders in Africa and Western Eurasia however, there are few good examples of effective action plans. For Slender-billed Curlew, there has been an international action plan since the mid-1990s (Gretton in Heredia *et al.* 1996).

In 1998, the European Commission consulted on a series of species action plans that included several waders (Table 14). The objective of these plans was to reverse the declines of these European quarry species (all of which had been categorised as having unfavourable conservation status by BirdLife International – Tucker & Heath 1994). However, although the draft plans have significant potential to drive forward positive conservation actions for these species at an international scale, they have not been concluded, and indeed no mechanisms appear to have been put in place to guide their implementation. This is greatly disappointing and it is to be hoped that the plans can rapidly be finalised and implemented by the European Union.

In 2002, the second Meeting of the Parties to AEWA agreed international actions for Black-winged Practincole, Sociable Plover and Great Snipe. However, it is not clear whether there are any implementation arrangements for these plans, and there seem to be no co-ordination arrangements proposed to take these plans forward. Their effectiveness in delivering favourable conservation status for these species is thus doubtful.

Action Plans are only valuable if they are implemented. The overall lack of good examples of effectively implemented international plans to date is disappointing. It is further notable that all the existing draft or agreed plans relate to European and/or Western Eurasian species. The lack of internationally action plans for African species is significant omission.

Table 14. Wader species for which international action plans are finalised or are in preparation within Africa and Western Eurasia in 2002.

Species	***Geographical scale of Action Plan***	***Wader populations included (in whole or part)***	***Source***
Black-winged Practincole	AEWA Range States	Whole global population	AEWA 2002[2]
Northern Lapwing	European Union	Europe (breeding)	European Commission unpublished
Sociable Lapwing	European Union	Whole global population	European Commission unpublished
	AEWA Range States	Whole global population	AEWA 2002[3]
Woodcock	European Union	Europe/Africa	European Commission unpublished (see also Ferrand & Gossmann 2001)
Great Snipe	AEWA Range States	The two biogeographical populations (both of which occur wholly within the AEA region)	AEWA 2002[4]
Jack Snipe	European Union	Europe (breeding)	European Commission unpublished
Black-tailed Godwit	European Union	*L. l. islandica* *L. l. limosa* (W Europe/W Africa) *L. l. limosa* (E Europe/C & E Africa)	European Commission unpublished
Slender-billed Curlew	Global	Global	European Union/ Council of Europe (Gretton in Heredia *et al*. 1996)
Eurasian Curlew	European Union	*N. a. arquata* Europe (breeding) *N. a. orientalis* (SW Asia and E Africa (wintering)	European Commission unpublished
Common Redshank	European Union	*T. t. robusta* Iceland & Faeroes *T. t. britannica* Britain and Ireland *T. t. totanus* East Atlantic wintering *T. t. totanus* E Europe/East Med. & Africa (wintering)	European Commission unpublished

Priority data and information needs: progress over the last 13 years

Smit & Piersma (1989) concluded their review of population sizes of East Atlantic Flyway wintering waders by highlighting the 14 topics identified as priority information needs by Piersma *et al*. (1987). It is pertinent to revisit these topics again to review progress in the last decade given the variation in progress in the different areas identified.

[2] http://www.unep-wcmc.org/AEWA/eng/Meeting%20of%20Parties/MOP2docs/pdf/MOP_docs/BW_Pratincole.Doc
[3] http://www.unep-wcmc.org/AEWA/eng/Meeting%20of%20Parties/MOP2docs/pdf/MOP_docs/Plover.PDF
[4] http://www.unep-wcmc.org/AEWA/eng/Meeting%20of%20Parties/MOP2docs/pdf/MOP_docs/Snipe.PDF

1. Population sizes of waders breeding in the former Soviet Union and in Mediterranean countries

There have been significant improvements of knowledge in both the countries of the former Soviet Union and around the Mediterranean. The Russian Working Group on Waders has been active in encouraging data compilations and other relevant publications (*e.g.* Shubin & Tomkovich 2002). In particular, the major publication *Migration and international conservation of waders. Research and conservation on North Asian, African and European flyways* by the International Wader Study Group (Hötker *et al.* 1998) brings together much data and information on waders from Russia and other eastern European and central Asian countries.

In the late 1990s, the Russian Bird Conservation Union and the Working Group on Waders (Tomkovich & Lebedeva 1998, 1999) published new estimates of the population sizes of breeding waders in European Russia, very significantly improving knowledge of breeding waders in this region. These publications are a major achievement.

With respect to the Mediterranean area, the *EBBC Breeding Bird Atlas* (Hagemeijer & Blair 1997) has provided the first ever overview of the breeding distribution and population sizes of waders (as for other European birds, and indeed for the countries of the former Soviet Union west of the Urals and the Caspian). However, the atlas only includes European countries and information needs regarding the waders of the North African part of the Mediterranean are as pressing as in the 1980s. More detailed country summaries of population data have been published by Tucker & Heath (1994) and Heath *et al.* (2000). Valle & Scarton (1996, 1998) published specific reviews on the status and distribution of breeding Redshank and Oystercatcher around Mediterranean coasts, whilst Valle *et al.* (1996) surveyed the breeding wader populations of the north-eastern Italian coastline.

2. Changes in the population sizes of waders breeding in Europe

The 1990s have seen a number of milestone publications. The *EBBC Breeding Bird Atlas* (Hagemeijer & Blair 1997) presented the first ever atlas of breeding distribution of European birds. The data from this compilation, with additional sources have been used to develop the European Bird Database of BirdLife International with national summaries published by Tucker & Heath (1994) and Heath *et al.* (2000) – the latter used extensively as a source by this review. Additionally, many other breeding atlases at national or sub-national scales have given improved information on status and distribution of breeding waders.

A range of national or other major reviews have been undertaken, such as those in France (Deceuninck & Mahéo 1998; Deceuninck 2001); Russia (Tomkovich & Lebedova 1998, 1999) and the international Wadden Sea (Rasmussen *et al.* 2000).

During the late 1990s the International Wader Study Group's project *Breeding waders in Europe 2000* has sought to reassess population sizes of waders breeding on agricultural land in Europe, especially wet grasslands (Thorup 2002). This allows reassessment with earlier estimates and trends (*e.g.* Hötker 1991).

Significant improvement in knowledge of population trends will come from the commencement of new national breeding bird monitoring schemes in Poland, Italy, Spain, Hungary, and the UK in the 1990s (*e.g.* Noble *et al.* 2001). The robust sampling design of these schemes will allow monitoring of trends in the commoner breeding waders in these countries with greater statistical confidence.

At international scales, BirdLife International and others have demonstrated the possibility of developing pan-European indices of population change through the statistical joining of the outputs of the various national monitoring schemes (van Strien *et al.* 2001).

