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“Making flyway conservation happen”

DRAFT INTERNATIONAL SINGLE SPECIES ACTION PLAN FOR THE CONSERVATION OF THE EURASIAN CURLEW

Introduction

This draft International Single Species Action Plan (ISSAP) for the Conservation of the Eurasian Curlew (*Numenius arquata arquata*, *N. a. orientalis* and *N. a. suschkini*) was commissioned to the Royal Society for the Protection of Birds (RSPB), United Kingdom.

Drafts of the plan went through rigorous consultations with experts and the resulting draft was provided to the Technical Committee via its Workspace and to government officials at the Range States of the species for final consultations.

It was presented to the Technical Committee at its 12th Meeting in March 2015, and to the AEWA Standing Committee at its 10th Meeting in July 2015, where it was approved for submission to MOP6 for adoption.

Action Requested from the Meeting of the Parties

The Meeting of the Parties is requested to review and adopt this draft ISSAP.

Agreement on the Conservation of
African-Eurasian Migratory Waterbirds (AEWA)

**DRAFT INTERNATIONAL SINGLE SPECIES ACTION
PLAN FOR THE CONSERVATION
OF THE EURASIAN CURLEW**

Numenius arquata arquata, N. a. orientalis and N. a. suschkini

Compiled by: Daniel Brown¹

¹ RSPB Scotland Headquarters, 2 Lochside View, Edinburgh Park, Edinburgh, EH12 9DH, UK

E-mail:

Milestones in the production of the Plan:

- Stakeholder planning workshop for subspecies *arquata*: 1st October – 3rd October 2013, Wilhelmshaven, Germany
- First draft: December 2013, presented to *N. a. arquata* experts (June – August 2014)
- Email consultation with subspecies *N. a. orientalis* and *N. a. suschkini* experts
- Second draft: January 2015, presented to the Range States and the AEWA Technical Committee
- Third draft: June 2015, submitted to the AEWA Standing Committee
- [Final draft: ****, submitted to the 6th Meeting of the AEWA Parties for adoption]

Review

This International Single Species Action Plan should be reviewed and updated every 10 years. The first revision should be in 2025. An emergency review will be undertaken if there is a significant change to the species' status before the next scheduled review.

Geographical scope

The Eurasian Curlew has a large global range and as such this International Single Species Action Plan shall be implemented in the following Range States:

Twenty *Principle Range States*: Range States that regularly support globally-important (i.e. >1% of the biogeographic population) breeding and/or non-breeding numbers of either of the three subspecies. This includes: Belgium; Denmark; Estonia; Finland; France; Germany; Iran, Islamic Republic of; Iraq; Ireland, Republic of; Kazakhstan; Netherlands; Norway; Oman; Russian Federation; Saudi Arabia; Sweden; Turkey; United Kingdom; United Arab Emirates; and Uzbekistan.

Nine *Survey Range States*: Range States for which there is currently insufficient data available to assess their significance for the species. This includes: Belarus; Greece; Guinea-Bissau; Hungary; Kuwait; Mauritania; Romania; Tunisia; and Ukraine.

Several Range States host breeding and/or non-breeding numbers below the 1% of the biogeographic population threshold, with some of them approaching it close and (others) undertaking species-specific and/or wider conservation measures intended to benefit Eurasian Curlew and their associated habitats. The involvement of these Range States in the implementation of the ISSAP is currently being consulted. This includes Austria; Bulgaria; Guinea; Italy; Latvia; Lithuania; Morocco; Poland; Portugal; Senegal; Slovenia; and Yemen.

Credits

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EXECUTIVE SUMMARY

The Eurasian Curlew *Numenius arquata* is a highly migratory species in need of coordinated conservation action and research. Population and range decline has been reported across much of its breeding range. As a result, in 2007 the species was uplisted to the globally Near Threatened (NT) category of the IUCN Red List of Threatened Species. This International Single Species Action Plan (ISSAP) sets a course of action to restore the Eurasian Curlew to a favourable conservation status.

The long-term goal of this plan is to restore the favourable conservation status of the Eurasian Curlew throughout its international range, as demonstrated by its assessment as Least Concern (LC) against IUCN Red List criteria by 2026. The short-term aims are to stabilise breeding population declines of *N. a. arquata*; to improve knowledge relating to the population and conservation status of *N. a. orientalis* and *N. a. suschkini*; and for any hunting activity to be undertaken within the context of an adaptive harvest management process.

The Eurasian Curlew is listed in Appendix II of the Bonn Convention and Appendix III of the Bern Convention. Three subspecies are recognised: *N. a. arquata*, *N. a. orientalis* and *N. a. suschkini*. *N. a. arquata* is listed on Table 1 in Column A, Category 4 of the Action Plan of the African-Eurasian Migratory Waterbird Agreement (AEWA). *N. a. orientalis* is listed on Table 1 in Column A, Category 3c. Lastly, *N. a. suschkini* is listed on Table 1 in Column A, Category 1c. This ISSAP is a composite plan that seeks to improve the conservation status of all three subspecies within the AEWA range.

The Eurasian Curlew is classified as Vulnerable on the European Red List of Birds (BirdLife International 2015). Europe probably hosts more than 75% of the global breeding population (BirdLife International 2004). It is listed on Annex II Part B of ‘the Birds Directive’ (the European Council Directive on the Conservation of Wild Birds 79/409/EEC, 2 April 1979), indicating it can be hunted in listed Member States which have a defined hunting season for the species. It is currently a quarry species only in parts of France. The *EU Management Plan for Eurasian Curlew (Numenius arquata) 2007-2009* set out a conservation plan for the species within the geographic area of the European Union, recognising that the 25 EU Member States of the time supported a significant proportion of the European population, and that declines were evident in many of these Member States. This ISSAP builds upon several of the actions identified in the EU Management Plan.

The Eurasian Curlew breeds mostly in the boreal, temperate and steppe regions of Europe and Asia; from Fennoscandia in the north to central Europe in the south, and from Ireland in the west to Transbaikalia, Russia in the east. Most populations are highly migratory and the species has a large wintering range that includes much of the coastlines of Northwest Europe, the Mediterranean Basin, Africa, the Arabian Peninsula, the Indian sub-continent and South East Asia and East Asia. On its breeding grounds the Eurasian Curlew is strongly associated with a range of wetland and agricultural habitats in ‘open’ landscapes. Coastal habitats and arable crops are also used for breeding. During the winter months, the Eurasian Curlew is found in large flocks at intertidal mudflats, coastal grasslands, farmland, and to a lesser extent, inland wetlands.

The Eurasian Curlew occurs regularly in 42 AEWA Range States. Population declines are being driven primarily by low reproductive success. The factors responsible for this low breeding success include:

- the loss, degradation and fragmentation of breeding habitats;
- high levels of nest and chick predation;
- nest destruction due to agricultural activities;
- human disturbance on breeding grounds;
- afforestation; and
- land abandonment.

Conservation of all the three subspecies will be dependant upon reversing population declines. This can only be achieved by increasing adult survival (i.e. reducing adult mortality rate) and/or by increasing productivity (i.e. breeding success). This ISSAP sets a framework for action to achieve this; an International Working Group will coordinate implementation.

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1. BIOLOGICAL ASSESSMENT

1.1. Taxonomy and biogeographic populations

Phylum: Chordata
Class: Aves
Order: Charadriiformes
Family: Scolopacidae
Subfamily: Tringinae
Tribus: Numeniini
Species: *Numenius arquata* (Linnaeus 1758)
Subspecies: *Numenius arquata arquata* (Linnaeus 1758)
Numenius arquata orientalis (Brehm 1831)
Numenius arquata suschkini (Neumann 1929)
Synonyms: *Scolopax arquata* (Linnaeus 1758)

Non-English common names: Storspove (Danish) Wulp (Dutch) Isokuovi (Finnish) Courlis cendré (French) Suurkoovitaja (Estonia) Guilbneach (Gaelic) Großer Brachvogel (German) Nagy poling (Hungarian) Fjöruspói (Icelandic) Crotach (Irish) Chiurlo (Italian) Storspove (Norwegian) Kulik wielki (Polish) Maçarico-real (Portuguese) Большой кроншнеп (Russian) Zarapito real (Spanish) Storspov (Swedish) and Gylfinir (Welsh).

Polytypic species. No studies have been conducted on the level of genetic variation across the range. However, three subspecies are recognised. The nominate *N. a. arquata* has a core breeding range which includes the British Isles, Fennoscandia, northern continental Europe and European Russia. It winters mostly in coastal regions of Northwest Europe and West Africa. The Ural Mountains mark the dividing line between the breeding range of *N. a. arquata* and one of two eastern subspecies; *N. a. orientalis*. All birds breeding to the west of the Urals are considered to be *N. a. arquata* (Thorup 2006) whilst those from the Urals eastwards are thought to be *N. a. orientalis*. The exact dividing line between the two subspecies is not clear, and there is probably a broad zone of inter-gradation (a ‘hybrid zone’) stretching from Ukraine through southern European Russia and into Kazakhstan (Delany *et al.* 2009). The *N. a. orientalis* breeding range stretches from the Urals, across temperate latitudes of Siberia, extending just to the west of Lake Baikal. There appear to be three distinct migration routes amongst *N. a. orientalis* birds (see Section 1.3 Migration Routes for full details). *N. a. suschkini* breeds on steppes to the south of the Urals in Russia and Kazakhstan and is thought to winter mainly in Africa. Historically, there has been uncertainty surrounding the validity of *N. a. suschkini* as a distinct subspecies. However, in recent years its subspecies status has been recognised by most leading authorities (e.g. Van Gils & Wiersma 1996, Gill & Donsker 2015).

1.2. Population size and trend

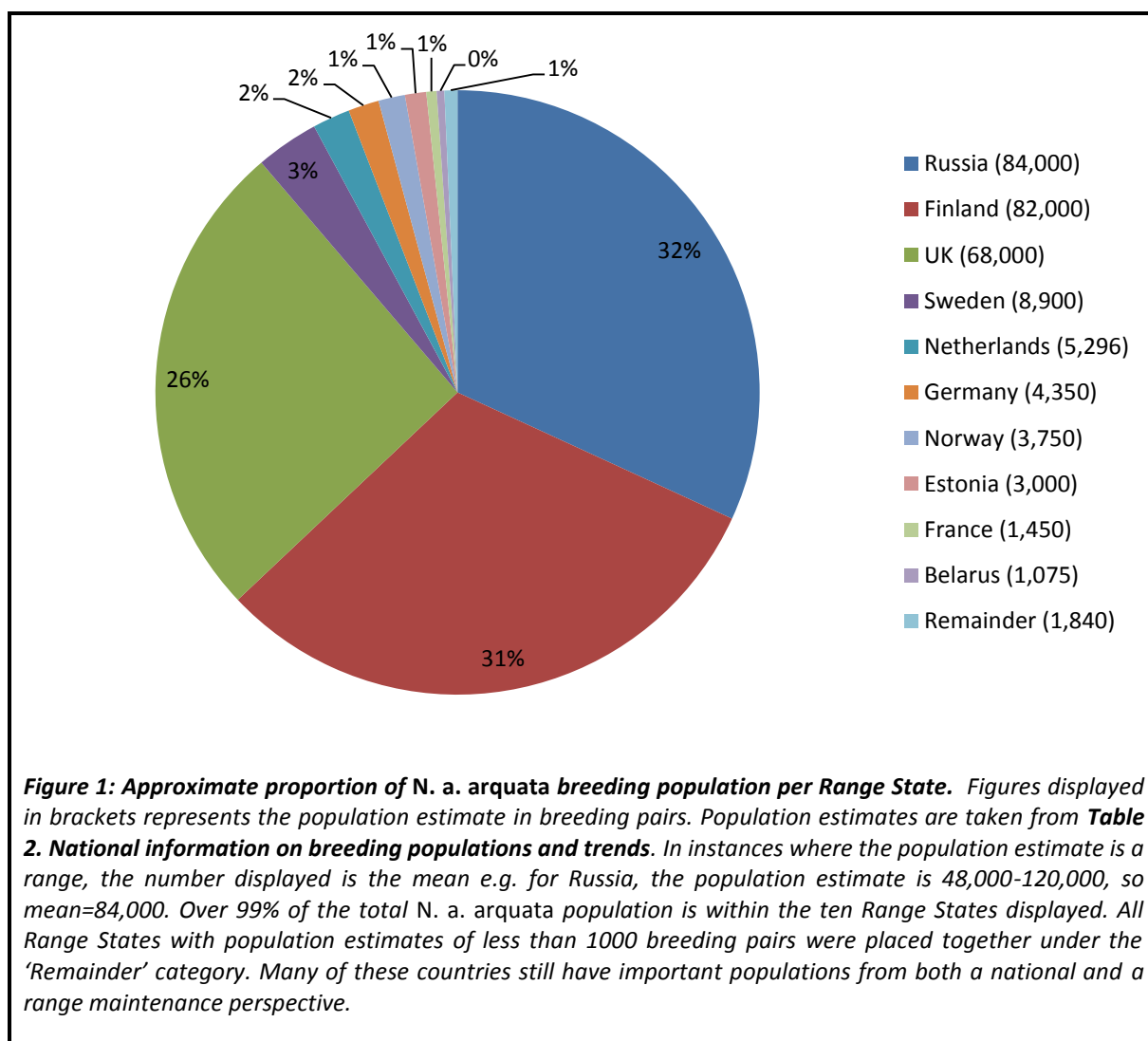
1.2.1. Global population

The recent global population was estimated at 700,000-1,065,000 individuals (Wetlands International 2006). However, combining the population estimates for the five populations listed in Waterbird Population Estimates 5 (2012) gives a slightly higher population estimate of 835,000-1,310,000. Part of the reason for this increase is due to an increase in the estimate of an *N. a. orientalis* population that uses the East Asian-Australasian Flyway (see below).