3. *Geographical variations in productivity per pair, and per unit area, over breeding ranges in Europe*

There has been little progress in this field, and we are aware of no publications in the last decade reviewing wide-scale (international) differences in productivity of breeding waders. The topic remains a priority, not just between geographical areas, but between habitats subject to different management regimes – especially as the negative effects of agricultural intensification on waders become ever more apparent (Beintema *et al.* 1997).

4. *Autumn migration patterns of inland waders*

There has been little internationally co-ordinated activity in the last decade. The notable exception has been the WSG project *Tringa glareola 2000*, led by the Polish Waterbird Research Group Kuling (Remisiewicz 1997, 1998). This internationally project has included the study of autumn Wood Sandpiper migration amongst its objectives (*e.g.* Mitrus *et al.* 1998; Szdlowski & Lysaczuk 1998; Elts 1998).

There have been studies of autumn wader migration at inland sites in Bulgaria (Nankinov 1998), Poland (Indykiewicz 1998; Polakowski & Juniewicz 1998), Slovenia (Vogrin 1998, 2001), Croatia (Radovic *et al.* 1999); Kazakhstan (Gavrilov *et al.* 1998), as well as elsewhere.

There is an urgent need to internationally synthesise the results from the various existing studies (often published locally), so as to provide better direction for future studies. The *Tringa glareola 2000* project is a model in this respect, and this approach could usefully be emulated for other species also.

5. *The relative importance of different coastal moulting sites along the East Atlantic flyway*

There appears to have been virtually no progress in the last decade. Major survey activities have tended to focus on the middle of the non-breeding period (December/ January) period.

6. *The winter distribution over Europe of open-habitat inland waders*

Generally, there has been little progress at international scales in the monitoring of species such as Golden Plover, Northern Lapwings and Eurasian Curlews. In northern Europe, a series of large-scale but uncoordinated counts of Golden Plovers were conducted in the Netherlands, Britain (Fuller & Lloyd 1981), Denmark and Lower Saxony during the period 1976-79. Winter atlas projects in Britain and Ireland (1981/2-1983/4; Lack 1986), France (1977-81; Yeatman-Berthelot & Jarry 1991) and the Netherlands (1978-1983; SOVON 1987) provided information on wide-scale national distributions in the 1980s.

More recently, surveys have been undertaken in Denmark, Schleswig-Holstein and Lower Saxony in October 1993 and in the Netherlands in October and November 1996 (reviewed in Hulscher 2001). Waders including Golden Plovers were surveyed throughout Spain and information summarised up to 1991 by Velasco & Alberto (1993) but totals may be underestimates for inland areas. In the UK, the BTO Winter Farmland Bird Survey, a randomised survey of 1-km squares in 1999/2000 to 2002/2003, is providing information on range and abundance, though intensive studies and supplementary records indicate that Golden Plover population estimates from this survey may be inaccurate (Gillings 2001).

Although there have been a number of national initiatives (summarised above) there has been poor international co-ordination, reducing the potential value of the separate surveys. Accordingly, there is a clear need for an international co-ordinated survey of staging/wintering Golden Plovers, especially in the light of suggested shifts in range apparent in Britain (Gillings 2001) and the Low Countries (Hulscher 2001).

Colour-marking studies to understand more clearly the extent of movement between the major wintering areas in The Netherlands and eastern Britain would be particularly valuable. Further internationally co-ordinated surveys on Golden Plovers should also include wintering Curlews and Lapwings (occurring generally in similar areas) for the greatest cost-effectiveness.

7. Numbers of waders wintering inland in Africa

There have been major steps to develop and revitalise the African Waterbird Census (AfWC) in the mid 1990s, with the development of a strategic plan to focus AfWC activities (Dodman 1997) and enhance reporting (Dodman *et al.* 1999; Dodman & Diagana 2003). This has encouraged the establishment of new national surveys in a number of countries, although, as always, resourcing for these generally constrains what is possible.

With Dutch government funding, Wetlands International has undertaken major surveys in the Inner Niger Delta of Mali activities (Kamp & Diallo 1999). This has markedly improved knowledge of waterbird numbers in this area. Other studies of these important wetlands have also been undertaken (*e.g.* Tinarelli 1998).

The South African Coordinated Waterbird Count scheme (Taylor *et al.* 1999) is now 10 years old, and has already amassed valuable data for inland waders through its regular coverage of many inland wetland sites. These data, although preliminary, could provide first estimates of total inland migratory wader populations for South Africa. Combined with data from inland sites from Namibia, Botswana, and Zimbabwe a regional estimate could be attainable, especially since most countries have been participating in AfWC for the past 8-10 years (Harebottle in litt.). There is, however, a need to identify additional key inland sites to obtain better population estimates and this should be addressed by all national AfWC co-ordinators in the future (Harebottle in litt.).

Overall, however, the assessment of total numbers of waders wintering inland in most of Africa remains hugely problematic. Whilst a greater number of 'key wetlands' are now routinely counted compared to the 1980s, for dispersed species, the assessment of numbers away from these areas will require some form of sample-based methodology. Such surveys are complex to undertake in regions even with many volunteers: in much of Africa, they may be largely unrealistic to any formal design. However, Harrison *et al.* (1997) developed innovative statistical techniques to obtain more information from atlas mapping techniques. Such innovation may lead to other approaches to population estimation, although none will do away with the fundamental need for observers!

8. Numbers of wintering waders along the Gulf of Guinea (from Guinea to Angola)

There has been a range of activity, generally reflecting expeditionary surveys to a number of countries in the region. Altenburg & van der Kamp (1991) reviewed the knowledge of waterbirds in coastal wetlands in Guinea, whilst Schepers & Marteijn (1993) similarly reviewed information for Gabon. Salvig *et al.* (1997) undertook extensive aerial surveys of wetlands in Guinea-Bissau in 1994.

Information on numbers and key sites for this region remains of high importance, yet for several countries situated along the coast of the Gulf of Guinea, political instability and insurrection has greatly constrained the ability or organise surveys for much of the past decade. We recall the complete aerial survey of waders along 28,000 km of South American coasts organised by the Canadian Wildlife Survey between 1982-1986 (Morrison & Ross 1989). There would be merit in exploring the practicalities of a similar Pan-African coastal wader (waterbird?) survey, perhaps organised and funded under the aegis of AEWA. This would give a hugely valuable synoptic view of key areas, especially for those countries where organisation of on-the-ground counts pose great logistic problems.

9. Numbers of waders wintering along the non-estuarine coasts of Europe (and Africa)

The Europe-wide Non-Estuarine Coastal Waterfowl Survey (NEWS), co-ordinated by the British Trust for Ornithology for the WSG was undertaken in midwinter 1997/98. Unfortunately, it has not been possible to use these data for this review and thus we have thus not been able to consider any findings in this review.

Upon their eventual publication, however, the data will add significantly to our knowledge of the winter distribution and population sizes of a number of non-estuarine waders, especially Purple Sandpiper, Sanderling and Ringed Plover. The survey, when published, will also be an important baseline for the monitoring of future trends in these species.