1.2.2. *N. a. arquata* population size

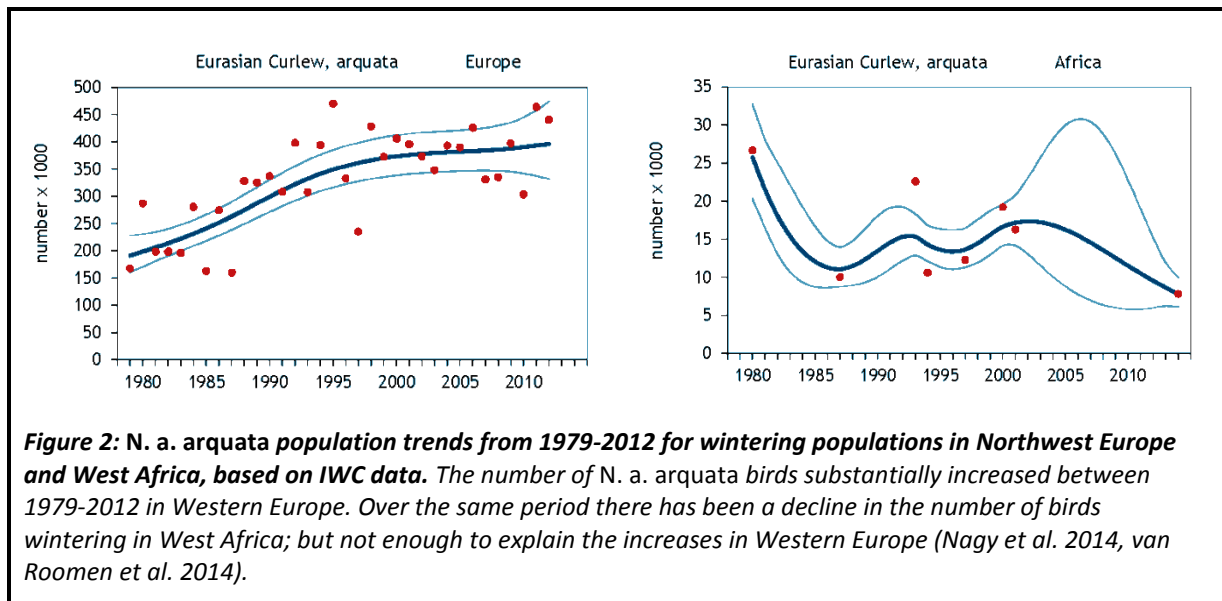
N. a. arquata is the most numerous of the three subspecies with an estimated population of 700,000-1,000,000 individuals (Thorup 2006, BirdLife International 2004b). The first estimate of 348,000 by Smit & Piersma (1989) was based on midwinter counts at coastal wetlands along the East Atlantic Flyway. It was acknowledged to be an underestimate due to the large number of inland wintering birds that the counts did not include. An updated estimate of 420,000 (Stroud *et al.* 2004) was based on midwinter counts and estimates at coastal sites during the 1990s and included populations wintering inland. Estimates derived from breeding populations have produced higher population estimates. Thorup (2006) produced an estimate of 240,000-347,000 breeding pairs for all birds breeding west of the Urals, equating to 720,000-1,040,000 individuals (Delany *et al.* 2009). A similar estimate of 660,000-1,080,000 individuals was produced by BirdLife International (2004), calculated from the sum of national breeding estimates which equated to 220,000-360,000 pairs.

Declines in breeding populations of *N. a. arquata* have been recorded or are suspected to be occurring across much of the breeding range. Over 99% of the breeding population is estimated to occur within ten Range States (Figure 1), and short-term and/or long-term declines (Table 3) have been recorded in eight; the exceptions being France (Fouquet 2013) and Belarus (BirdLife International 2004a). Population and range decline have been particularly pronounced in some Range States, for example the UK, where the population has declined by 43% between 1995 and 2012 (Harris *et al.* 2013) and the whole of Ireland (i.e. Republic of Ireland and Northern Ireland), where the breeding range has contracted by 78% in the past four decades (Balmer *et al.* 2013).



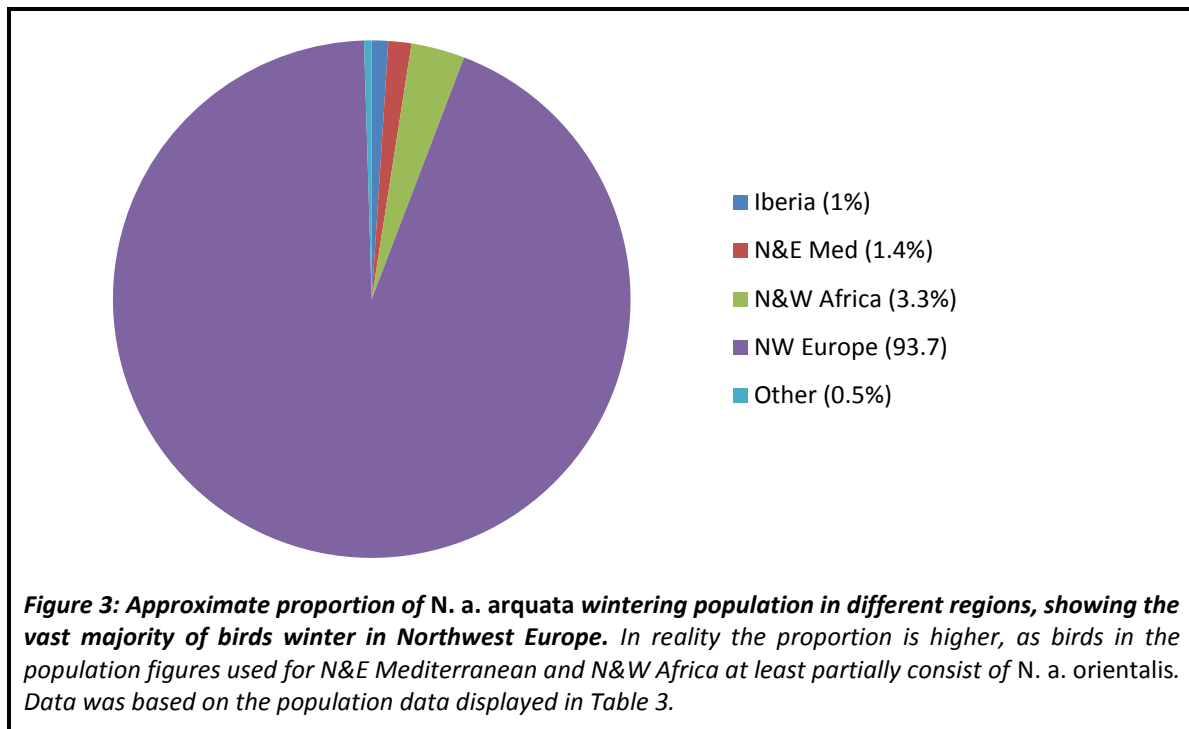
Declines of a similar magnitude are not apparent from wintering population data. Indeed, analysis of International Waterbird Census (IWC) data actually reports a long-term increase in the wintering

population from 1979-2012, with an apparent stabilisation in recent years (2003-2012). One possible explanation, or contributing factor, for this discrepancy between wintering and breeding trends is that the wintering distribution is shifting in response to changing climatic conditions. This phenomenon has been described for several species of shorebird in Western Europe, and such shifts could obscure or confound breeding population declines (Taylor & Dodd 2013, Rehfish *et al.* 2004, Maclean *et al.* 2008). A climate-driven shift in wintering distribution of *N. a. arquata* may well have occurred between West Africa and Northwest Europe in recent decades. However, it alone cannot account for the large increase in Northwest Europe, as the magnitude of decline in West Africa is considerably less than the increase in Northwest Europe (see Figure 2).



An alternative explanation is that the breeding population in Russia is actually increasing, although it is thought to be declining (Vladimir Morozov, pers. comm.), but this assertion is not based on quantitative data. Another explanation is that strict restrictions on hunting are in place in the Netherlands and Denmark, and there is evidence to suggest that some species of wader and waterfowl do not migrate further south if they find suitable habitats closer to their breeding areas. One objective of this ISSAP is to address this discrepancy through a programme of research actions. Irrespective of the factors responsible, the varying population trends across different parts of the wintering range mean that approximately 95% of the population now occurs in Northwest Europe (Figure 4).

Whilst discrepancies exist between the breeding and wintering population trend data, it is important to note that both are subject to limitations due to gaps in temporal and spatial coverage, as well as significant variation in the quality of national or regional datasets upon which they are based.



1.2.3. *N. a. orientalis* population

Considerable uncertainty remains over the population size of *N. a. orientalis*, partly due to no information being available on breeding numbers in western Siberia. A previous estimate of 90,000-350,000 individuals, based on transect counts, in the Yamalo-Nenets Autonomous Area in Western Siberia (Tertitsky *et al.* 1999) is most certainly an overestimate (Lappo *et al.* 2012). Perennou *et al.* (1994) estimated the wintering population at 28,000, including almost 25,000 South West Asian birds, but acknowledged this figure was likely to be a considerable underestimate (Delany *et al.* 2009). Stroud *et al.*'s 2004 estimate of 44,600, based on 1990s midwinter counts and estimates, was also considered an underestimate due to incomplete coverage in parts of the Arabian Peninsula and Northeast Africa. Included was an old estimate of 20,000 birds in Iran. This figure was based upon 1970s aerial surveys of the north coast of the Persian Gulf and the coast of Persian Baluchestan (Perennou *et al.* 1994, Scott 1995). These birds have been unrecorded since. More recently, the population estimate for the population using the East-Asian Australasian Flyway (EAAF) was increased to 100,000. This revised estimate followed non-breeding counts in coastal China of 82,000 birds in 2008 (Cao *et al.* 2009) and was increased to 100,000 to account for birds that winter inland. This recent estimate is more than twice the previous estimate of 40,000 for this flyway (Bamford *et al.* 2008).

1.2.4. *N. a. suschkini* population

There is little information available on the population size of *N. a. suschkini*. Thorup (2006) assigned 1,220-2,170 breeding pairs in south and southeast Russia to *N. a. suschkini* whilst Delany *et al.* (2009) concluded that the numbers breeding in Southwest Asia were unknown but likely to be very low. A population estimate of 1-10,000 has been adopted.

1.3. Distribution throughout the annual cycle

January. Birds are on their wintering grounds. Whilst breeding pairs are monogamous, there is little evidence that the pair bond is maintained outside the breeding season (Cramp & Simmons 1983). The largest wintering populations occur in northwest Europe, West Africa, the Middle East and East Asia. The first birds start their northbound migration towards the end of the month.

February. An increasing number of birds that breed in northwest and central Europe start their northbound migration. Birds at more northerly and easterly latitudes remain on their wintering grounds (Delany *et al.* 2009). The first adults arrive back on their breeding grounds in France (Fouquet *et al.* 2013). Males typically arrive a few days before females (Delany *et al.* 2009).

March. The main passage of birds during the northbound migration. Birds start to leave Tunisia (Feltrup-Azafzaf pers. comm.). At estuaries in northern Scotland, resident birds depart for their breeding grounds; those that breed in Scandinavia will remain for a further month (Wernham *et al.* 2002, Dennis *et al.* 2011).

April. The main passage of birds continues. Mating and egg-laying commences in southern and western regions of the breeding range. Most birds form solitary territorial pairs. Occasionally, small colonies are formed. Birds breeding at more northerly latitudes - such as Fennoscandia and Russia - depart their wintering grounds and start to arrive back on breeding grounds (Delany *et al.* 2009). Some birds make stopovers en route to breeding grounds (Dennis *et al.* 2011).

May. Early clutches hatch with the first chicks fledging towards the end of the month. Breeding starts in Fennoscandia (Valkama *et al.* 1999). Both sexes contribute equally to incubation (Currie *et al.* 2001) but the level of subsequent parental care varies: males stay with chicks during the entire brood-rearing period whilst females depart approximately halfway through. Females depart earlier at north-easterly latitudes. They also depart sooner when they have late clutches (Currie *et al.* 2001).

June. Breeding continues whilst the first southbound migrations begin (Delany *et al.* 2009). Some females in central Europe depart their breeding grounds at the beginning of the month and arrive at their non-breeding grounds. Unsuccessful females typically depart first, followed by breeding adults, and lastly by juveniles. The wing moult starts towards the end of the month (Delany *et al.* 2009) and moulting flocks beginning to assemble at sites such as the Wadden Sea and the north coast of the Caspian Sea (Lebedeva & Butiev 1999). In Fennoscandia, females depart breeding grounds during the second half of the month, leaving successful males to guard their young (Adriaan de Jong, pers. comm.).

July. Breeding continues at northerly latitudes. Most British chicks fledge. Increasing numbers of west European birds gather on the coast as the post-breeding moult continues (Delany *et al.* 2009). During the moult birds are fairly sedentary (Sach 1968). There is little evidence of further movements following the moult: many birds, particularly in Europe, will spend the rest of the non-breeding season at their moulting sites (del Hoyo *et al.* 1996). Birds arrive in Tunisia (Claudia Feltrup-Azafzaf pers. comm.).

August. Final month of breeding at northern latitudes. Moult flocks increase in size as increasing numbers of birds undertake their autumn migration. The first migrants arrive in southern Africa (Underhill 1997). There is some overland passage in eastern & southern Africa, as birds move southwest towards wintering sites on the Atlantic Coast (Urban *et al.* 1986, del Hoyo *et al.* 1996).

September. Juveniles from continental Europe begin to arrive at their coastal wintering sites.

October. Eastern European birds continue moving south and west.

November. The last birds complete their southbound migration (Delany *et al.* 2009). During the winter the species usually forages singly or in small groups, occasionally aggregating into flocks of several thousand individuals, especially at roosting sites.

December. Birds remain on their non-breeding grounds. Last moults finish in northern Scotland (Simon Foster, pers. comm.). Many first-year birds spend the whole of the following year on their wintering grounds (Bainbridge and Minton 1978) including in southern Africa (Delany *et al.* 2009).

1.4. Migration routes

Most Eurasian Curlew populations are fully migratory (del Hoyo *et al.* 1996) although there can be considerable variation in the migratory behaviour between populations.

Irish birds appear to be largely resident and **Ireland** sees an influx of birds arriving from northern **Britain**, which also overwinter on the **British** coast of the **Irish** Sea. Birds from southern **Britain** winter mostly in southwest **Britain**, **France** and occasionally **Spain** (Bainbridge and Minton 1978). Bainbridge and Minton's study discussed variation in the timing of migration by fledged juveniles. Whilst some had travelled long distances by early August, the movement of many was slow: 70% were within 100 km of their natal site in August. This was reduced to 55% in September, and down to 6% in October.

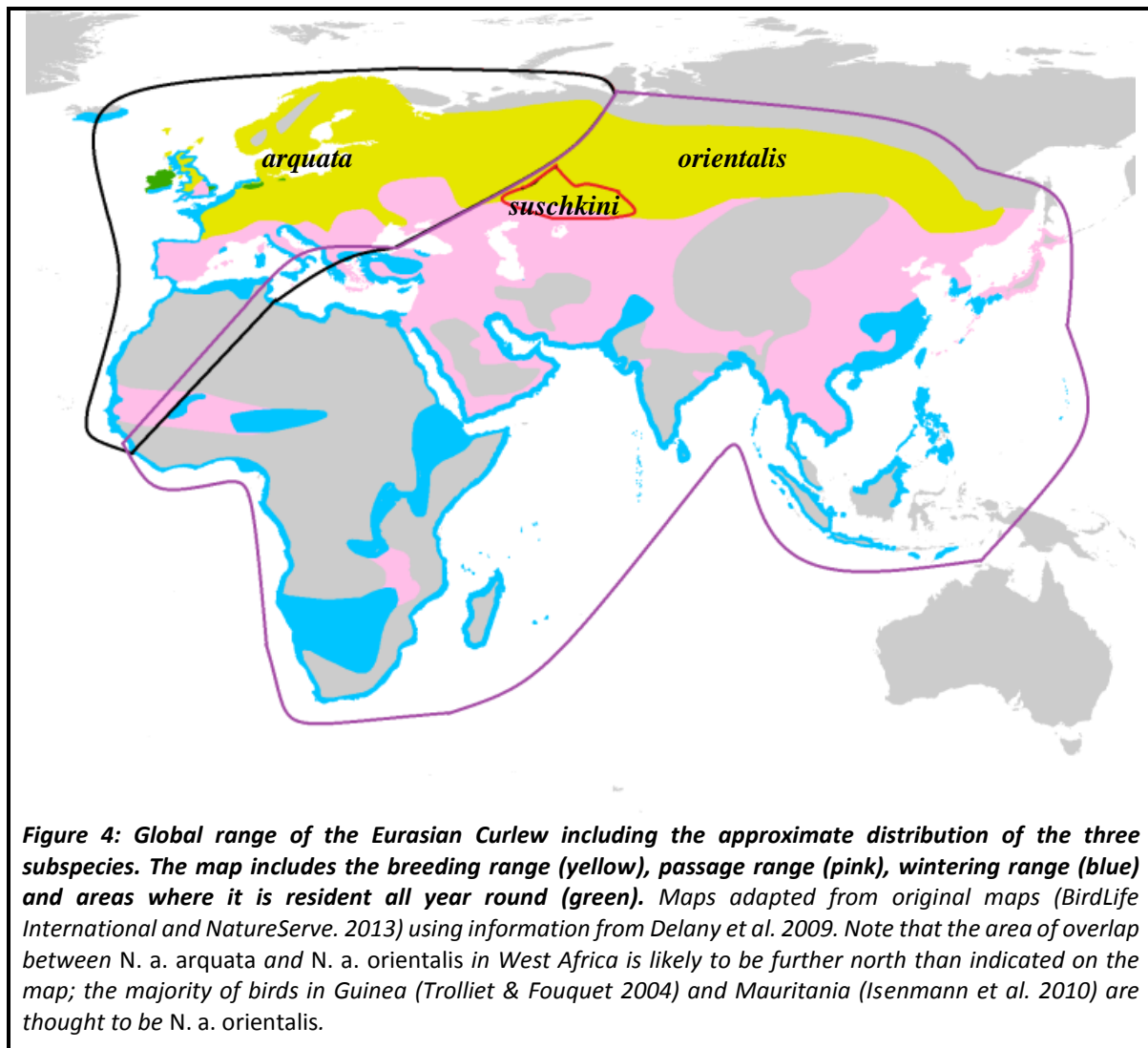
Breeding populations in **Fennoscandia**, the **Baltic states** and north-west **Russia** winter in the **British Isles**, the **Netherlands**, **Germany** and western **France**. A small population also winters in the coastal north of **Norway** (Strann 1993). Some may extend into **Iberia** and beyond.

Breeding populations in **Germany**, **Belgium**, **Denmark** and the **Netherlands** mostly winter in the **Wadden Sea** and the **British Isles**, although some birds winter inland in **Germany** (Trösch, 2003). The arrival of birds into **Britain** swells the wintering population, and internationally important numbers (i.e. over 1% of the global *N. a. arquata* population) can be found at Morecambe Bay and the Wash (Austin *et al.* 2014). Similarly, the vast numbers arriving into **German**, **Dutch** and **Danish** stretches of the Wadden Sea results in 4 sites holding internationally important numbers. The Rhine-Maas-Schelde Delta and Friesland Province in the **Netherlands** also host internationally important numbers, as too does Baie des Veys at Marais du Cotentin, **France**.

Ringling recoveries have shown that whilst birds from southern **Finland** winter in western **France**, those from northern **Finland** largely winter in **Britain** (Jensen & Lutz 2006). Birds from southern **Germany** and **France** also winter in western **France**, and into **Iberia**. Many migrate beyond the **Iberian** peninsula, extending into the Atlantic coast of **West Africa**, where internationally important numbers winter in the Banc d'Arguin National Park, **Mauritania** and the Bijagos Archipelago, **Guinea-Bissau**. The exact range limits of *arquata* and *orientalis* in West Africa, whilst poorly understood, are thought to overlap to an unknown degree. However, the majority of birds in **Guinea** and **Mauritania** are thought to be *orientalis* (Trollet & Fouquet 2004, Isenmann *et al.* 2010). There have been no definitive records of *N. a. arquata* in southern Africa (Underhill 1997).

Birds breeding in central and southeast **Europe**, including southern **Russia**, are thought to winter around the Mediterranean coast (Smit & Piersma 1989, Boschert 2001). As large populations migrate south-westerly from **Russia**, large concentrations gather at important stopover sites including the Danube Plain and Hortobagy in **Hungary**. Whilst birds can be found around the Mediterranean coastline, large numbers concentrate in particular at one site: the Gulf of Gabès, **Tunisia**.

Birds breeding in the western region of the *N. a. orientalis* range appear to migrate in a south-westerly direction, which sees them pass through parts of eastern Europe (including large numbers in **Ukraine**, where they possibly mix with *arquata* birds) and southeast Europe (**Greece**, **Turkey**, **Bulgaria**) before migrating further into **Africa**. Large numbers are known to pass through parts of Central Asia during migration, including at Rogatoe Lake in **Uzbekistan**. Birds using this flyway also migrate in large numbers through the Middle East, and several sites hosting internationally important numbers (i.e. over 1% of the global *N. a. orientalis* population exist in **Iran** (Khouran Straits, Rud-i-Gaz and Rud-i-Hara Deltas, Rud-i-Shur, Rud-i-Shirin and Rud-i-Minab deltas), **Iraq** (Khawr Al Zubair), **Oman** (Barr Al Hikman), **Saudi Arabia** (Tarut Bay), the **United Arab Emirates** (Khor al Beideh). Flocks of several hundred birds have also been observed at sites in **Yemen** (Midi-Al-Luhayyah) and **Kuwait** (Sulaibikhat Bay).



A large number of *N. a. orientalis* birds migrate to the coasts of East and South East Asia. A portion of the population also spends the non-breeding season in South Asia. The geographical zones that separate the different migration routes are not known. As these regions are outwith the scope of AEWA, they are not described here in detail.

Lastly, little is known about the migration routes and non-breeding grounds of *N. a. suschkini*. They are thought to winter mainly in Africa (Delany *et al.* 2009) although have been recorded as far afield as **Sri Lanka** (Oriental Bird Club) and the **Netherlands** (Foundation Voorne Bird Observatory).

1.5. Site Fidelity

1.5.1. Natal philopatry

Bainbridge and Minton's 1978 study reported that of 287 Eurasian Curlew ringed as chicks in Britain, 94% of birds aged 2 years or more were recovered within 100km of their birthplace between April and June, showing that most birds return to the vicinity of their natal area to breed.

1.5.2. Winter site fidelity

Adults and first winter birds show a high degree of site fidelity to their wintering sites both within and between years. Of British & Irish Eurasian Curlew ringed as fully grown birds during the non-breeding season (including both first winter birds and adult birds), 81% were recovered within 30km of the original ringing site in subsequent winters. Virtually all were recovered within the same estuary system (Bainbridge & Minton 1978). Of recoveries within the same winter, 83% of adults were recovered

within 30km of the ringing site. The percentage was slightly less for first winter birds, with 67% within 30km and 22% within 31-100km; juveniles appear to travel further during the non-breeding season.

At one study site in Wales, UK of 3000 captures over 36 years, only 1 bird has been recovered elsewhere (Taylor & Dodd 2013).

1.5.3. Breeding dispersal

Eurasian Curlew exhibit a high degree of breeding site fidelity, rarely nesting more than 250 m from previous nesting attempts. Kipp (1982) investigated breeding dispersal (the extent of movement between years) in Germany by colour-ringing 142 adults and found that a large proportion (77.5%) remained in their territories in subsequent years, even if breeding sites were subsequently degraded. Valkama *et al.* (1998) also investigated breeding dispersal both between successful and unsuccessful pairs across two study sites of varying landscape characteristics: the 'fragmented' Vammala, which comprised 5 small agricultural units separated by woodland, farms and small villages; and the 'continuous' Kauhava, which comprised a larger area of continuous farmland of long, narrow fields separated by ditches.

In Vammala, a statistically significant difference ($p=0.034$) was found between pairs that had failed in their previous breeding attempt compared to successful pairs. Mean dispersal distance amongst failed breeding pairs was 281m (± 40.5 m, $n=24$) whilst mean dispersal of successful pairs was only 143m (± 43.2 m, $n=12$). There were too few failed nests at Kauhava to quantify breeding dispersal between successful and failed breeding attempts.

Breeding dispersal was significantly higher ($p=0.004$) in Vammala (mean dispersal distance= 236 ± 32 , $n=36$) compared to Kauhava (mean dispersal distance= 102 ± 23 , $n=18$). The differences were attributed to lower breeding densities in Vammala (allowing birds to move over larger areas) and higher nest predation rates in Vammala compared to Kauhava (70% compared to 10%), i.e. Eurasian Curlew avoid breeding close to sites where they have previously failed due to nest predation.

Breeding dispersal is highest amongst pairs that have failed in previous breeding attempts, and some evidence suggests pairs may seek new territories after continually unsuccessful breeding years (Berg 1994, Valkama & Currie 1999).

1.6. Habitat requirements

1.6.1. Breeding habitat selection and use

Eurasian Curlew breed in the boreal, temperate and steppe regions of Europe and Asia (Delany *et al.* 2009), occasionally extending as far north as the subarctic (Cramp & Simmons 1983). The altitudinal range for breeding varies from sea level to 750m (Cramp & Simmons 1983) and a variety of coastal, lowland and upland habitats are used. There are some common features of breeding habitats: the availability of wet features, a suitably long sward structure for nesting and good visibility (Berg 1992a, Valkama *et al.* 1998). As such, territories are typically in 'open' landscapes away from woodland, although patchy low-lying shrub and tall herbage are tolerated (Boschert 2001, Cramp & Simmons 1983).

They mostly breed in solitary territorial pairs (Johnsgard 1981) although small colonies are occasionally formed (Flint *et al.* 1984) including with other wader species, where they may benefit from communal nest defence against predators; the so-called 'protective umbrella' (Valkama *et al.* 1999). The nest is a shallow scrape on the ground, or on a hummock if on wet ground (Flint *et al.* 1984). Nests are sometimes in the open but more often protected on one side by tussocks of grass, heather, etc. (del Hoyo *et al.* 1996). They may also be in uniform habitat e.g. in dense swards such as those typical of leys in Sweden (de Jong, 2014) or in sparse swards e.g. spring cropping.

In upland areas, they breed in wet and dry heathlands, peat-bogs, fens, acid grassland and steppe. In the UK they often breed in moorland (unenclosed farmed land) containing *Calluna vulgaris* (Stillman & Brown 1994) and *Molinia caerulea* (Haworth & Thomson 1990). Structural heterogeneity within these moorland habitats is important; abundance typically increases with varied vegetation height and the

presence of plants indicative of wet ground including rushes *Juncus spp.* (Pearce-Higgins & Grant 2006). Enclosed agricultural grasslands adjacent to moorlands can be an important component of these moorland territories (see later). In the steppes of southern **Russia** and western **Kazakhstan**, birds breed in dry meadows within lake depressions, amidst large sandy expanses (Belik 1998). They have also successfully adapted to breeding in a variety of lowland agricultural systems, such as permanent pastures, meadows, grass leys and extensive farmland in large swampy river valleys (Hayman *et al.* 1986). In many regions, farmland supports substantial proportions of the population: two-thirds of the **Swedish and Norwegian** population and 90-95% of the **Finnish** population breeds in farmland. Arable fields are utilised as well, for example in **Germany** (Boschert 2004), the **Netherlands and Finland**, where they breed in spring-sown cereals and potato crops (Jensen & Lutz 2006, Valkama *et al.* 1998). However, within these arable landscapes, the availability and proportion of grassland as brood-rearing habitat is important: tall grasslands occur more frequently in territories than would be expected by its availability (Valkama *et al.* 1998, Berg 1992a). Arable fields and improved grasslands comprise preferred foraging habitats for adults during the breeding season (Berg 1992a, de Jong 2012). The temporal usage of both habitats has been found to vary in different study areas, but both habitats are probably preferred due to higher invertebrate densities (especially earthworms), higher foraging success rates due to more open swards and prey being more conspicuous on tillage (Valkama *et al.* 1998, Berg 1992a, Galbraith *et al.* 1993).

Coastal marshes and dune valley systems are also used for breeding (del Hoyo *et al.* 1996), including grazed shore meadows in **Finland**. Grassy or moss-dominated bog habitats within forests have also been reported in certain parts of their range (del Hoyo *et al.* 1996) and birds nest on large open aapa mires in Northern Scandinavia (Adriaan de Jong, pers. comm.).

As the range of nesting habitats suggests, Eurasian Curlew adapt to new breeding habitats in response to modification by man. One **German** study (Peitzmeier 1952) observed how nests at one study site were confined to an area of boggy ground, with no nests in the surrounding arable land. The boggy ground was subsequently drained and cultivated, yet the birds remained site faithful and bred on the same ground despite the transition to arable cropping. In subsequent years, nest sites expanded into the previously avoided cultivated land; the expansion was attributed to the imprinting of young birds reared on the new habitat (Cotter 1990). There is evidence from the **UK** and **Germany** that populations traditionally nested in upland moorland and raised bog respectively, before expanding into surrounding farmland (Hötter pers. comm.). Conversely, birds started breeding in **Estonian** farmland in 1956 in areas not close to mires (Jaanus Elts, pers. comm.). In Sweden, birds started breeding in arable fields (cereals and leys) when they replaced natural damp grasslands as a result of drainage and cultivation (Adriaan de Jong, pers. comm.).

In Berg's Swedish study, there was evidence that the most important factor when selecting a territory was good foraging habitat. This is probably a necessity for the energy-demanding acts of territory establishment and egg production (Berg 1992a). Nest sites in close proximity to good foraging habitat may allow feeding adults to quickly come to the aid of the incubating adult during acts of nest defence (Berg 1992a).

Berg (1993) showed that foraging behaviour changed as the breeding season progressed. Earthworms are an important part of the diet during the pre-breeding period due to their large biomass compared to other invertebrates. Berg found that birds preferred to forage in habitats where earthworms were readily available, namely sown grasslands. Here, they enjoyed higher foraging success compared to tillage - despite both habitats containing similar earthworm biomass - because cultivation destroys earthworm burrows and therefore reduces prey availability. Whilst surface-living invertebrates are not a particularly important prey source during the pre-breeding period, Berg found them to be more important during the breeding season, as their biomass increased.

1.6.2. Breeding Density

Breeding density can vary considerably between different habitats. Densities may range from 5-7 breeding pairs/km² on parts of mainland Northern Ireland, **UK** (Grant *et al.* 1999) to 16-17 breeding pairs/km² on the Orkney Isles, **UK** (Andy Knight, pers. comm.). In moorland sites in the UK, densities were 1.85 breeding pairs/km² in upland plots where dwarf shrubs (e.g. *Calluna vulgaris*) comprised 0-

33% of vegetation cover. This increased to 2.77 in plots containing 33-66% dwarf shrub cover but reduced to 2.45 in plots with 66-100% dwarf shrub; densities peak where vegetation structure is relatively heterogeneous in terms of height (Pearce-Higgins & Grant 1996). At Swedish study sites breeding density varied from 0.1-0.68 breeding pairs/km² (Berg 1992b). In 700 ha of open farmland interspersed with forestry and settlements in northeast **Sweden**, densities have fallen from ~ 5 breeding pairs/km² in the 1990s (de Jong 1990) to ~3 breeding pairs/km² (Adriaan de Jong, pers. comm.). In **Finland**, nesting density varied from 1.6 breeding pairs/km² on arable ground interspersed with towns and forests, compared to 6.7 breeding pairs/km² in a similar arable setting without woodlands and towns (Valkama *et al.* 1999).

1.6.3. Habitat selection and use at stopover and staging sites

Many Eurasian Curlew migrate directly to their wintering grounds to moult, where they remain until return migration commences (Bainbridge & Minton 1978). As such, staging sites appear to be uncommon (staging sites defined here as per Warnock 2010, as sites with abundant, predictable food resources whereby birds prepare for an energetic challenge requiring substantial food stores and physiological changes e.g. crossing an ocean or mountain chain). However, birds are known to moult in the Wadden Sea before continuing westwards.