NEWS results have the potential to add significantly to our knowledge of the numbers and distribution of waders occurring predominately on European non-estuarine coasts. We recommend that when the data become available, a further review of international population sizes and 1% thresholds be undertaken for relevant species. The conclusions of this review should be published and the results incorporated in *WPE4* in 2005. This review will especially affect the populations listed in Table 15.

Table 15. Biogeographic populations that will require review when NEWS data become available.

Species	Current population
Purple Sandpiper	1. *maritima* E Atlantic (wintering)
Sanderling	1. *alba* E Atlantic, W & S Africa (wintering)
Ringed Plover	1. *hiaticula* Europe/N Africa (wintering)
Turnstone	1. NE Canada, Greenland/W Europe & NW Africa

10. Population fluctuations of waders wintering in coastal west Africa

There has been little substantive work, with Ntiamoa-Baidu's (1991) study of seasonal changes in numbers of waders on the coast of Ghana being the only significant study.

The establishment of unambiguous count-units is a fundamental prerequisite for meaningful monitoring. Accordingly, a number of studies have focussed on defining survey methodologies. In particular, Zwarts *et al.* (1998a,b) have established survey methodologies for the Banc/Baie d'Arguin in Mauritania, whilst Salvig *et al.* (1997) have similarly focussed on aerial survey methodologies in Guinea-Bissau.

11. Size and composition of the over-summering wader populations along the East Atlantic flyway

There appear to have been very little progress and no significant new surveys in the last decade of which we are aware.

12. Spring migration patterns of inland waders

For many years the study group OAG Münster co-ordinated the WSG inland wader count project. Interim results were published in 1994 (OAG Münster 1994), although final results remain to be produced.

There have been a number of other projects, including the successful *Tringa glareola 2000* project noted above (Remisiewicz 1997, 1998; Elts 1998; Persson 1998), together with other studies in eastern Europe (Indykiewicz 1998; Gavrilov *et al.* 1998; Vogrin 1998, 2001; Radovic *et al.* 1999).

A WSG project running from 1998 has undertaken a simultaneous spring census of migrating Ruff survey yielding valuable insights (Wymenga 1999) and demonstrating again the value of such international collaborations at a flyway scale.
Vogrin 1998 – Wood & Green Sand in Slovenia

13. Migratory pathways of the waders wintering in coastal West Africa

There has been very little progress to report.

14. Connections involving migrating waders between East Atlantic and Mediterranean flyways

Very little progress has generally been made in determining whether biogeographical populations are 'closed' – that is how much mixing there is between flyways? Although there has been continued ringing and survey in Italy – a country on the boundaries of both East Atlantic and Black Sea Mediterranean flyways. This work has the scope of providing information from marked birds. However, at flyway scale has hardly advanced at all in the last decade.

Underhill (1995) reviewed migration strategies of waders and showed that for Curlew Sandpiper, the conceptual model of linkage between a specific breeding area and a specific non-breeding area did not well explain known migration patterns. He considered the species to be close to having an "all breeding areas to all non-breeding areas" strategy, such that the flyway concept was not helpful to understand migration systems. Other species known to have similarly dispersive migration systems are Little Stint and, to a lesser extent, Ruff. Like Curlew Sandpiper these species have no sub-species, negligible breeding site fidelity and exceptional breeding records beyond their normal breeding range (Underhill 1995).

The degree of 'closure' of flyways remains an important research challenge.

Priorities for the next nine years

Top priority must be to ensure there is adequate monitoring provision for all wader populations.

Lack of monitoring provision is a serious conservation deficiency given not just needs to assess populations at local and country scales, but also in the face of potential major impacts consequent upon climate changes (Zöckler & Lysenko 2000). Monitoring is a fundamental conservation necessity, both for species and the sites on which they depend.

The International Waterbird Census has made great steps forward, especially in Africa, but remains highly constrained by resources and capacity both at national and international scales.

Dodman (1997) reported a strategy for the development of the African Waterbird Census, and since then a Committee comprising African national co-ordinators has met on several occasions.

As well as making progress on those areas outlined above where there has been limited activity in the last decade, there are a number of other areas that have developed as priorities more recently. Overall, in the implementation of these future needs and priorities it is vital to first review the state of existing knowledge, and then review the data and information currently or potentially available to provide the required knowledge. It is necessary to assess what information is needed to define population units, the site networks used by these populations, and the functional uses of the networks (including normal inter-relationships and exceptional circumstances such as severe weather refugia).

This is essential for establishing a soundly-based forward strategy for both data collection and data analysis to address the key questions that need answering for the implementation of wader flyway conservation. Implicit in the above approach is the importance of maximising analysis of existing data and information before embarking on further indiscriminate data collection, including catching and ringing.

Specific current needs include:

i. *Better population sizes and trends for Black Sea/Mediterranean & West Asian/East African Flyways*

Table 7 and Figure 4 show the poor knowledge base for these two flyway systems compared with the East Atlantic Flyway. Whilst not lessening survey and monitoring activity on the East Atlantic Flyway, at international scale, the Black Sea/Mediterranean and West Asian/East African Flyways should received strategic priority in terms of the development of capacity for survey and monitoring and hence the derivation of better and more population estimates and trends.

ii. *Understanding the importance of staging areas and the implications of their loss or degradation*

Staging areas are the critical energetic springboards for 'long-distance migrants'. Especially through the work of Theunis Piersma, Bruno Ens and colleagues, the last decade has seen major advances in understanding the importance of staging areas to the ecophysiology of migrant waders (*e.g.* Ens *et al.* 1990, 1994; Piersma 1994; van de Kam *et al.* 1999; Battley 2003). Such understanding is of critical conservation importance and we need to build on this, particularly developing better conservation application of ecological insights.

iii. More frequent surveys of Banc d'Arguin, Arquipélago dos Bijagós (and other megasites)

The Banc d'Arguin in Mauritania is one of the most remote and unspoilt coastal wetlands in the world and seems to have remained unchanged over recent decades. Around two million waders are concentrated here — about a quarter of all waders wintering along the entire coast of Europe and West Africa. This amounts to nearly twice the number of all coastal wintering waders found in the international Wadden Sea or in all British estuaries combined. However, despite its huge importance, few attempts have been made to completely count all waders using the Banc d'Arguin.

Counts were carried out in the winters of 1978-79 (Trotignon *et al.* 1980) and 1979-80 (Altenburg *et al.* 1982; Engelmoer *et al.* 1984) were the first (nearly) complete censuses. Apart from a count in the summer of 1988 (van Dijk *et al.* 1990), it took more than ten years before a new winter assessment occurred (Gowthorpe *et al.* 1996) albeit based on sample counts. The two counts in 1979 and 1980 respectively arrived at about the same number of over two million waders and there was no reason to doubt that the wintering number would have changed since then. Instead of confirming this, the results of Gowthorpe *et al.* indicated an alarming decline in the intervening years, with significant declines in numbers of wintering waders and other waterbirds.