Stopover sites may be frequently used by some populations (defined here as per Warnock 2010, as sites used for a short length of time, subsequent to relatively short subsequent flights to their next step, and relatively low fuelling rates and fuel loads). Birds migrating westwards through Sweden are known to occasionally stopover at inland sites and alpine meadows, then coastal sites in Norway, before migrating to the British Isles. These sites are used for short periods of time and their overall migration to the British Isles is rapid (Adriaan de Jong, pers. comm.). Birds that migrate to West Africa pass through France and Iberia.

1.6.4. Winter habitat selection and use

Outside of the breeding season, the species frequents a variety of coastal and inland habitats. The majority are found in coastal areas, where large estuarine mudflats are the preferred habitat (Lack 1986). Lesser-used coastal habitats include sandflats, rocky and sandy beaches with pools, mangroves, saltmarshes, coastal meadows and the muddy shores of coastal lagoons (Johnsgard 1981, Snow & Perrins 1998). Substantial numbers also forage in adjacent grasslands at high tide. Whilst most birds winter on the coast, in certain regions, especially Europe, significant numbers also winter inland (Delany *et al.* 2009) where the shores of inland lakes, riverbanks, inland grasslands and arable fields are all used (del Hoyo *et al.* 1996). A UK study suggested that habitat selection may change from coastal to inland sites in response to the onset of hunting (Bainbridge and Minton 1978). Several studies have noted the tendency of short-billed birds, predominately the smaller males, to feed on pastures whilst longer-billed birds, predominately females, feed on mudflats (Cramp & Simmons 1983) where they often form territories up to 1 hectare in size (Cotter 1990). Inland birds are not territorial and frequently feed in flocks, enabling less time looking for predators (Cotter 1990).

1.7. Diet

The Eurasian Curlew is omnivorous. The following account is mostly adapted from Cramp and Simmons (1983) unless otherwise stated: A range of invertebrate prey items are taken at coastal sites. Polychaetes comprise an important part of the diet, with *Nereis*, *Cirriformia*, lugworm *Arenicola* and sand mason worms *Lanice* all foraged from the littoral zone. So too are a variety of crustaceans, including crabs *Carcinus*, shrimps *Crangon* and amphipods such as *Corophium*, *Gammarus*, *Bathyporeia* and *Orchestia*. Also included are bivalve molluscs including peppery furrow shell *Scrobicularia*, clams *Macoma* and *Mya*, mussels *Mytilus* and cockles *Cardium*. Occasionally small fish are taken, such as the common goby *Pomatoschistus microps*.

Inland, during the breeding season, the adults and larvae of several beetle *Coleoptera* families are eaten, such as the ground beetles *Carabidae*, clown beetles *Histeridae*, rove beetles *Staphylinidae*, water scavenger beetles *Hydrophilidae* and scarab beetles *Scarabaeidae*. Adults and pupae of various fly *Diptera* species are taken; importantly the larvae and pupae of crane flies *Tipulidae*, and various *Muscomorpha* species. Other invertebrates include earthworms *Lumbricidae*, grasshoppers and locusts

Acrididae, crickets *Gryllidae*, earwigs *Dermaptera*, bugs *Hemiptera*, the larvae of *Lepidoptera*, caddisflies *Trichoptera*, dragonflies *Odonata*, mayflies *Ephemeroptera*, ants *Formicidae*, freshwater shrimps *Gammarus*, woodlice *Isopoda* and spiders *Araneae*. Occasionally, vertebrates may be taken, including small fish, frogs *Rana* and toads, lizards, young birds and occasionally eggs, and small rodents. On wintering grounds, curlews will frequently attempt to steal food from each other and other waders (Cotten 1990).

A variety of plant material is also included in the diet, including mosses *Bryophyta*, horsetails *Equisetum* and sea lettuce *Ulva*. In late summer the berries of various shrubs are consumed, such as bilberry *Vaccinium*, crowberry *Empetrum*, blackberry *Rubus* and cranberry *Oxycoccus*. The leaves and grain of cereals and grasses *Gramineae* are also taken.

1.8. Survival and productivity

1.8.1. Population modelling

Grant *et al.* (1999) described a stable population model for the **UK**, which assumed (1) zero immigration, (2) breeding at three years old, (3) survival from fledging to 1-year old of between 50-65%, (4) annual adult survival of 88% and (5) annual survival rate from 1-year old to breeding also of 88%. This model requires annual productivity in the region of 0.48-0.62 fledged young per breeding pair.

Valkama and Currie (1999) calculated that 0.79 fledged young per breeding pair was required for their **Finnish** study population, assuming (1) breeding at 2 years, (2) first-year survival of 47% and (3) second year survival being similar to adults.

Similarly, Roodbergen *et al.* (2012) described a stable population based on (1) adult survival of 70-90% and (2) juvenile survival of 0.35-0.55 (both taken from Klok *et al.* 2009) that would require 0.7-1.6 fledged young per breeding pair.

Another productivity study for a population in Westphalia, **Germany**, suggested 0.41 fledged young per breeding pair was required for population stability (Kipp 1999).

1.8.2. Adult survival, juvenile survival and longevity

Several studies have explored adult and juvenile (post-fledging) survival. Survival is broadly similar between the sexes (Berg 1994) but is lower in juveniles (Bainbridge & Minton 1978). In Finland, adult survival was estimated at 84.4% during 1995-1996 for both sexes combined (Valkama & Currie 1999) which was similar to estimates in Sweden of 82.1% (Berg 1994). Estimates from one UK study placed first-year, post-fledging survival at 47% (lower than other wading birds that have been studied), second-year survival at 63% and adult survival at 73.6% (Bainbridge & Minton 1978).

A more recent UK study, based on long-term ringing data in Wales estimated an average annual survival rate of 89.9% from 1974-2011; a period encompassing both prior to and following a hunting ban in 1982. Estimated adult survival increased slightly following the ban (from 86.9% (se=0.04) to 90.5% (se=0.01)) whilst longevity increased by at least 40%; from 8 years (range 5-10) for a bird hatched in 1974 to 16 years (range 9-22) for a bird hatched in 1982 (Taylor & Dodd 2013).

The same study estimated that the mechanised cockle harvesting which occurred in the winter of 1996/97 had reduced apparent survival from 95% (se=0.07) to 81% (se=0.19) for the two years following dredging. Assuming that this represented an actual impact on survival (and not emigration from the estuary study site) the reduction in longevity was estimated to be considerable; a 5 year (39%) reduction from the pre-dredging estimate of 18 years (Taylor & Dodd 2013).

The longevity record is 32 years (Robinson 2005).

1.8.3. Productivity

Several studies have shown productivity to be below the threshold required for a stable population, with productivity across Western Europe and Fennoscandia averaging 0.34 fledged young per breeding pair (Taylor & Dodd 2013; Roodbergen *et al.* 2012).

At two study sites in Northern Ireland, productivity was estimated to be 0.14-0.26 and 0.20-0.47 (Grant *et al.* 1999). This was deemed sufficiently low to account for the 58% decline in the breeding population recorded between 1987-1999 (Grant *et al.* 1999, Henderson *et al.* 2002). Similarly, a 4-year study over 18km² of arable farmland in southwest Finland found overall productivity to be just 0.32, and concluded this was likely to be responsible for the observed 23% decline in the study area's breeding population (Valkama & Currie 1998). Mean productivity was estimated to be 0.25 across mixed and arable farmland in Sweden, and again deemed too low to maintain a stable population (Berg 1994). Similarly low productivity has been recorded in Germany; between 0.28 and 0.53 between 1977 and 1986 (Dornberger & Ranftl 1986) and between 1977 and 1990 productivity was recorded at 0.32 in the Upper Rhine Valley (Boschert & Rupp 1993). Between 1991 and 2003 this was as low as 0.05 (Boschert 2004).

1.8.4. Nest survival and causes of nest and chick loss

Nest survival does not appear to be influenced by vegetation height around the nest, nor to clutch laying date (Grant *et al.* 1999). Like most waders, the Eurasian Curlew typically lays 4 eggs (range 1-7) often 1.5-1.8 days apart (Mulder & Swann 1992, Berg 1992b). Incubation typically lasts around 30 days and starts after the laying of the 3rd or 4th egg (Grant *et al.* 1999) thereby ensuring that all eggs hatch around the same time.

Nest failure rates are particularly high during the egg-laying period. In four out of five study site years in Northern Ireland, less than 50% of nests survived through to clutch completion (Grant 1997). Studies have shown the frequency of replacement clutches to be highly variable (Valkama & Currie 1999, Berg 1992, Grant *et al.* 1999). For instance, 76% of first clutch failures were replaced in the Swedish study (Berg 1992) compared to 0% of 10 well monitored nests on the Orkney Islands, UK (Grant *et al.* 1999). There is evidence to suggest replacement clutches only occur when nest failure occurs during egg-laying or early incubation, and replacement clutches are thought to be less productive (Valkama & Currie 1999). Seven days typically elapse between nest failure and replacement clutches (Grant *et al.* 1999).

Even successful clutches still suffer partial losses. Grant *et al.*'s study (1999) found these partial losses result from a variety of sources, including infertility (42.5%), predation (40%), desertion prior to last egg(s) hatching (17.5%) and trampling (10%). As a result of these partial losses, successful nests produced an average of 2.75 ± 0.25 hatched young at the mainland study site in Antrim and 3.02 ± 0.17 at the island site of Lough Erne.

Several studies have found predation to be the largest source of nest failure. At the Northern Irish study sites, between 1993 and 1995, only 3.6-19.0% of all nests hatched, and nest predation accounted for 85-97% of these failures. A German study found 70 out of 136 nests between 2001-2005 to have been predated (Boschert 2004, 2005) whilst a recent unpublished study in Germany recorded 66% nests lost due to predation (n=35), and three due to desertion and agricultural practices (Natalie Busch, pers. comm.). In Valkama & Currie's study in Finland (1999), 68% of nests failed to reach hatching with nest predation accounting for 81% of failures. Mainly all nest predation events were attributed to mammals (Red Fox *Vulpes vulpes*, Raccoon Dog *Nyctereutes procyonoides* or European Badger *Meles meles*). Other sources of nest loss in Valkama & Currie's (1999) study were desertion (3%) and spring farming operations (16%; although nests in arable fields were cane marked, and it was accepted that loss to agricultural operations is higher).

Predation also appears to be the largest source of chick mortality, however less studies have been conducted. In the Northern Irish study (Grant *et al.* 1999), estimated chick survival (measured from hatching to 31 days of age) ranged from 19.1-38.5% across three study site years, with predation accounted for 74% of chick mortality. Chick survival has also been estimated at 38.3% (Cramp & Simmons 1983) and 20.3% (Boschert & Rupp 1993).

Whilst predation has emerged as the main proximate cause of both nest and chick failure, since the majority of failed breeding attempts occurred during the nest stage, nest predation is thought to be the greatest factor limiting productivity (Grant *et al.* 1999). An important finding from the Finnish study

was that whilst 64% of nests were depredated in the 'fragmented' Vammala study site, only 5% were depredated in area of 'continuous' Kauhava study site (Valkama *et al.* 1999).

1.8.5. Chick survival and post-hatching movements

Chicks fledge at approximately five weeks and become independent soon after: it takes over a week between their initial flights and full aerial vigilance (Adriaan de Jong, pers. comm.). Adults and chicks will move around their home range using different foraging habitats. Of 18 broods studied in the North Pennines, UK, the mean maximum distance recorded from nest sites was 374m (Grant 1997). A study in Sweden found movements up to a maximum of 1.5km from the nest site (Berg 1992b).

Table 1: Summary of population estimates from Waterbird Population Estimates 5 (Wetlands International 2012).

Subspecies	Season	Population Name	Start Year	End Year	Minimum (ind.)	Maximum (ind.)	Estimate Quality	1% Threshold ¹	References
<i>N. a. arquata</i>	Non-breeding	Europe/Europe North & West Africa	1990	2000	700,000	1,000,000	Expert Opinion	8,400	BirdLife 2004b, Thorup 2006
<i>N. a. orientalis</i>	Non-breeding	Western Siberia/SW Asia E & S Africa ²	1987	1991	25,000	100,000	Best Guess	1000	Perennou <i>et al.</i> 1994
<i>N. a. orientalis</i>	Non-breeding	S Asia	1987	1991	10,000	100,000	Best Guess	1000	Perennou <i>et al.</i> 1994
<i>N. a. orientalis</i>	Non-breeding	E & SE Asia	2008	2008	100,000	100,000	Expert Opinion	1000	Cao <i>et al.</i> 2009
<i>N. a. suschkini</i>	Breeding	Southeast Europe & South-west Asia	2009	2009	1	10,000	Best Guess	100	Delany <i>et al.</i> 2009

¹ 1% of a species or biogeographic population is the minimum population threshold required for a site to be considered of international importance under criterion 6 of the Ramsar Convention.

² whilst not implied in the population's name, the wintering range described in WPE5 for the "Western Siberia/SW Asia E & S Africa" population is described as 'SW Asia, E & S Africa (few SW Africa)'.

1.9. National population information

The most contemporary information on the numbers and trends for Eurasian Curlew are presented below in Tables 3 and 4.

Key to quality

Good: reliable quantitative data available (e.g. atlas, survey or monitoring data).

Moderate: generally well known, but only poor, outdated or incomplete quantitative data available.

Poor: poorly known, with no quantitative data available.

Unknown: information on the quality of data was unavailable

Table 2: National information on breeding populations and trends. Occasional breeding occurs also in the Czech Republic, Serbia, Montenegro, Italy, Faroe Islands and Spain, however these Range States have been excluded due to low numbers.

Country/ Subspecies	Population (breeding pairs)	Year(s)	Quality	Short-term trend	Year(s)	Quality	Long-term trend	Year(s)	Quality	References ³
Austria <i>N. a. arquata</i>	140–160	2011-2012	Good	Increase	2001-2012	Good	Increase	1980-2012	Good	EU Article 12 Reporting; Michael Dvorak; Grinschgl & Malicek 2010; Kohler & Rauer 2010; Uhl 2013; Ulmer <i>et al.</i> 2012
Belarus <i>N. a. arquata</i>	950–1,200	1997-2000	Good	Increase	1997-2000	Unknown	-	-	-	BirdLife International 2004a
Belgium <i>N. a. arquata</i>	500–600	2008-2012	Moderate	Stable	2000-2012	Moderate	Stable	1980-2012	Moderate	EU Article 12 Reporting
Denmark <i>N. a. arquata</i>	330	2011	Moderate	Stable	1999-2011	Good	Increase	1980-2011	Good	EU Article 12 Reporting
Estonia <i>N. a. arquata</i>	2,000–4,000	2008-2012	Moderate	Decline	2001-2012	Moderate	Decline	1980-2012	Moderate	EU Article 12 Reporting Elts <i>et al.</i> 2013.
Finland <i>N. a. arquata</i>	76,000–88,000	2006-2012	Good	Stable	2001-2012	Good	Decline	1983-2012	Good	EU Article 12 Reporting Bird monitoring schemes of the Finnish Museum of Natural history

³ Note that access to the original sources was not available for most EU range states.

Country/ Subspecies	Population (breeding pairs)	Year(s)	Quality	Short-term trend	Year(s)	Quality	Long-term trend	Year(s)	Quality	References ³
France <i>N. a. arquata</i>	1,300–1,600	2010-2011	Good	Stable	1996-2010	Good	Stable	1983-2011	Good	EU Article 12 Reporting
Germany <i>N. a. arquata</i>	3,700–5,000	2005-2009	Good	Stable	1998-2009	Moderate	Decline	1985-2009	Moderate	EU Article 12 Reporting
Hungary <i>N. a. arquata</i>	20–60	2008-2012	Good	Unknown	2000-2012	Moderate	Unknown	1980-2012	Poor	EU Article 12 Reporting
Ireland <i>N. a. arquata</i>	98	2008-2013	Good	Decline	1991-2013	Poor	Decline	1972-2013	Poor	EU Article 12 Reporting NPWS Unpublished Data; BWI Unpublished Data; Balmer <i>et al.</i> 2013; Lauder & Donaghy 2008
Kazakhstan* <i>N. a. suschkini</i> <i>N. a. orientalis</i>	No Data									
Latvia <i>N. a. arquata</i>	134-288	2000-2004	Moderate	Unknown	-	-	Stable	1980-2004	Moderate	EU Article 12 Reporting
Lithuania <i>N. a. arquata</i>	50-100	2008-2012	Moderate	Decline	2001 -2012	Moderate	Decline	1980-2012	Moderate	EU Article 12 Reporting Kurlavičius 2006
Netherlands <i>N. a. arquata</i>	4,643–5,949	2008-2011	Moderate	Decline	2002-2011	Good	Decline	1984-2011	Good	EU Article 12 Reporting
Norway <i>N. a. arquata</i>	2,500-5000	1994/2003 /2015	Good	Decline	1996-2013	Moderate	-	-	-	Shimmings & Øien 2015
Poland <i>N. a. arquata</i>	250–350	2008-2013	Moderate	Decline	2000-2013	Moderate	Decline	1980-2013	Moderate	EU Article 12 Reporting
Romania <i>N. a. arquata</i>	1–10	2008-2013	Moderate	Unknown	2000-2012	Poor	Unknown	1980-2012	Poor	EU Article 12 Reporting
Russia <i>N. a. arquata</i>	48,000–120,000	1990-2000	Poor	Decline	2001-2013	Poor				Mischenko 2004; Pavel Tomkovich, pers. comm.:
Russia <i>N. a. orientalis</i>	?	-	-	-	-	-	-	-	-	
Slovenia <i>N. a. arquata</i>	12–15	2007-2012	Moderate	Stable	2001-2012	Moderate	Stable	1980-2012	Moderate	EU Article 12 Reporting
Sweden	6,800–11,000	2008-2012	Moderate	Decline	2001-2012	Good	Decline	1980-2012	Good	EU Article 12 Reporting

Country/ Subspecies	Population (breeding pairs)	Year(s)	Quality	Short-term trend	Year(s)	Quality	Long-term trend	Year(s)	Quality	References ³
<i>N. a. arquata</i>										
UK <i>N. a. arquata</i>	68,000	2009	Good	Decline	1998-2010	Good	Decline	1980-2010	Good	EU Article 12 Reporting Musgrove <i>et al.</i> 2013.; Harris <i>et al.</i> 2014; Baillie <i>et al.</i> 2013.
Ukraine* <i>N. a. arquata</i>	50-75	2001-2002	Medium	-2						BirdLife International 2004a

Table 3: National information on non-breeding populations and trends.

Country/ Subspecies	Wintering Population (Individuals)	Year(s) of the estimate	Quality	Short- term trend	Year(s) of the estimate	Quality	Long-term trend	Year(s) of the estimate	Quality	References
Austria <i>N. a. arquata</i>	700-900	1995- 2010	Good	Stable	1995-2010	Good	1980-1995	Increase	Good	Schuster 2011; Egretta; Jürgen Ulmer, Anne Puchter, Alwin Schönenberger & Bianca Burtscher, 2012; Schuster 2010
Belgium <i>N. a. arquata</i>	8,872-25,925	2008- 2012	Good	Unknown	2001-2012	Good	Unknown	1980-2012	Moderate	EU Article 12 Reporting
Bulgaria <i>N. a. arquata</i>	10-95	2008- 2012	Moderate	Stable	2000-2012	Good	Decline	1980-2012	Poor	EU Article 12 Reporting
Denmark <i>N. a. arquata</i>	15,300	2008	Good	Increase	2000-2011	Good	Increase	1980-2011	Moderate	Birds in Europe 3 <i>in prep.</i>
France <i>N. a. arquata</i>	20,000-65,000	2008- 2012	Good	Increase	2000-2012	Good	Increase	1980-2012	Good	Wetlands International & ONCFS 2010, 2011 & 2012. Fouquet M. 2013. EU Article 12 Reporting
Germany <i>N. a. arquata</i>	100,000	2000- 2005	Good	Fluctuating	1997-2009	Moderate	Decline	1987-2009	Moderate	EU Article 12 Reporting
Greece* <i>N. a. arquata</i> <i>N. a. orientalis</i>	1,000-2,000	1987- 1991	Unknown	Unknown	Unknown	Unknown	Stable	1970-1990	Unknown	BirdLife International 1994
Guinea- Bissau <i>N. a. arquata</i> <i>N. a. orientalis</i>	4148	2010s	Unknown	Decrease	1990s-2010s	Unknown	Decrease	1980s- 2010s	Unknown	Unpublished data, AEWA conservation status review
Guinea <i>N. a. arquata</i> <i>N. a. orientalis</i>	3940	2000s	Medium							Trolliet & Fouquet 2004
Iran* <i>N. a. orientalis</i>	14,430 ⁸	1970- 1977	Moderate	-	-	-	-	-	-	Critical Site Network Tool; Delany <i>et al.</i> 2009.

Iraq <i>N. a. orientalis</i>	3,000-7,000	2010-2014	Moderate	No trend	-	-	No trend	-	-	Salim, M.A. <i>et al.</i> 2007
Ireland <i>N. a. arquata</i>	27,830	2006-2011	Moderate	Decrease	1999-2011	Good	Decrease	1987-2011	Moderate	EU Article 12 Reporting; Crowe & Holt 2013;
Italy* <i>N. a. arquata</i>	6,207-7,218	2007-2009	Good	Increase	2000-2009	Good	Increase	1991-2009	Good	Birds in Europe 3 <i>in prep.</i>
Kuwait* <i>N. a. orientalis</i>	490-860	1988-1990	Moderate	-	-	-	-	-	-	BirdLife International 2014
Mauritania <i>N. a. arquata</i> <i>N. a. orientalis</i>	4,000	2010s	Unknown	Decrease	1990s-2010s	Tbc	Decrease	1980s-2010s	tbc	Unpublished data, AEWa conservation status review
Morocco <i>N. a. arquata</i>	308	2010s	Unknown	Decrease	1990s-2010s	Tbc	Decrease	1980s-2010s	tbc	Unpublished data, AEWa conservation status review
Netherlands <i>N. a. arquata</i>	143,390-219,237	2006-2010	Good	Increase	2000-2011	Good	Increase	1981-2011	Good	EU Article 12 Reporting
Norway <i>N. a. arquata</i>	100-500	2006	Moderate	Stable/ Fluctuating	1995-2005	Moderate	Stable/ Fluctuating	1980-2011	Moderate	Svorkmo-Lundberg <i>et al.</i> 2006; Ranke <i>et al.</i> 2011, Wold <i>et al.</i> 2012.
Oman <i>N. a. orientalis</i>	8,250-8,500	2008-2014	Poor	Decline	2008/09-2013/14	Poor	Stable	1986-2013	Moderate	De Fouw. J. <i>et al</i> in prep; Eriksen & Victor 2013.
Portugal <i>N. a. arquata</i>	1,218	2008-2012	Good	Fluctuating	2001-2012	Good	Stable	1988-2012	Moderate	EU Article 12 Reporting
Romania* <i>N. a. arquata</i>	40-60	1990-2002	Unknown	Unknown	-	-	Fluctuating	1990-2002	Unknown	BirdLife International 2004
Saudi Arabia* <i>N. a. orientalis</i>	2,000-2,700	1990-1992	Moderate	-	-	-	-	-	-	BirdLife International 2014
Senegal <i>N. a. arquata</i> <i>N. a. orientalis</i>	417	2010s	Unknown	Decrease	1990s-2010s	Unknown	Stable	1980s-2010s	Unknown	Unpublished data, AEWa conservation status review
Slovenia <i>N. a. arquata</i>	35-70	2001-2012	Moderate	Stable	2001-2012	Moderate	Unknown	1980-2012	Poor	EU Article 12 Reporting

Spain <i>N. a. arquata</i>	4,233-5,063	2008-2010	Good	Stable	2000-2010	Good	Increase	1980-2010	Good	EU Article 12 Reporting
Turkey <i>N. a. orientalis</i>	1,200-2,000	-	Moderate	Decline	1991-2001	Poor	-	-	-	Kılıç & Eken 2004.
Tunisia <i>N. a. arquata</i>	4,000-7,500	2006-2013	Moderate	Decline	2006-2013	Moderate	Decline	1976-2011	Moderate	Czajkowski 1984; Van Dijk <i>et al.</i> 1984; AAO database 2013
Ukraine* <i>N. a. arquata</i> <i>N. a. orientalis</i>	1,400-3,700 (passage only)	Unknown	-	-	-	-	-	-	-	Delany <i>et al.</i> 2009
United Arab Emirates* <i>N. a. orientalis</i>	1,440-1,650	1990-1992	Moderate	-	-	-	-	-	-	Critical Site Network Tool
United Kingdom <i>N. a. arquata</i>	150,000	2004-2008	Good	Decline	1999-2010	Good	Increase	1980-2010	Good	Holt <i>et al.</i> 2012
Uzbekistan <i>N. a. orientalis</i>	180-1,500 ¹	-	-	-	-	-	-	-	-	Elena Kreuzberg, pers. comm. 2014.
Yemen <i>N. a. orientalis</i>	<1,000	-	Poor	-	-	-	-	-	-	Richard Porter, pers. comm. 2014.

2. THREATS

2.1. General Overview of Threats

This chapter discusses threats that are known or suspected to be having a negative impact on Eurasian Curlew populations. They include factors that are **directly** affecting population size through increased mortality of adults and chicks as well as factors that are **indirectly** affecting population size through loss of habitat, disturbance, etc. Threats have been assessed for each subspecies and have been made on the basis of severity (the impact on the population) and scale (the proportion of the population affected by the threat).

Several scientific studies have investigated threats acting upon Eurasian Curlew populations in Europe, both on their breeding grounds and on their wintering grounds. In such cases, the impact that threats have on the population is relatively well understood, supported by published scientific papers (i.e. experimental or correlative studies). Several studies have recorded productivity levels below those required for population stability, and there is consensus that breeding population declines are being caused by low productivity alongside the loss, degradation and fragmentation of breeding habitats. In the near future, there are concerns that senescence (an ageing population as a consequence of poor breeding success) may begin to exacerbate the trend of reproductive failure, and also lead to decreasing adult survival (Taylor and Dodd 2013). A summary overview of threats is provided in Table 4, followed by a description of each threat and an explanation of its rank, as set out below.

Key to threat assessment ranks⁴:

Critical: a factor causing or likely to cause very rapid declines (>30% over 10 years)

High: a factor causing or likely to cause rapid declines (20-30% over 10 years)

Medium: a factor causing or likely to cause relatively slow, but significant, declines (10-20% over 10 years)

Low: a factor causing or likely to cause fluctuations

Local: a factor causing or likely to cause significant impacts at specific sites

Unknown: A factor likely to affect the subspecies but it is unknown to what extent

⁴ Note that the AEWA ISSAP format categorises threat ranks quantitatively. Knowledge of the quantitative impact of particular threats on populations of Eurasian Curlew is highly variable. In some instances, no quantitative data is available at all. In such instances, threats are categorised as ‘unknown’, together with a best guess as to their rank, if one can be made. Such instances would be displayed as e.g. ‘unknown/local’ which would denote that the impact is unknown, but experts believe it is only having a local impact.

Table 4: Overview of threats acting upon the three subspecies of Eurasian Curlew.

	Stress	Threat	<i>N. a. arquata</i>	<i>N. a. orientalis</i>	<i>N. a. suschkini</i>
BREEDING SEASON	Mortality on breeding grounds	A. Nest and chick predation	Critical	Unknown	Unknown
		B. Nest destruction and increased chick mortality due to agricultural operations (including mowing, trampling and burning)	Medium-high	Unknown/local	Unknown
		C. Mortality caused by <u>hunting</u> on breeding grounds	Absent-low	Medium-high	Medium-high
		D. Mortality caused by <u>illegal killing</u> on breeding grounds	Absent	Unknown	Unknown
	Loss, degradation and fragmentation of breeding habitats	E. Impacts of agricultural on breeding habitats (including intensification, specialisation and disturbance)	Critical	Low	Low
		F. Land abandonment on breeding grounds	Unknown/medium	Unknown/low	Absent
		G. Loss and degradation of peat bog habitats used for breeding	Unknown/medium	Unknown	Unknown
		H. Pollution on breeding grounds	Unknown	Unknown	Unknown
		I. Afforestation on breeding grounds	Medium	Low	Low
		J. Residential and commercial developments on breeding grounds	Local	Local-medium	Low
		K. Oil and gas drilling and associated infrastructure on breeding grounds	Local	Local-medium	Local
		L. Human disturbance on breeding grounds (excluding disturbance from agricultural activities)	Local	Local-medium	Local-medium
		M. Expansion of wind turbines on breeding grounds	Medium	Low	Low
		N. Impact of climate change on breeding grounds	Local-medium	Local-medium	Local-medium
NON-BREEDING SEASON	Mortality on non-breeding grounds	O. Mortality caused by <u>hunting</u> during migration and on non-breeding grounds	Unknown/disputed	Unknown	Unknown
		P. Mortality caused by <u>illegal killing</u> during migration and on non-breeding grounds	Unknown/low	Unknown	Unknown
	Loss, degradation & fragmentation of non-breeding habitats	Q. Pollution on non-breeding grounds	Unknown	Unknown	Unknown
		R. Human disturbance on non-breeding grounds	Unknown	Unknown	Unknown
		S. Shellfisheries on non-breeding grounds	Low	Unknown	Unknown
		T. Impact of climate change (incl. sea level rise) on non-breeding grounds	Local-medium	Local-medium	Unknown
		U. Residential and commercial developments on non-breeding grounds	Local	Unknown/ medium	Unknown
		V. Drainage on non-breeding grounds	Local	Unknown	Unknown

Threats on breeding grounds

A. Nest and chick predation

arquata: critical
orientalis: unknown
suschkini: unknown

Predation levels can be influenced both directly and indirectly by human activity. Nest predation of a group of wading birds in Western Europe, including Eurasian Curlew, has increased 4-fold over the last four decades (Roodbergen *et al.* 2012). Populations of several avian and mammalian predators of nests and chicks have increased in recent decades (Roos *et al.* 2012). Factors responsible for these increases include: decreasing levels of predator control for sporting or farming reasons (e.g. leading to increased Red Fox *Vulpes vulpes* and crow *Corvid spp.* populations); the introduction and subsequent range expansion of non-native species (e.g. Raccoon *Procyon lotor*, Raccoon Dog *Nyctereutes procyonoides*, American mink *Neovison vison*); and the recovery of depleted populations following the introduction of environmental legislation (e.g. recovery of raptors following the DDT ban, protected status of Badgers *Meles meles* in the UK).