They also suggested that a possible common explanation for these negative trends might be over-exploitation of fish causing a disturbance to the entire ecosystem. The Banc d'Arguin is the shallowest part of an extensive upwelling zone that occurs along the Mauritanian coast. In recent years, this has attracted a large offshore international fishing fleet, using he fine-mesh nets. Local fishermen at the Banc d'Arguin who use traditional small sailing boats and standing nets to catch fish, complain that their catch has decreased dramatically over recent years. Indeed, it is conceivable that the decline in fish numbers on the Banc d'Arguin is a direct consequence of the increase in industrial fisheries further offshore.

The 1997 count of waterbirds at the Banc d'Arguin by Zwarts *et al.* (1998a) confirmed the decline in numbers suggested by Gowthorpe *et al.* (1996), although not on the same scale and not in all species. The total of two million waders was similar to the total numbers counted in 1979 and 1980. However, more Dunlin and Curlew Sandpipers were counted, and fewer Knot and Bar-tailed Godwits. The same trend was found in coastal waders in Guinea-Bissau (Zwarts *et al.* 1998b), but Redshank and Greenshank showed an increase on the Banc d'Arguin, possibly because there are now more shrimp and young fish due to the over-exploitation of fish further offshore, and a decrease in Guinea-Bissau. The most notable declines were in Kentish Plover, Turnstone, Little Stint and Knot on the Banc d'Arguin as well as in Guinea-Bissau.

In view of their extreme importance, it is a high international priority to ensure that wader numbers on the Banc d'Arguin are monitored on a more regular basis, subdividing the area into the same sections as used in 1908 and 1997. At least for the present, it seems that the only way to monitor wader numbers on the Banc d'Arguin is by performing a complete count of the whole area (WIWO 1999).

iv. Waders using the Caspian Sea region, Iran and Iraq

The wetlands of Iraq have never been adequately surveyed by ornithologists, and most of the information available on the avifauna of the once vast Mesopotamian marshes dates back to the first half of the 20th century. Between 1968 and 1979, the International Waterfowl and Wetlands Research Bureau (later to become a part of

Wetlands International) sponsored four mid-winter waterbird surveys to the wetlands of Iraq, but these were able to cover only a tiny fraction of the wetlands, and gave only an rough indication of the relative abundance of wintering waterbirds, including waders. The results of these four surveys are summarised in Scott & Carp (1982). No major waterbird surveys have been undertaken in Iraq since then, and it has now become apparent that since the early 1980s, there has been a massive loss of wetland habitat throughout Mesopotamia. There were originally some 15,000-20,000 sq. km of wetlands in Lower Mesopotamia (Scott 1995), but this area had already been reduced to about 9,000 sq. km by the late 1970s, when the last waterbird counts were carried out. Recent satellite imagery has revealed that massive drainage works in the 1980s and 1990s have destroyed all but 1,300 sq. km of wetlands, and most of this survives in a single system, the Hawr Al Hawizeh/Hawr Al Azim on the Iraq/ Iran border (UNEP 2001).

Historical information indicates that the wetlands of Mesopotamia were formerly a major staging and wintering area for many species of waders in the West Asian /Eastern and Southern African flyway and also a core breeding area for several species, such as Black-winged Stilt, Collared Pratincole and White-tailed Lapwing. Given the massive wetland loss that has occurred in the past two decades, it would seem likely that there have been consequent major declines in those wader populations dependent upon these wetlands as breeding, staging or wintering areas. The total numbers of waders that once utilised the wetlands of Iraq will never be known, and in view of the present political situation in the region, it may be some years before it is possible to carry out any assessment of the numbers of waders still occurring in the region.

Much of the information on the status, distribution and numbers of waders in Iran dates back to the 1970s, when the Iran Department of the Environment devoted considerable resources to a nationwide survey of its wetlands and waterbirds at all four seasons of the year. Annual mid-winter waterbird counts have been carried out by the Department of the Environment almost without a break since then, but attention has been focused primarily on the Anatidae and other large waterbirds. Furthermore, it has not been possible to carry out any aerial surveys since the late 1970s, and thus there has been almost no coverage of the extensive inter-tidal mudflats along the south coast, which support some of the largest concentrations of wintering waders in the country. A local shortage of observers with a specialist interest in waders has also contributed to the paucity of information on wader numbers in the past two decades.

Within the last few years, however, several international expeditions, working in collaboration with the Iran Department of the Environment and other national institutions, have been able to survey wetlands and count waders in various parts of the country. Notable amongst these are the surveys organised by Werkgroep Internationaal Wad - en Watervogelonderzoek (WIWO) to the Urumiyeh Basin in September 2000 and the south coast in January/February 2000 (van der Have *et al.* 2001; Keijl *et al.* 2001) and January 2002 . Further surveys of this type are planned, and it is anticipated that many of the important gaps in knowledge of wader numbers and distribution in Iran will be filled within the next few years.

v. Intra-African migrants

Waders migrating wholly, or substantively, within the African continent have not been comprehensively reviewed here. Indeed, they are a group that is largely overlooked and certainly very poorly known with regard to population status and trends. Most population sizes are little more than informed guesses. They include the following species: Two-banded Courser *Rhinoptilus africanus*, Bronze-winged Courser *R. chalcopterus*, Cream-coloured Courser *Cursorius cursor*, Temminck's Courser *C. temminckii*, Madagascar Pratincole *Glareola ocularis*, Kittlitz's Plover *Charadrius pecuaris*, Three-banded Plover *C. tricollaris*, Forbes's Plover *C. forbesi*, Chestnut-banded Plover *C. pallidus*, White-fronted Plover *C. marginatus*, Spur-winged Plover *V.*

spinosus, White-headed Lapwing *V. albiceps*, Senegal Lapwing *V. lugubris*, Wattled Lapwing *V. senegallus*, Black-winged Lapwing *V. melanopterus*, Crowned Plover *V. coronatus*, Brown-chested Lapwing *V. superciliosus* and Pintail Snipe *Gallinago stenura*.

The population status of these species should be evaluated, and a greater focus placed upon them, especially by international conservation instruments such as AEWA.

vi. Identification and monitoring populations at greatest potential risk of climate change effects

A number of potential direct impacts of climate change can be predicted for wader populations. These include:

- **Effects of direct habitat loss in arctic breeding areas** (*e.g.* Zöckler & Lysenko 2000), especially for high arctic breeders. Simple modelling has shown the loss of significant areas of habitat for some species: for example, 45-65% for Little Stint, 41-70% for Curlew Sandpiper, and 36-58% for Dunlin. The population consequences are impossible to predict.
- **Effects of direct habitat loss in non-breeding season** – in particular, loss of inter-tidal areas consequent on sea-level rise (IPCC 2001). Rising sea levels is already causing impacts in coastal areas in some parts of Europe (*e.g.* case studies reported by Tooley & Jelgersma 1992).
- **Indirect effects on survival/ mortality and productivity** resulting from changing ecological conditions at all/any stages of wader life cycles.
- **Changes in distribution and migration routes** consequent upon changing habitat condition in different parts of their ranges. Austin *et al.* (2000) have suggested that regional changes in the wintering distribution of some waders in Britain may be a consequence of milder winter weather conditions resulting in some species 'short-stopping' and settling preferentially on eastern rather than western estuaries. Such distributional consequences of future climate change may have implications for the future interpretation of monitoring information. Thus, there is the risk that, over time, the movement of birds from well-monitored sites to areas less well-counted may be interpreted as population decline rather than distributional change.
- **Direct effects of climate changes on wader ecology** – *e.g.* through reduced frequency of severe winters, increased frequency of storm events. There are theoretically a large number of possible impacts whose long-terms impacts are impossible to predict.

Whilst modelling can give insights into some possible consequences of climate change (*e.g.* Yates & Goss-Custard 1997; Zöckler & Lysenko 2000; Harrison *et al.* 2001), the search for exact predictions is likely to be a largely futile exercise. Climate change will have multiple direct and indirect impacts on migratory waders at all stages of their annual cycle — not only in different countries but also during their journeys through different continents. Whilst developing our understanding of the science of climate change impacts will be valuable, the single most important response must be to improve the quality of monitoring at population levels so as to be able to provide key messages to policy makers on the changing status of populations. We make some recommendations on this below.

vii. Methodological development and standardization of survey and census techniques

Meltofte's recent (2001) assessment of census efficiency for arctic breeding waders is of major importance. It stresses how little is understood about many of the fundamental assumptions under-pinning current survey methodologies, not only for arctic-breeding species but also for other waders. As Meltofte notes, it is crucially important to improve our understanding of survey methodologies so we are clear exactly *what* population measures are being recorded. Only then will scaling up from surveys to wide-scale population estimates will yield accurate assessments of 'true' numbers.

There is a need also for consistent standards or methodologies for the assessment and presentation of trends. There is no current consistency in the derivation or definitions of terms such as 'rapid decline'. Methodologies such as those of Atkinson *et al.* (submitted) may be helpful in this regard, and we note the call by AEWA's MoP2 in 2002 for such a definition.

viii. Establishing functional links between important sites

We still know little about how and when migratory waders move between the various sites within their annual network, and, in particular, the role of, and links between, key sites for each population or species. Only for a few species, with relatively simple site networks, are such links and uses well known in populations using western Europe (*e.g.* Avocet and Red Knot). Better information on the links between key sites in flyway networks is a conservation priority. The results of long-term ringing can valuably contribute to this, particularly in regions where large numbers within a population have been ringed. An example of the elucidation of a complex site network for Dunlin in Britain using ring recoveries is given in Davidson *et al.* (1991) and Broad-billed Sandpiper by WIWO (1999).

It will be important to target key sites in geographic contexts — such as the termini of flyways. An example would be the need to re-establish regular ringing at Langebaan Lagoon in South Africa, where pioneering ringing by the Western Cape Wader Study Group in the 1970s and 1980s did much to 'supply' marked waders for recovery further north in the flyway.

Individual or cohort colour-marking (using coded leg or neck bands for larger species, and colour leg bands or flags and/or plumage dye-marking in smaller species) and the analysis of subsequent observations of marked birds offers an additional tool. For examples of its use to investigate international site networks used by Dunlin in a single season see Pienkowski & Pienkowski (1983) and Davidson *et al.* (1991). A major BTO/Wader Study Group project on waders in Britain (the West Coast Spring Passage Project) took place in 1984 and 1985 (Moser *et al.* 1985), but its results have never been fully analysed or published. Colour-marking has also been used successfully to assess movements and site-use at smaller geographic scales (*e.g.* Davidson & Stroud 1996). The collection of such information necessarily involves extensive collaboration and effort by networks of volunteers, involving both those catching and marking the birds and those observing them elsewhere. However, even with what may be realistically the most active of such networks, information return on effort can be very sparse (*e.g.* Davidson & Piersma 1986). Telemetry (below) will be increasingly of use for establishing precise migration routes and site links in waterbirds. However, the costs of such activities are still high and the results are generally limited to establishing the networks for only a few individuals within a population.

ix. Use of new technologies

In order to develop effective networks of protected areas targeted specifically at the needs of specific populations (*e.g.* Stroud *et al.* 2001), there is an increasing need to verify the presence of individuals of a particular population at given sites. It is also important to know for how long they remain at sites and how they move between them within a network.

Remote sensing, using radio or satellite telemetry, offers the great advantage of yielding detailed and precise information about the location (and sometimes also behaviour) of the individuals carrying transmitters. Miniature data loggers, for recording the behaviour of individuals, are also likely to become more widely used in the future. Radio-telemetry has been used very successfully for interpreting long distance migrations of even small waders, notably Western Sandpipers *Calidris mauri* (Iverson *et al.* 1996). There are currently some limitations to the technique, notably high costs, the high time cost of locating birds carrying transmitters, weight limitations for satellite transmitters (meaning that they can currently only be carried by the largest waders), and that generally results come from a few individuals that may not represent the behaviour of the population as a whole. However, costs and minimum size of transmitters are falling – increasing the number of individuals and species that can carry them. This will greatly increase the value of the technique.

Given the increasing evidence of great individual variation in migration strategy within populations, the most biologically appropriate approach to the analysis and interpretation of ringing-recovery data now seems to be the use of telemetry to establish in detail the range and types of individual strategies within a biogeographic population (*e.g.* Scott *et al.* 2004). This information can then be used to guide and inform the interpretation of the other general ringing-recovery data. Neither telemetry nor ringing should be seen as the only or best approach; rather each will add value to the interpretation and understanding of waterbird flyways if used in combination. Often, knowledge of the population of origin of individuals using a particular site is essential for developing networks of protected areas. Some populations may be distinguishable using plumage characters or morphometrics, but others are not. Here genetic fingerprinting or isotopic analyses will be required to differentiate populations (*e.g.* Wennerberg 2001), and the use of such techniques is likely to increase in future. All these new technologies require that birds are caught, so that maintenance of the pool of skilled wader catchers (ringers) will remain a basic essential for the study of migratory waders.