Landscape and habitat variables may also influence predation pressure by benefitting predators and/or their hunting strategies. The conversion of rough grazings into improved grasslands may have increased food supplies for mammalian and avian predators through increasing the availability of carrion and soil invertebrates (Grant *et al.* 1999) whilst uniform grass swards and reduced habitat heterogeneity may increase the ease with which predators locate nests and chicks (Grant *et al.* 1999, Valkama *et al.* 1999). Predation of Eurasian Curlew nests and chicks has been found to be higher in fragmented landscapes (Valkama *et al.* 1999). Finally, lower nesting densities in increasingly fragmented landscapes may also result in a reduction in the effectiveness of communal nest defence of waders (Valkama *et al.* 1999).

The main predators of nests and chicks have been shown to vary in different geographic areas. Where medium-sized mammalian predators are present (Red Fox *Vulpes vulpes*, European Badger *Meles meles*, Raccoon *Procyon lotor*, Raccoon Dog *Nyctereutes procyonoides*) they appear to depredate the majority of nests and chicks (Grant *et al.* 1999, Valkama *et al.* 1999, Berg 1992b). In the absence of medium-sized mammalian predators (e.g. on islands) high levels of predation may still occur through avian predators (Grant *et al.* 1999). A study in the UK uplands found an almost significant ($p=0.08$) negative correlation between Common Raven *Corvus corax* abundance and Eurasian Curlew abundance, implying further research is required to better understand whether ravens are contributing to Eurasian Curlew declines (Amar *et al.* 2008).

In a UK study area containing low Fox and Crow densities due to intensive predator control for Red Grouse *Lagopus lagopus scotica* shooting, the Stoat *Mustela erminea* was identified as the main predator of Eurasian Curlew nests and chicks (Grant 1997).

The relative impact of different predators therefore appears to be site-specific, and the absence or reduction of one predator species may result in higher levels of predation from others. The interactions between different predators are highly complex. In some landscapes the reduction or removal of a top predator in an ecosystem (e.g. fox) may lead to a surge in the population of medium-sized predators (e.g. stoat) resulting in an overall increase in the predation of vulnerable prey species: a process known as mesopredator release.

An increasing number of studies are assessing these complex interactions and evaluating the impact of predator control as a potential management tool for increasing the productivity of ground-nesting birds. An experimental study in the UK uplands found that the control of Carrion Crows, small mustelids and Red Foxes resulted in a 3-fold increase in Eurasian Curlew nesting success and a significant increase in the number of Eurasian Curlew (Fletcher *et al.* 2010). Whilst the impact of Foxes, Badgers, Raccoons, Raccoon Dogs, mustelids and possibly Ravens can have an impact on Eurasian Curlew breeding success and population numbers, research has shown no population level impact of adult and sub-adult predation by birds of prey e.g. Peregrine Falcon *Falco peregrinus* (Amar *et al.* 2008).

In certain locations (e.g. northern Fennoscandia) the influence of human predator management on mesopredator abundance is far more localised and less influential; mesopredator populations are driven by other factors such as vole cycles (de Jong, pers. comm).

N. a. arquata: The impact of this threat has been assessed as ‘Critical’ with a high degree of confidence. Modelling by Grant *et al.* (1999) predicted that the productivity levels recorded at a mainland study site⁵ would lead to a decline of 25-40% over a 6-year period, which would be sufficient to account for the 25% observed population decline in Northern Ireland between 1986 and 1992 (i.e. a 6-year period). Extrapolating, such a rate of decline would exceed 30% over a ten-year period. Since predation was the overwhelming source of nest and chick mortality in this study, and that high levels of nest and chick predation have been recorded in numerous study populations (Valkama *et al.* 1999, Berg 1992b, Boschert 2004, 2005) and is increasing across much of Europe (Roodbergen *et al.* 2012), predation of nest and chick predation is likely to be causing very rapid population declines (>30% over 10 years).

N. a. orientalis: insufficient information is available to make an assessment on this threat. It has therefore been assessed as ‘unknown’.

N. a. suschkini: insufficient information is available to make an assessment on this threat. It has therefore been assessed as ‘unknown’.

<p>B. Nest destruction and increased chick mortality due to agricultural operations (including mowing, trampling and burning)</p>	<p><i>arquata</i>: medium-high <i>orientalis</i>: unknown/local <i>suschkini</i>: unknown</p>
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Eurasian Curlew nest and rear their broods in a variety of agricultural grasslands and crops. Nests and chicks are therefore highly susceptible to farming operations that take place during the breeding season.

In areas where birds nest in arable crops, operations such as ploughing, harrowing, sowing, rolling and spraying could all destroy nests. Harvesting typically takes after the breeding season. Studies from Sweden have shown that of the small number of nests that occur in spring-sown cereals, a proportion of nests are destroyed by operations (see section 1.7.4) whilst a study in Lower Saxony, Germany found that farming operations destroyed all nests in arable fields (Tuellinghoff & Bergmann 1993).

Agricultural grasslands include permanent pastures, grass leys (temporary grass fields within an arable/grassland rotation), meadows and rough grazings. The management and timing of operations can vary greatly between these grasslands, but operations such as rolling and cutting can result in nest destruction and chick mortality, as too can trampling by livestock.

A study in the UK found tramping by cattle accounted for 20-33% of nest failures (Grant 1997). The impact of nest trampling is associated with the stocking density and livestock used (Green 1985). In parts of Germany, considerable effort is put into chick protection schemes during mowing periods (Natalie Busch, pers. comm.).

New EU agricultural regulations require some form of agricultural activity to occur for the payment of agricultural subsidies, including on fallow land. Where such activities take place during the nesting and chick-rearing period they may have impacts on the breeding success of ground-nesting birds. Whilst Member States have reduced the potential impact by prohibiting agricultural activity for a period during the summer (e.g. 1 March to 30 June in Sweden) some losses could still result from these policies (David Schönberg Alm, pers. comm.).

Whilst the burning of abandoned grasslands is thought to be increasing in European Russia, it is not expected to be having a population-level impact (Vladimir Morozov, pers. comm.). The burning of grasslands to encourage fresh growth for livestock also occurs on breeding grounds in parts of Siberia, and when undertaken during the breeding season this can obviously destroy nests and chicks. However, since land abandonment is also increasing across European Russia (Vladimir Morozov, pers. comm.) it is possible that burning abandoned grasslands might actually provide overall benefits by preventing scrub formation and maintaining habitat diversity e.g. through creating short grassy areas for feeding.

⁵ Grant *et al.* (1999) studied a mainland and an island population. In terms of implications for the wider breeding range, the results from the mainland site are likely to be more representative of breeding sites across the majority of the global range, as mammalian predators were present (unlike at the island site).

In summary, studies have shown that agricultural operations do result in nest destruction and chick mortality across a suite of agricultural habitats (upland pastures, lowland wet grassland, spring cropping) and across the range.

N. a. arquata: This impact is likely to vary considerably across the breeding range, due to variation in preferred nesting habitats and the agricultural management they are subject to. This threat appears to be particularly prevalent at southern latitudes, where birds nest in more intensively managed grasslands. Overall, this threat has been assessed as Medium-High, recognizing that in some Range States (e.g. the Netherlands) it may be High-Critical.

N. a. orientalis: The general decline in all forms of farming activity across the breeding range (Brown *et al.* 2014) suggest that nest and chick losses to agricultural activity are probably decreasing across the breeding range as a whole. It will still likely to be a factor at certain sites. It has therefore been assessed as 'unknown/local'.

N. a. suschkini: insufficient information is available to make an assessment on this threat. It has therefore been assessed as 'unknown'.

C. Mortality caused by hunting on <u>breeding</u> grounds

<i>arquata</i> : absent-low <i>orientalis</i> : medium-high <i>suschkini</i> : medium-high

For a long-lived species with low productivity, Eurasian Curlew populations are especially sensitive to adult mortality (Jensen & Lutz 2006).

N. a. arquata: No hunting occurs on breeding grounds within EU member states, nor in Norway, which together account for 61-77% of the breeding population. Information on hunting in Belarus is lacking. Eurasian Curlew are a game species in regions of Russia, but the open season occurs mostly outwith the breeding season (early August to December) and the species is not popular quarry. Whilst some gaps in information exist, it is unlikely that hunting on breeding grounds is impacting on the population. It has therefore been assessed as 'absent-low'.

N. a. orientalis & *N. a. suschkini*: Expert opinion is that hunting pressure has increased considerably across parts of the both subspecies' breeding ranges in recent years, and whilst there is no statistical or published evidence to support this, experts believe it to be having a negative impact on the population (Brown *et al.* 2014). It has therefore been assessed as 'unknown/medium-high'.

D. Mortality caused by <u>illegal killing</u> on breeding grounds

<i>arquata</i> : absent <i>orientalis</i> : unknown <i>suschkini</i> : unknown

N. a. arquata: Illegal killing and collecting is not thought to occur at any detectable level on European breeding grounds nor in European Russia. It has therefore been assessed as 'absent'.

N. a. orientalis: Eurasian Curlew are a game species only in certain regions of Russia; they are protected in other regions. Illegal killing and collecting was not highlighted as an issue in a recent review of all *Numenius spp.* (Brown *et al.* 2014). It has therefore been assessed as 'unknown'.

N. a. suschkini: Insufficient information is available to make an assessment on this threat. It has therefore been assessed as 'unknown'.

E. Impacts of agricultural on breeding habitats (including intensification, specialisation and disturbance)

<i>arquata</i> : critical <i>orientalis</i> : low <i>suschkini</i> : low

Recent decades have seen large-scale agricultural improvements (e.g. drainage, reseeded with more agriculturally productive grasses, increased fertiliser rates, etc) across a large proportion of the breeding range. Grasslands subject to such management typically result in a homogenous habitat (i.e. a uniform sward structure with low plant species diversity). Such grasslands are fast-growing, allowing earlier and more frequent mowing compared to semi-natural or agriculturally unimproved grasslands (Baines 1989, Donaghy & Mellon 1998). Low plant species diversity combined with frequent cutting reduces

the diversity of surface-dwelling invertebrates, which are an important source of food later in the breeding season (Berg 1993). It is important to note that improved grasslands can provide high-quality foraging grounds for adults when part of a mosaic of wetlands and varying grassland habitats (e.g. Ewing *et al.* 2012); the problem arises when improved grassland dominates agricultural landscapes.

The impact of a reduction of grassland habitats in arable landscapes (i.e. areas where cropping is the dominant land use) that support breeding populations has been documented in parts of Finland (Tiainen 2001, Tiainen & Pakkala 2001), southern Sweden (Berg 1992), and the upper Rhine Valley, Germany (Boschert 2004, 2005). Similarly, in grassland-dominated landscapes, the loss of arable fields may cause a reduction in quality of breeding habitat (de Jong 2012).

Wetland habitats are a key component of breeding habitat. Drainage is a management practice used to increase agricultural production (it increases the growth rate of crops and grass and reduces the susceptibility of livestock to certain diseases such as liver fluke) and can include both the maintenance of existing field drainage systems (often a requirement of EU cross compliance) as well as new field drainage systems. Political pressure from the agricultural sector to provide grant support for land drainage continues (e.g. NFUS 2014). The method of drainage is important as certain drainage systems (e.g. overland drainage systems or ‘footdrains’) can improve the quality of breeding habitat (e.g. Smart and Coutts 2004), and replacing such systems with underground drainage systems leads to habitat degradation and population decline. For example, in northern Sweden, the majority of Eurasian Curlew breed on well-drained farmland, but densities have dropped in response to open ditches being replaced with underground drainage systems (Adriaan de Jong, pers. comm.).

***N. a. arquata*:** Large-scale changes in farming practices that have had negative consequences for farmland breeding habitats have occurred across much of breeding range in recent decades, and continues today. Evidence quantifying the overall scale and population-level impact on Eurasian Curlew populations isn’t available, but many of the farming practices outlined above clearly result in the loss and degradation of breeding habitat, and are evident across a large proportion of the range. It has therefore been assessed by experts as ‘Critical’.

***N. a. orientalis*:** Large-scale changes in farming practices (excluding land abandonment which has been assessed separately) is not considered to be having a population-level impact due to a general trend of reduced farming activity across Siberia (Brown *et al.* 2014). It has therefore been assessed as ‘low’.

***N. a. suschkini*:** Experts believe that whilst there has been an increase in the scale and intensity of cropping in recent decades across the breeding range, it is not resulting in any impact on the population (Brown *et al.* 2014). It has therefore been assessed as ‘low’.

F. Land abandonment on breeding grounds

***arquata*: unknown/medium**
***orientalis*: unknown/low**
***suschkini*: absent**

Land abandonment can occur at a landscape, farm and field level. Decline in farming activity across large areas, driven by global economic and social trends, has occurred in regions of northern European Russia and Scandinavia (Vladimir Morozov, Adriaan de Jong, pers. comm.), resulting in ecological succession taking place; breeding habitats sustained by farming will revert to coarse grasslands then ultimately scrub and forest. In such landscapes, breeding areas have become restricted to peatlands and meadow floodplains (Vladimir Morozov, pers. comm.). In some eastern European Range States (e.g. Lithuania), the collapse of the Soviet agricultural scheme led to important farmland breeding habitats (e.g. alluvial meadows, fens) being undermanaged and degraded due to the development of rank grassland and scrub encroachment (Kurlavičius and Raudonikis 1999). Other examples include the Saone Valley, France (Broyer & Roche 1991), parts of the UK uplands and Västerbotten, Sweden, where abandonment was associated with population decline and range contraction (Adriaan de Jong, pers. comm.).

Whilst reversing such trends is impossible in certain regions, agricultural support schemes do exist to support the continuation of farming in certain areas. Where these are adequately resourced and targeted they may maintain breeding habitat.

Land abandonment may also occur at the individual farm level, whereby certain fields or areas are ‘undermanaged’ as production is increasingly focused on more agriculturally productive fields. Sometimes this under-management is exacerbated by agri-environment management (O’Brien & Wilson 2011). It is important that these undermanaged areas are sufficiently grazed and/or cut to provide breeding habitat; if the level of agricultural activity is too low then these fields may become dominated by tall, rank vegetation (e.g. *Juncus spp.*) and scrub.

N. a. arquata: Increasing land abandonment is reported to be occurring in several Range States (e.g. Russia, Sweden, Estonia, Ireland, UK) which together host approximately 62% of the population (based on tallying up mean national population estimates). However, it only affects certain regions within these Range States. Whilst the evidence base is poor and no quantitative data exists, since it is occurring over a reasonable proportion of the breeding range, and is expected to be having an impact where it does occur, the impact is likely to be greater than just ‘local’. For these reasons it has been assessed as ‘unknown/medium’.

N. a. orientalis: There is much less information available in terms of the scale of land abandonment, but expert opinion is that declining farming activity across Siberia is not likely to be having a population-level impact (Brown *et al.* 2014). It has therefore been assessed as ‘unknown/low’.

N. a. suschkini: large-scale land abandonment was not been reported to be occurring across the breeding range during a recent review (Brown *et al.* 2014). It has therefore been assessed as ‘absent’.

G. Loss and degradation of peatland habitats on breeding grounds

<i>arquata</i> : unknown/medium <i>orientalis</i> : unknown/ <i>suschkini</i> : unknown

Peatland habitats (e.g. lowland raised bog) are an important breeding habitat in several Range States. Anecdotal evidence from Germany and the UK suggests that Eurasian Curlew first began breeding on farmland after colonising farmland from adjacent bog habitats. In the future, peatland habitats may become increasingly important refuges in areas where farmland no longer provides suitable breeding habitat.