There should accordingly be strong encouragement of research using remote sensing to establish precise patterns of migration phenology as the basis for guiding and information interpretation of general ringing-recovery data.

x. Turnover

An improved understanding of population turnover, particularly at migration staging sites, and, hence, of the total numbers of birds depending on such sites, is also a high conservation priority. However, recent appraisal of the theoretical and analytical framework for such assessment has shown that most methods in regular use for calculating turnover (*e.g.* cohort colour-marking) are seriously flawed. They can seldom yield reliable results, except perhaps where the use of sites by a population is highly synchronous (A.D. Fox & N.C. Davidson, pers. comm.; Fox in prep.). At present, the only statistically valid approach appears to be that of applying capture-recapture analysis to individually marked birds (either with visual marks or remote sensing devices - Frederiksen *et al.* 2000). However, approaches using radio-transmitters (Scott *et al.* 2004) suggest that some species may have extremely rapid turn-over highlighting the lack of practicality of such methods in these situations.

Where turnover information exists (*e.g.* Smit & Piersma 1989), then clearly it should be used in the identification of important sites (as indeed, is urged by the site selection guidance of the Ramsar Convention). However, the methodological problems in obtaining reliable estimates of total numbers using sites may be considerable. We urge caution in development of expensive programmes to attempt to 'calculate' turnover rates as the cost of obtaining this information may ultimately prove to be disproportionate to its conservation value.

xi. Future data handling and accessibility

Monitoring results need to play an important role in underpinning flyway conservation action for migratory waders. Improving the availability and use of existing data and information should be a guiding principle, so as to maximise the value of the huge amount of largely volunteer effort expended on counting, catching, ringing and reporting on waders to date. This wealth of existing information can go at least some way to answering key questions. However, such information needs to be made much more freely available to those analysing patterns of waterbird distribution and movements between sites in order to fulfil its full potential, not just at national level but more particularly at international scales.

Upon its completion, WSG's draft *Atlas of Wader Populations in Africa and western Eurasia* will make a major contribution to providing a synthesis of current data and information.

xii. Monitoring demographic parameters

The continued monitoring of demographic parameters for wader at a sample of key sites is a priority, particularly to aid interpretation of the causes of decline in populations and with a focus on those species of conservation concern.

Piersma & Baker (2000) reviewed the range of lifestyle attributes of migratory waders and stressed the key importance of adult survival in determining population size. Waders are generally long-lived species with relatively low (and variable) productivity compared to other birds. Modelling shows that the overall stability of wader populations is more sensitive to small changes in adult survival rather than it is to changes in productivity. For both Eskimo Curlew and Slender-billed Curlew — both waders now close to extinction — causes of decline were likely to have been relatively high adult mortality, coupled with habitat loss and fragmentation (Piersma & Baker 2000). Modelling also shows how quite small or subtle changes in ecological factors affecting survival can, in combination, lead to rapid population changes or "catastrophic collapses". Piersma & Baker (2000) speculate that the drastic population changes on the Banc d'Arguin for some wader populations between 1980 and 1997 (Zwarts *et al.* 1998a) may have resulted from such effects.

In interpreting population changes, monitoring of survival is an essential element that will provide insight and early-warning of changing demographics. Potentially, there is much information that could already be available from the results of existing ringing activity. Yet, there are no effective systems to draw this information together at national or international scales. We make proposals for such enhancements below. (In aiding the accurate collection of data and future survival assessments for many populations, we further note the desirability of updating published ageing criteria for waders, *i.e.* revising the 1977 guide to the ageing of Holarctic waders (Prater *et al.* 1977)).

Direct information on mortality from bag statistics will be of importance in modelling survival levels. Indeed, AEWA seeks to encourage the collation of such information at national and international levels.

Information on productivity is also important and can be derived from data on the age structure of populations, collected when birds are caught for ringing (*e.g.* Summers *et al.* 2001). New analytical techniques, for handling some of the biases inherent in such datasets, are developing rapidly. The proportion of juveniles in passage and wintering populations of, particularly, arctic-breeding species are a valuable and reliable measure of annual variation in breeding productivity in both waders and geese (*e.g.* Summers & Underhill 1987). Such information is already regularly collected for waders at some major European estuaries. More sites for the regular monitoring of wader demographic patterns are required, however, and this activity should occur within an international framework that establishes desirable targets based on statistical requirements established at population scales (below).

The process of reviewing population estimates and trends

Timetable for future international reviews

Although in the mid 1970s the Ramsar Convention adopted the 1% Criterion as a basic criterion for assessing internationally important sites for aggregating waterbirds, there was no agreed process by which such information would be collated. The process was clarified, however, in the early 1990s

(Rose & Stroud 1994), with Ramsar COP6 adopting Resolution VI.4.

In essence, this has resulted in two cycles of population review undertaken:

- a three year cycle of revision/update of available waterbird population estimates (for every Ramsar Conference of Parties); and
- a nine year cycle of revision of 1% thresholds for Western Palearctic waterbirds (every third Ramsar meeting), unless major population change occurs in the interim.

According to Wetlands International's indicative timetable, the current review should have been completed in 1995 and presented to Ramsar COP6 in 1996. The reality is that it has taken much longer than this to complete the review, and these results will go to Ramsar COP8.

We recommend that the next review of wader populations in Africa and Western Eurasia cover the period 1997-2004, and be reported to Ramsar COP10 in 2008. For this to occur, it will be necessary to commence the review in 2005 at the latest.

One of the reasons the review has taken so long is that it has been an almost entirely voluntary activity by members of the International Wader Study Group. Several person-years of voluntary activity have gone into the current review. Such input from many specialists is important. Yet, the process overall has been greatly slowed by the central co-ordination having been undertaken on a voluntary basis also, and thus at risk from other calls on the 'spare' time of busy individuals.

If the next review is to deliver results according to the timescale recommended above, it is highly desirable that co-ordination at least is undertaken on a professional basis. Likewise, the functional delivery of Wetlands International's wader count database would greatly facilitate the compilation of estimates and derivation of trend information. As noted in Methods above, there is potential to use more sophisticated forms of indexing for some populations so as to provide information on trends (*e.g.* as Delany *et al.* 1999 undertook for other waterbirds).

Accordingly, we strongly recommend that the International Wader Study Group and Wetlands International seek resources and immediately start to project-plan the next review in order to allow its timely delivery in 2008.

Populations in need of more urgent re-evaluation

There are a number of populations for which this review and other information suggests are in a process of rapid and/or widespread change. These include the populations indicated as emboldened in Tables 11 & 12above.

Alongside work to consider population definitions (below), we recommend that the population sizes of these populations be reviewed for the fourth edition of *Waterbird Population Estimates* in 2005. Given lead-times, this will require review activity to commence in 2004.

Population definitions

In undertaking this review we have come across a number of instances where there may be a case for changing the current treatment of biogeographic populations. In a number of clear-cut cases we have adopted these changes, for example, the splitting of temperate-breeding *schinzii* Dunlin into two populations, the treatment of Golden Plovers as a number of separate breeding populations, and the recognition of 'new' sub-species of Greater Sand Plover, Curlew, Whimbrel and Purple Sandpiper.

Other situations are less clear-cut and would benefit from further review by WSG or others of data and information on movements. We list these in Table 16 and recommend that, if changes are warranted, they be considered for adoption by the fourth edition of *Waterbird Population Estimates* in 2005.

Table 16. Issues relating to the definition of current biogeographic populations for waders in Africa and Western Eurasia needing further review.

Species	Current population	Issue for review
Crab Plover	Northwest Indian Ocean, Red Sea and Gulf	Is there any new information to support a split of the current (single) world population into eastern and western populations as seems geographically probable?
Oystercatcher	Europe/NW African (=*H. o. ostralegus)*	Better understanding of biological populations within the current European/NW African 'population') needed. At least five discrete breeding populations have been identified within the range of *H. o. ostralegus*, but these extensively overlap in migration periods and there is uncertainty over origins and migratory destinations of some of these.
Woodcock	Europe/Africa	Are Woodcock breeding in the Caucasus a discrete biogeographical population? The status of Woodcock in the Crimea, the Azores and the Canary islands is similarly obscure.
Bar-tailed Godwit	??	Are birds wintering in Morocco of the nominate race or *taymyrensis*?
Eurasian Curlew	W, C & N Europe	Better information needed about the geographic distribution of *arquata, orientalis* or *suschkini* races to enable correct allocation of Russian breeding totals to population.
Common Redshank	*T. t. robusta* (Iceland/ Faeroes breeding)	Does the range of this race extend to Orkney and Shetland (and elsewhere?) in Northern Scotland as suggested by Engelmoer & Roselaar (1998).
	T. t. britannica	What is the extent of the breeding distribution of this race in continental Europe? Engelmoer & Roselaar (1998) indicated its occurrence in Denmark, Germany, the Baltic States and the Netherlands (as well as in south and east England). How does this distribution relate to that of European-breeding *T. t. totanus*?
Common Greenshank	??	Are birds breeding in Britain and Ireland a discrete population wintering in the British Isles as suggested by Hutchinson (1986) and Smit & Piersma (1989)?
Ruddy Turnstone	??	The taxonomic status of *A. i. oahuensis* and the westwards limit of its distribution into European Russia (see Engelmoer & Roselaar 1998 and Tomkovich & Serra 1999 – p. 296).
Red Knot	??	What is the status of birds wintering on Mediterranean coasts? Do these comprise a distinct population?
Purple Sandpiper	East Atlantic	The population currently comprises birds from both Nearctic and Palearctic breeding areas that are morphologically distinct (short-billed and long-billed). Should these be treated as two (or more?) separate populations?
Dunlin	*schinzii* Britain and Ireland	What is the relationship between the peatland and machair-breeding elements of this population which seem to have different breeding phenologies, and thus my represent temporally isolated populations?
Broad-billed Sandpiper	??	How discrete is the small population wintering in Tunisia (van der Have *et al*. 1997) and what are the affinities of this population?
Ruff	SW Asia, E and southern Africa	Evaluation of the differing definitions for this flyway (and the South Asian Flyway) adopted by this review and by Zöckler (2002a,b) supported by movements of marked birds reported by Underhill *et al*. (1999).

Making progress: targeted gap-filling research

The conclusion of this review is that — other than a few populations wintering on the coasts of NW Europe — the general state of monitoring of wader populations is poor, indeed, very poor. There are clear differences between flyways (Table 5) with generally better information for the East Atlantic Flyway than for other flyways and regions. Whilst a general urging for better 'across-the-board' improvement in monitoring effectiveness is an obvious response — this is probably not very realistic nor indeed helpful.
Monitoring of wader populations at international scales has suffered for many years from a seeming total lack of direction. The International Waterbird Census has collated totals but has not been pro-active on providing a framework of objectives for data collection. Perhaps in contrast, past projects that have given international direction and focus for field activities and data collation *have* been very effective in developing the knowledge base. Good examples include WIWO's very effective activities (WIWO 1994, 1999), and WSG's projects on Knot migration in the 1980s (Davidson & Piersma 1986; Piersma *et al.* 1992; Piersma & Davidson 1992); on Black-winged Stilts (Dubois 1987) and more recently WSG's project on spring migration of Ruff (Wymenga 1999).

There seem to us to be a number of positive steps that could be taken to improve the current situation. We detail these below.

1. Better regular awareness of the state of monitoring

At present, the community of wader researchers in Africa and Western Eurasia receive limited feedback on current monitoring activity at international scales at all. Whilst national monitoring schemes report at regular, often annual, intervals, there is no comparable international reporting of data for waders. As there are so many international strategies and treaties have monitoring of waterbird populations as a core activity of primary importance, this is an extraordinary situation.

If there is to be greater motivation amongst national schemes and counters to enhance current counting activity, then there needs to be better feedback at international scales. Logically, it falls to Wetlands International to provide this leadership, and we urge the development of funded programmes of work that will provide regular (at least annual) feedback to counters and national count schemes on the quality and quantity of data received. Decadal international feedback (as provided by Prater 1976; Smit & Piersma 1989 and this paper) is greatly inadequate.

2. Development of monitoring priorities

Whilst it is crucial to improve monitoring coverage generally, we suggest that it may be opportune to focus initially on the development of better monitoring for a few particular populations. These may be considered as 'focal populations'. The objective will be to improve monitoring coverage to the point where trends can be assessed to a defined level of statistical precision. Accordingly, for these populations, there will be a need to review current monitoring coverage (location and frequency of counting) and make recommendations for improving the effectiveness of monitoring trends for each such focal population.

The selection of such populations will be informed by a number of considerations. In particular, such populations might be considered as 'indicators' of particular breeding biotopes or issues about which there is a need for information on trends to help develop conservation policies (for example, the effectiveness (or otherwise) of agri-environment measures to mitigate known negative effects of the European Union's Common Agricultural Policy on certain wader populations, or the rapidity of climate change impacts on high arctic wader breeding areas).

In the first instances, it may be appropriate to consider populations where there is already good count coverage (category 3 of Annex 5) and assess what additional activity (which may perhaps be limited) needs to take place to enhance monitoring effectiveness (*i.e.* move these populations to category 4).

We give an initial list of such possible populations in Table 17 (with rationale for their selection) and invite debate on this proposal.

3. Gap-filling expeditionary activity

Although there is long-term and extensive count and ringing information covering many areas of flyways in Europe, there is very little information from some parts of flyways in Africa and in the more remote or inaccessible parts of Europe. Detailed analyses of existing data reveal such gaps, which can limit our understanding of how flyway networks are used, even for well-known species in generally well-covered areas. The efficiency of monitoring and ringing should be maximised in support of such analyses by focusing activity into places where flyway knowledge is known to be lacking. Some such focusing is already taking place, such as recent Werkgroep Internationaal Wad - en Watervogelonderzoek (WIWO) and other collaborative research expeditions to numerous little-researched areas of Europe and Africa (WIWO 1999), including notable WIWO surveys to Iran in January 2000, September 2000 and January 2002.