Peatland habitats can be degraded by several land management practices (Gunnarsson & Löfroth 2009) including peat extraction for fuel and horticultural products, overgrazing by livestock and native herbivores, burning and lastly drainage, which facilitates many of the other practices. Peat extraction typically involves peat being cut at the onset of the breeding season, so disturbance can be a secondary issue. Grazing and burning, when delivered at the appropriate intensity, can maintain a varied vegetation structure which benefits Eurasian Curlew and other species (Pearce-Higgins & Grant 2006). The wider environmental benefits, specifically relating to carbon sequestration and natural floodplain management, of restoring the hydrological function of peatlands has been increasingly well documented in recent years, resulting in several restoration projects.

N. a. arquata: more than half of the countries in Europe have lost 90% or more of their original natural peatlands (Wetlands International 2003). Whilst utilisation of peat and the subsequent degradation of peatland habitats still occurs across Europe, degradation is likely to be increasingly offset by large-scale peatland restoration projects that are occurring in several Range States (e.g. Belarus, Latvia, Lithuania, UK, Ireland) some of which are specifically targeted towards Eurasian Curlew (Saulius Svazas, pers. comm). No data is available to quantify the impact of this threat, but overall it is considered by experts to be having a negative impact on the population. It has therefore been assessed as ‘unknown/medium’.

N. a. orientalis: insufficient information is available to make an assessment on this threat. It has therefore been assessed as ‘unknown’.

N. a. suschkini: insufficient information is available to make an assessment on this threat. It has therefore been assessed as ‘unknown’.

H. Pollution on breeding grounds

<i>arquata</i> : unknown <i>orientalis</i> : unknown <i>suschkini</i> : unknown

Increased emissions and downfall of nitrogen can alter soil fertility, altering the competitive relationship between plant species, leading to scrub and tree establishment and a subsequent degradation of habitat quality. This process has been proposed as a major factor for declining populations in southern and central Sweden (de Jong & Berg 2001). In a study in western Finland, Valkama and Currie (1998) found higher heavy metal concentrations within Eurasian Curlew eggs in polluted areas compared to control areas. Accumulated PCB residues have been found in adults (Denker & Buthe 1995) and clutches (Boschert 1992, 2004), including some showing very high levels. Generally little is known about the susceptibility of the species to PCBs, but they are not considered a major threat in most countries.

All subspecies: whilst pollutants are present within breeding habitats and have been detected within birds, there is no evidence to support whether pollutants have any impact on any demographic parameters (survival rates, hatching success, etc) although there is general consensus amongst experts that it is likely to be having some impact. It has therefore been assessed as ‘unknown’ with the acknowledgment that further research is required (see Section 4. Framework for Action).

I. Afforestation on breeding grounds

***arquata*: medium**

***orientalis*: low**

***suschkini*: low**

New woodland planting can cause both loss and fragmentation of breeding habitat as well as a reduction in the quality of habitat surrounding the new woodland (Douglas *et al.* 2014). This secondary impact is sometimes referred to as the ‘edge effect’, whereby waders avoid nesting close to forest edges as a possible adaptation to forest edge habitats typically containing higher densities of avian and mammalian predators (Stroud *et al.* 1990, Valkama *et al.* 1998, Berg 1992a). Eurasian Curlew have been found to nest further from forest edges than random nest sites (Berg 1992a, Valkama *et al.* 1998). Predation rates are often higher in landscapes fragmented by woodland (Valkama *et al.* 1999), the result of which is often reduced productivity leading to population decline.

***N. a. arquata*:** Afforestation of breeding habitats is particularly apparent in the UK, where low-grade agricultural land in the uplands is increasingly being converted to forestry; Scotland, which is estimated to host around 55% (~37,400 breeding pairs) of the UK’s Curlew population (O’Brien 2004), has a policy to increase the area of woodland cover from 17% to 25% by 2050 (Scottish Government 2015). Such farmland is often found within landscapes that hold breeding curlew. A recent correlative study suggests that increasing woodland cover from 0-10% within 1km of Curlew breeding sites requires a 50% increase in human predator control effort to achieve population stability (Douglas *et al.* 2014). This study also found that the negative impact of afforestation was greatest in areas containing high breeding densities. Another study estimated that since the 1950s, 5000 breeding pairs had been lost from a local authority region of Scotland due to the planting of conifer plantations on open ground (Ratcliffe 2007). The issue of inappropriately-sited woodland appears to mostly be confined to the UK. However, since the UK supports approximately 26% of the population (Figure 1) afforestation on breeding grounds has been assessed as ‘medium’.

***N. a. orientalis*:** commercial forestry is thought to be increasing across the breeding range (Brown *et al.* 2014). It has therefore been assessed as ‘low’.

***N. a. suschkini*:** commercial forestry is thought to be increasing across the breeding range (Brown *et al.* 2014). It has therefore been assessed as ‘low’.

J. Residential and commercial developments on breeding grounds

***arquata*: local**

***orientalis*: local-medium**

***suschkini*: low**

Nest and chick predation rates are typically higher in fragmented landscapes (see Section 1.8.4. for details). Inappropriately sited buildings can contribute to habitat fragmentation both visually and by increasing predator densities: building and associated gardens can provide predator perches and nest sites; cats and dogs are frequently introduced to the landscape; and refuse may provide an additional food source to support predators.

N. a. arquata: It is unlikely that this threat will occur over a large enough area of the breeding range to have any population-level impact. It has therefore been assessed as ‘local’.

N. a. orientalis: Whilst no quantitative data exists, this threat is considered by experts to be increasing across the breeding range and to be having a population-level impact (Brown *et al.* 2014). It has therefore been assessed as ‘local-medium’.

N. a. suschkini: this threat was not perceived by experts to be a threat during a recent review (Brown *et al.* 2014). It has therefore been assessed as ‘low’.

K. Oil and gas drilling and associated infrastructure on breeding grounds

arquata: local
orientalis: local-medium
suschkini: local

Oil and gas drilling, with associated roads and service corridors, lead to habitat loss and fragmentation and are important contributors to increasing levels of the human disturbance and pollution issues discussed earlier.

N. a. arquata: this threat is very localised and is not thought to be impacting on the population.

N. a. orientalis: activities relating to oil and gas drilling are increasing across the breeding range, and whilst no quantitative data exists, this threat is considered by experts to be having some level of population-level impact (Brown *et al.* 2014). It has therefore been assessed as ‘local-medium’.

N. a. suschkini: activities relating to oil and gas drilling are believed to be increasing across the breeding range but not to be having any population-level impact (Brown *et al.* 2014). It has therefore been assessed as ‘local’ in recognition that it may be having some local impacts.

L. Human disturbance on breeding grounds from recreational activities

arquata: local
orientalis: local-medium
suschkini: local-medium

Note: disturbance arising from agriculture is assessed within threat ‘E. Impacts of agricultural on breeding habitats (including intensification, specialisation and disturbance’ for the reason that such disturbance events are linked to wider agricultural management practices, and so conservation actions designed to combat such disturbance are best considered within the context of wider farming actions. However, the information below is useful for considering the impact that disturbance from farming activities exerts on populations. The same is true for disturbance which only occurs due to other threats e.g. peat extraction, wind turbines.

A variety of human activities can result in increased levels of disturbance of breeding birds. Such disturbance exerts a direct influence on breeding activities as well as indirect influences on food supply (Boschert & Rupp 1993) and may exacerbate the impact of other threats outlined in this section. For example, disturbance may result in higher rates of nest predation if, following a disturbance event that forces an incubating adult to leave the nest, crows return to the disturbed area faster than the incubating adult (Jensen & Lutz 2006). Alarm calls and other behaviours in response to disturbance could also alert predators to the whereabouts of nests and broods. Research in the Upper Rhine Valley, Germany highlighted the impact of human disturbance on breeding success. 30% of nest losses (39/131) were assigned to disturbance events, which encompassed agricultural activity, recreational activities, military use, predation and weather (Boschert & Rupp 1993). The flying of model aircraft and density of road traffic have been shown to have an impact on the nesting and feeding distribution of a breeding population (Boschert 1993). Failed breeding attempts due to high levels of public access to farmland have also been reported in Sweden, where dogs, horse riding and ATVs can pose a problem (Adriaan de Jong, pers. comm.).

N. a. arquata: Eurasian Curlew nesting in the UK uplands have typically been associated with areas of low potential disturbance (Haworth & Thompson 1990) and large areas of the UK, Fennoscandia and Russia, which together host > 90% of the population, are likely to suffer relatively low levels of disturbance. Conversely, disturbance in Dutch moorland habitats by walkers and dogs is thought to be significant, whilst recreational activities are perceived to be increasing within some Range States (e.g.

Denmark, Estonia, Austria, Poland). This threat has been assessed as ‘local’, in recognition that large portions of the population may be subject to relatively low levels of disturbance, but that disturbance can have a particularly large impact locally.

N. a. orientalis and *N. a. suschkini*: levels of disturbance are increasing within the breeding ranges of both subspecies and this threat is considered by experts to be having a population-level impact (Brown *et al.* 2014). They have therefore been assessed as ‘local-medium’.

M. Expansion of wind turbines on breeding grounds	<i>arquata</i> : medium <i>orientalis</i> : low <i>suschkini</i> : low
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Research suggests that the impact of wind turbines on breeding populations may vary between sites. Research at an upland site in Scotland found that birds demonstrated clear turbine avoidance (Pearce-Higgins *et al.* 2009). Conversely, research at a lowland site in Germany found no evidence of wind turbines impacting on the overall population trend for the site; however, there was weak evidence that suggesting turbines had a displacement effect up to 200 metres (Reichenbach 2001).

N. a. arquata: The construction of wind turbines coincides with breeding habitats in several Range States (e.g. Ireland, Germany, UK) and whilst the evidence suggests different populations might respond differently, expert opinion is that wind turbines are likely to have a population-level impact, especially in the future as increasing numbers of wind farms are constructed within breeding areas. As such, this threat has been assessed as ‘medium’ with the acknowledgment that further research is required (see *Section 4. Framework for action*).

N. a. orientalis & *N. a. suschkini*: This threat is not considered by experts to be having an impact on the breeding grounds of either population (Brown *et al.* 2014). It has therefore been assessed as ‘low’.

N. Impact of climate change on breeding grounds	<i>arquata</i> : local-medium <i>orientalis</i> : local-medium <i>suschkini</i> : local-medium
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Climate change predictions are associated with an increase in the frequency and intensity of severe weather events, including flooding and droughts. Both have the potential to impact negatively on habitat quality and productivity, particularly cold, wet weather conditions that occur during the breeding season; if sustained for over 24 hours then chicks are susceptible to starvation or hypothermia (Witt 1989, Beintema & Visser 1989). There are examples of flooding impacting on local populations; rising water levels has caused the total loss of key breeding habitats in the Volga River delta and in other coastal wetlands of the Caspian Sea (Saulius Svazas, pers. comm). The flooding of clutches is also the principle threat to breeding populations in the Pripyat River floodplain, Belarus and Nemunas River delta, Lithuania (Saulius Svazas, pers. comm).

A changing climate may also impact on breeding habitats in a more subtle, gradual manner; a prolonged growing season across northern Europe, as a consequence of climate change, may result in earlier mowing dates and longer grazing periods which could result in reduced breeding success (David Schönberg Alm & Anja Pel, pers. comm). Recent modelling work, as undertaken in *A Climatic Atlas of European Breeding Birds*, has predicted that if current climate projections are realised, by the end of the 21st Century the *simulated* potential distribution of the Eurasian Curlew will have reduced by 40% and shifted north-eastwards (Huntley *et al.* 2007).

All subspecies: there is already evidence of breeding habitat loss and deterioration as a result of climate change. This threat seems particularly apparent for populations that breed at low altitudes. Whilst quantifying the impact at population-level is not possible, it is likely that climate change will lead to both the immediate and sudden changes with consequence for local populations, as well as gradual changes that degrade habitat quality. As such, this threat has been assessed as ‘local-medium’ for all three subspecies.

Threats present on non-breeding grounds

O. Mortality caused by hunting during migration and on non-breeding grounds

arquata: unknown/disputed
orientalis: unknown
suschkini: unknown

Eurasian Curlew are a game species across several parts of their non-breeding range. For certain populations, hunting may unintentionally target younger birds. For example, adult birds from Sweden mostly migrate to northwest Europe whilst juveniles and sub-adults migrate further down the Atlantic coast (Adriaan de Jong pers. comm.). It is also likely that juveniles are more vulnerable to hunting due to their inexperience.

N. a. arquata: approximately 95% of the population overwinters in northwest Europe (Figure 3) with a small percentage migrating through into the Iberian Peninsula and West Africa, where hunting is thought to be minimal. The Eurasian Curlew is listed on Annex II, Part B of the EU Birds Directive, permitting hunted in listed Member States, stated as Denmark, France, Ireland and the UK. Hunting bans were subsequently implemented in Denmark, the UK (1982 for Scotland, England and Wales; 2011 in Northern Ireland) and Ireland (2012), whilst France implemented a 5-year moratorium on hunting in July 2008. However, in February 2012 the moratorium was partially lifted, allowing hunting at certain coastal sites from the first Saturday in August until the end of January (Mathieu Sarasa pers. comm.). The moratorium was extended for terrestrial sites and some coastal areas until 2018.

The number of birds shot in France is unknown because prior to the moratorium, annual estimates of bag size were pooled with ten other waterbird species in surveys (ONCFS 2000). A posteriori inference suggested an annual bag size of approximately 7,000-8,000 birds prior to the moratorium in 2008 (Fouquet 2013). Anecdotal evidence suggests that annual hunting bag estimates were probably overestimated due to the sampling techniques and inferences used during the survey (Mathieu Sarasa pers. comm.). Either way, the current level of hunting in France is expected to be less due to the partial moratorium at terrestrial and some coastal sites, and an ongoing survey will provide updated estimates (Enquête Nationale Tableau de Chasse ONCFS/FNC). At least 25,000-52,000 curlews were estimated to winter in France during 2010-2012 (Wetlands International & ONCFS 2010, 2011, 2012), with a peak of 80,000 during migration (Fouquet 2013).

As mentioned earlier, Eurasian Curlew are hunted in certain regions of Russia. Whilst no bag data exists, they are not a popular quarry species, at least in the northern European Russia (Vladimir Morozov, pers. comm.). The level of hunting in southern European Russia is currently unknown. The situation regarding hunting in parts of eastern Europe (Belarus, Ukraine and Romania) where Eurasian Curlew *may* pass through on migration in reasonable numbers, is also unknown.

Overall, hunting pressure will have declined considerably across Northwest Europe in recent decades due to bans and moratoria. However, whilst the numbers of birds shot in France is likely to be less than 1% of the total population, the impact of this harvesting on the total population and the portion of the population that overwinters or migrates through France en route to Iberia and West Africa, is currently disputed.

N. a. orientalis: Hunting may occur around the Black Sea, but no data or information is currently available (Vladimir Morozov pers. comm.). In Iraq, the average annual hunting bag is approximately 200-300 birds, which occurs mostly in the south (Mudhafar Salim, pers. comm.). Overall, there is insufficient data to enable an adequate assessment for the entire range. It has therefore been assessed as 'unknown' with the acknowledgment that further research is required (see Section 4. Framework for Action).

N. a. suschkini: the non-breeding range of this subspecies is currently unknown and therefore an assessment of this threat is not possible at this stage.