These expeditions have yielded much important new information on the distribution, population size and movements of waterbirds. Close dialogue between those undertaking flyway-scale analyses and those planning expedition research programmes should continue, so as to target volunteer research effort to fill key gaps.

Table 17. Possible candidate populations for treatment as 'focal populations for the development of international population monitoring capability.

Rationale for selection as monitoring 'focal population'	Species	Biogeographical population
Representative of waders breeding on Indian Ocean tropical coasts. Commence with establishment of international inventory of breeding colonies.	Crab Plover	World
Representative NW European coastal breeding wader with already good coverage.	Avocet	Western Europe
Representative of waders breeding in Icelandic farmland. Discrete population already subject to good monitoring in UK. Already extensive colour-ringing occurring (1-2% of population) which is providing information on extent of sub-specific overlap, turnover rates, site networks and independent population size estimates.	Black-tailed Godwit	*L. l. islandica*
Representative of the status of waders breeding in high arctic Canada/Greenland – areas identified as at early risk of habitat change consequent on global climate change. A discrete population already subject to good monitoring in UK and elsewhere.	Red Knot	*C. c. islandica*
Representative of the status of waders breeding in high arctic Russia – an area identified as at early risk of habitat change consequent on global climate change. A discrete population with good understanding of movement patterns.	Red Knot	*C. c. canutus*
Representative of breeding wader of low-intensity grasslands, already rapidly declining and adversely affected by agricultural change throughout its (limited) European range. Already piecemeal monitoring at many key sites in Baltic region. Relatively easy to collate data on breeding numbers on annual basis for regular (annual) overview of trends.	Dunlin	*C. a. schinzii* (Baltic-breeding)

4. Non-census based monitoring

For a significant number of populations (for example the sandpipers breeding across extensive ranges across northern Eurasia and not aggregating in winter), it seems unlikely that 'traditional' assessment of population status through counting in the non-breeding season will ever provide realistic information on population status and trends.

Ringing provides alternative means of providing information on population status — whether regarding productivity (indices based on proportions of young in standard catches), or survival/mortality. There is great potential that could be unlocked here (Piersma & Baker 2000; Fox in press). There is much ringing activity throughout Europe, but little current co-ordination at national or international scales to develop the full potential of ringing-derived information.

For species where counting is ineffective, ringing-derived information has the potential to give feedback on trends (for example, changing balance between productive and survival that may indicate population trends *e.g.* Summers *et al.* 2001). For species where counting does provide a level of information on status and distribution, ringing-derived information can enhance this to provide more coherent Integrated Population Monitoring (*e.g.* Kershaw *et al.* 2001).

As with our suggestions above for the further development of counting activity for 'focal populations', we recommend that a pilot project be established to try and establish annual assessment of population parameters for a small number of populations. Such a pilot would help to explore the issues arising, and would be an initial first step towards better development of ringing activity to monitor populations at international scales. The pilot would need to assess the following issues:

1) understanding when, where and how much ringing currently takes place for each population;
2) what are the proportions of recoveries and retraps from existing activity;
3) how much ringing activity would be necessary to generate sufficient recoveries to allow annual assessment of survival rates (to defined levels of confidence);
4) consequent on step 3), planning where additional ringing activity is best placed to be encouraged to generate the necessary annual 'quotas' of ringed birds; and
5) the development of the necessary international partnerships (addressing issues such as data sharing) between individuals and organisations to put in place such monitoring.

5. Resourcing

Much international wader research is undertaken on a non-professional basis. Whilst amateur networks such as the International Wader Study Group can guide and encourage specific surveys and work, this inevitably provides a constraint on the scope of studies undertaken. Indeed, in many of the areas identified above as priorities (*e.g.* spring wader movements in Europe; monitoring of changes in mortality using ringing recoveries; understanding site-networks through analysis of ring-recoveries *etc.*) significant datasets already exist, although funding is lacking to allow their analysis and publication. Even small amounts of 'pump-priming' funding can have a hugely catalytic influence in stimulating work – as demonstrated by the Dutch government's innovative support of many international conservation programmes.

Ultimately, the better development of wader monitoring in Africa and Western Eurasia will depend on the willingness of government's to fund this activity in support of obligations under both domestic legislation and international treaties.

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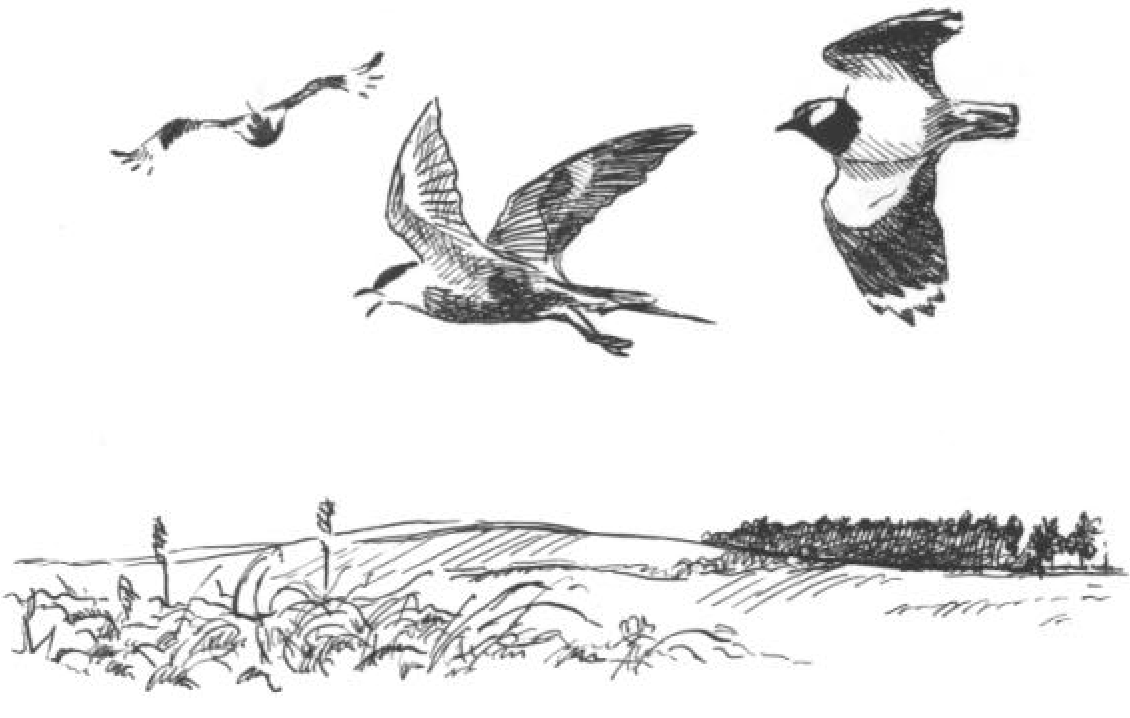

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