P. Mortality caused by illegal killing during migration and on non-breeding grounds

arquata: unknown/low
orientalis: unknown
suschkini: unknown

N. a. arquata: There is not thought to be any illegal killing or taking of birds across Europe or much of West Africa, although illegal killing is thought to be increasing in Tunisia (Claudia Feltrup-Azafaf,

pers. comm.). There are some information gaps concerning the legal status and level of hunting and/or illegal killing in some Range States in eastern Europe. Since illegal hunting is not thought to be occurring in NW Europe, Iberia and other parts of West Africa, it is probable that the impact on the population is low but confirmation of the situation in eastern Europe is needed to be certain.

***N. a. orientalis*:** In Yemen, waders are increasingly being indiscriminately trapped by falcon trappers using mist nets at coastal sites to feed falcons; whilst no data exists, it is likely this includes Eurasian Curlew (David Stanton, pers. comm.). No information has been made available regarding illegal killing (nor legal hunting) of passage birds in the eastern Mediterranean or the Middle East; indeed, the legal status of Eurasian Curlew within the Range States of these regions is largely unknown. The impact of illegal killing is therefore unknown.

***N. a. suschkini*:** the non-breeding range of this subspecies is currently unknown and therefore an assessment of this threat is not possible at this stage.

Q. Pollution on non-breeding grounds	<i>arquata</i>: unknown <i>orientalis</i>: unknown <i>suschkini</i>: unknown
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Pollution of non-breeding habitats can arise from several different sources (e.g. oil, toxic substances, plastic garbage, agricultural run-off, etc). Such pollutants have the potential to impact on Eurasian Curlew through both direct effects (e.g. the digestion of a pollutant resulting in a reduction in fitness, or mortality) and indirect effects (e.g. by negatively impacting on the invertebrate food chain). Whilst oil spills can have disastrous impacts on marine and coastal habitats, most oil pollution comes from regular shipping traffic (Hötter *et al.* 2010). As is the case on breeding grounds, there have been no studies investigating the impact of different pollutants present at wintering sites on adult and juvenile survival, or the impact they may have on subsequent breeding success. Evidence from studies of Snipe *Gallinago gallinago* (Beck & Granval 1997) suggest that ingestion rates of lead shot in some wader species may be as high as amongst wildfowl, but there have been no specific studies on Eurasian Curlew (Jensen & Lutz 2006).

There are concerns regarding the impact pollutants are having at important wintering sites, with anecdotal evidence suggests pollution from a variety of sources (including industrial effluents, domestic waste and urban run-off) is increasing in the Gulf of Gabès, Tunisia (Claudia Feltrup-Azafazaf, pers. comm.), whilst a slow but significant deterioration of habitat due to pollution is expected to be occurring at The Banc d'Arguin National Park in Mauritania (BirdLife International 2014).

Pollution of coastal sites is occurring in Yemen due to increasing agricultural run-off and the accumulation of heavy metals due to sewage outflows (David Stanton, pers. comm.) and is also increasing at non-breeding sites in Turkey, although is localised and the impact is unknown (Kiraz Erciyas-Yavuz, pers. comm.). Wetland sites used by Eurasian Curlew in southern Iraq are potentially threatened by widespread oil drilling activities as well as the resulting smoke produced from the extraction units (Mudhafar Salim, pers. comm.).

***N. a. arquata* & *N. a. orientalis*:** For both subspecies, there is no evidence to support whether pollutants have any impact on demographic parameters (survival rates, hatching success, etc). With no such evidence available, this threat has been assessed as 'unknown' and urgently requires investigating.

***N. a. suschkini*:** the non-breeding range of this subspecies is currently unknown and therefore an assessment of this threat is not possible at this stage.

R. Human disturbance on non-breeding grounds	<i>arquata</i>: unknown <i>orientalis</i>: unknown <i>suschkini</i>: unknown
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Disturbance at non-breeding sites can affect waterbirds both during feeding and roosting, especially at high-tide roosts (Burton *et al.* 2002). Eurasian Curlew are one of the most 'nervous' waders on their wintering grounds (Davidson & Rothwell 1993) with escape flight distances amongst the greatest of any intertidal feeding wader (Smit & Visser 1993). However, this is highly site-dependent and related to hunting intensity (Fitzpatrick & Bouchez 1998).

Disturbance itself can be caused by a variety of recreational and commercial activities. Dutch studies show them to be sensitive to walkers and low-flying planes near high tide roosts: a reduction of 10% available foraging time was recorded in response to aeroplane traffic (Jensen and Lutz 2006). A UK study found curlew use of intertidal mudflats was significantly lower when within 200m of footpaths and when within 25m of roads (Burton *et al.* 2002). In Spain, an experimental disturbance study found that many birds would change site completely if flushed by a single walker. This led to a 51.2% reduction in the population using the site at mid-tide, and an 83.9% reduction when the disturbance occurred at high-tide. The disturbance treatment had no effect in reducing the number of individuals within the experimental area during low-tide (Navedo & Herrera 2012).

N. a. arquata and *N. a. orientalis*: Human disturbance at coastal sites in Turkey is widespread (Kiraz Erciyas-Yavuz, pers. comm) and increasing levels of disturbance at coastal sites has also reported across the Middle East (Brown *et al.* 2014). Increased disturbance caused by expanding human activity has been identified as a medium-level threat in the Bijagós archipelago (BirdLife International 2014a) and increasing levels of disturbance is thought to be occurring at staging and wintering sites in Ireland, Sweden and Denmark. Conversely, at a population level, the wintering population of *N. a. arquata* in NW Europe has increased in recent decades (Figure 2); a period coincident with site protection under the Birds and Habitats Directives.

Disturbance is perceived to be increasing in some Range States and has been shown to impact on the foraging and roosting behaviour of Eurasian Curlew. However, the impact on daily energetic balances and individual survival rates has not been investigated. In addition, significant proportions of national wintering populations are within the Natura 2000 network, affording enhanced protection from threats including disturbance; for example, 32.8% of the UK's wintering population is within the SPA network (David Stroud, pers. comm.). Overall, this threat has been assessed as 'unknown' for both subspecies as there is no way of quantifying the impact of disturbance on the population.

N. a. suschkini: the non-breeding range of this subspecies is currently unknown and therefore an assessment of this threat is not possible at this stage.

<p>S. Shellfisheries on non-breeding grounds</p>	<p><i>arquata</i>: low <i>orientalis</i>: unknown <i>suschkini</i>: unknown</p>
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Suction dredging of shellfish species not only depletes the target species but also disrupts sediments and severely disrupts benthic invertebrate communities. This can impact on bird species dependant on benthic communities for extended periods of time (Duriez *et al.* 2012, Ferns *et al.* 2000). At a long-term study site in the UK, mechanized cockle harvesting in 1996 reduced apparent survival from 95% (best data estimate: se=0.07) to 81% (se=0.19) for two years, and was correlated with a published analysis showing reduced survival in Oystercatchers *Haematopus ostralegus* (Taylor & Dodd 2013). Dredging for Brown Shrimp *Crangon crangon* in the Wadden Sea alters benthic communities and some species, such as *Sabellaria* worms, do not recovery following intensive dredging activity (Hötter *et al.* 2010). Dredging of Blue Mussel *Mytilus edulis* beds severely impacts on the flora and fauna associated with subtidal and intertidal mussel beds; curlews often feed on invertebrates within the mussel beds (Hötter *et al.* 2010).

N. a. arquata: whilst studies have shown the impact shellfisheries can have in reducing Eurasian Curlew survival, with ~95% of the wintering population found in Northwest Europe, where there is an extensive network of protected sites, the scale of this threat is likely to have declined in recent decades. As such, it has been assessed as 'low'. Shellfisheries are likely to be having a negative impact on the segment of the population that winters in West Africa alongside *N. a. orientalis* (see below).

N. a. orientalis: large-scale fishing and harvesting of aquatic resources is leading to moderate-rapid habitat degradation in the Banc d'Arguin National Park, Mauritania (BirdLife International 2014b). Similarly, small-scale subsistence harvesting is happening across a large area of the Bijagós archipelago that the cumulative impact has been assessed as 'high' in a threat assessment for the site (BirdLife International 2014a). There is currently insufficient information regarding the scale of shellfisheries

within other parts of the range to make an informed assessment. This threat has therefore been assessed as ‘unknown’.

N. a. suschkini: the non-breeding range of this subspecies is currently unknown and therefore an assessment of this threat is not possible at this stage.

T. Impact of climate change (including sea level rise) on non-breeding grounds

arquata: local-medium
orientalis: local-medium
suschkini: unknown

Increasing drought periods in certain parts of the range could lead to degradation or loss of important staging sites. This has been reported in the Volga region of Russia, where steppe wetlands have been lost over a period of 5-7 years (Vladimir Morozov pers. comm.). Water shortages are increasing in Iraq and could have an impact (Mudhafar Salim, pers. comm.). Sea levels are predicted to rise by up to 56 cm by 2100 (International Panel on Climate Change). If natural processes were unhindered, intertidal and supratidal habitats would be expected to gradually ‘move’ inland as a result of sea level rise. However, in many coastal areas the presence of sea defence structures (i.e. sea walls) constrain and prevent this from happening, resulting in the loss of coastal habitats (‘coastal squeeze’). In the long-term, this has implications for roosting and feeding habitat, however the ability for populations to alter their wintering range towards more suitable sites, whilst largely unknown, is likely to occur.

N. a. arquata and *N. a. orientalis*: degradation and loss of vital stopover and staging habitats is already being reported. Whilst it is impossible to quantify the impact, loss of important staging sites for a highly-migratory bird cannot be understated. It is likely that there will be further large-scale local impacts similar to the situation in the Volga region, alongside more gradual degradation of wintering habitats. At the same time, climate change may result in distributional shifts as birds adapt and take advantage of new sites as they become more suitable. As such, this threat has been assessed as ‘local-medium’.

N. a. suschkini: the non-breeding range of this subspecies is currently unknown and therefore an assessment of this threat is not possible at this stage.

U. Residential and commercial developments on non-breeding grounds

arquata: local
orientalis: unknown/medium
suschkini: unknown

Increasing coastal development (for golf courses, marinas, hotels, real estates, recreation, industrial developments) is the primary reason for declines in the intertidal habitats used by Eurasian Curlew on the Arabian peninsula (Porter *et al.* 2008). Aquaculture developments pose an additional threat in some areas (David Stanton, pers. comm.).

N. a. arquata: as with several other threats, with a reasonable proportion of the wintering population found within the Natura 2000 network, it is likely that important sites will be protected from such developments, and therefore any impacts are only likely to be ‘local’.

N. a. orientalis: there is far greater development pressure at wintering sites, and this is known to be having an impact (Porter *et al.* 2008). Whilst insufficient data exists to quantify the impact, so it has been assessed as ‘unknown/medium’ since coastal development is increasing across wintering grounds in the Middle East and Africa (Brown *et al.* 2014).

N. a. suschkini: the non-breeding range of this subspecies is currently unknown and therefore an assessment of this threat is not possible at this stage.

V. Drainage on non-breeding grounds

arquata: local
orientalis: unknown
suschkini: unknown

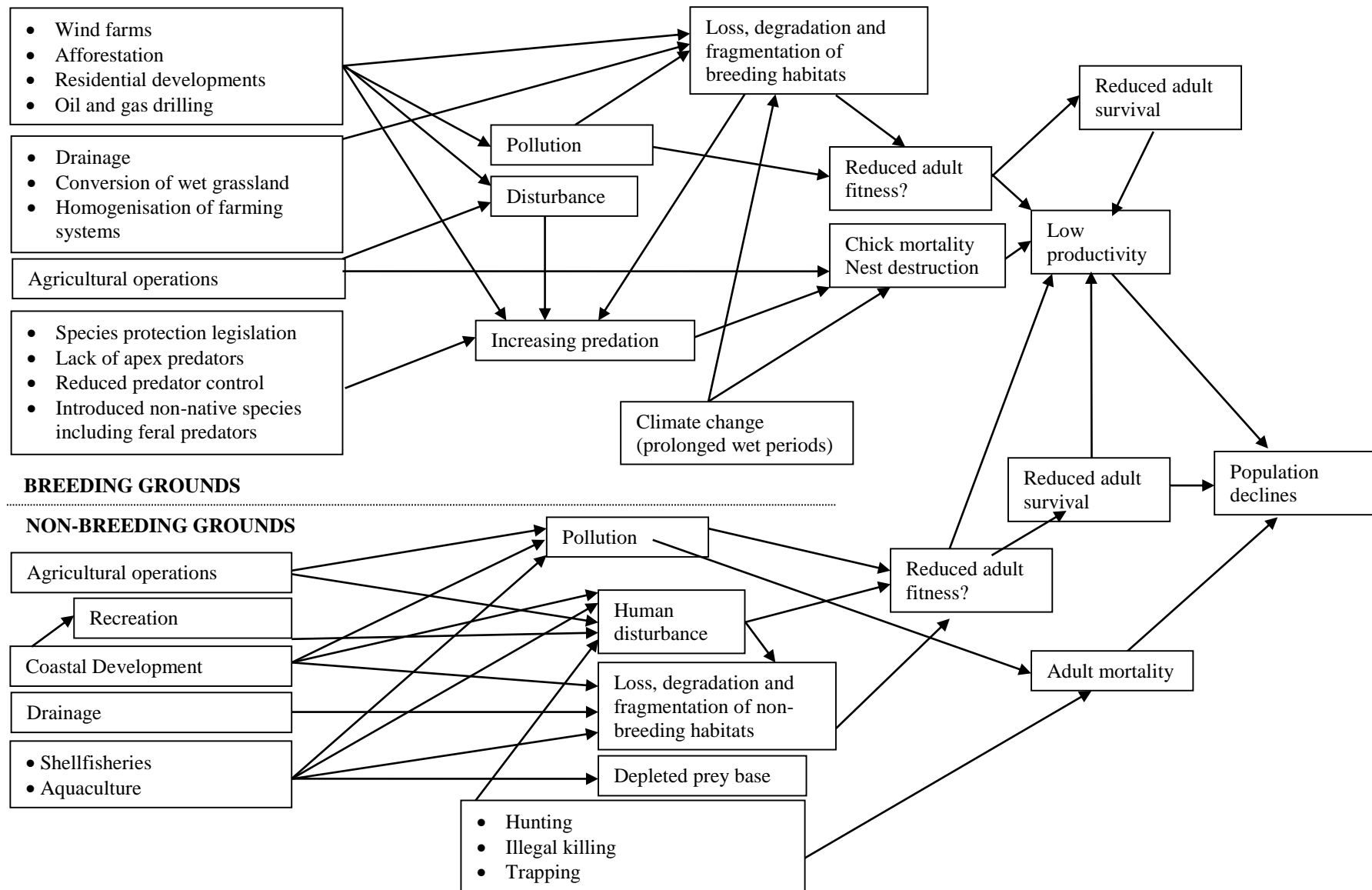
No research has been undertaken that has investigated the impact of drainage on staging or wintering birds. The impact could theoretically be large, if for example it occurred at an important staging site.

N. a. arquata: drainage is not thought to be an issue for the wintering population in NW Europe, which accounts for approximately 95% of population. It could have local impacts, and has been assessed as such.

N. a. orientalis: There are several areas where drainage of non-breeding is occurring, for instance in Uzbekistan, where staging sites are being lost as a result of land conversion to agriculture (Elena Kreuzberg, pers. comm.). Overall, the extent and therefore impact drainage at staging, stopover and wintering sites is unknown.

N. a. suschkini: the non-breeding range of this subspecies is currently unknown and therefore an assessment of this threat is not possible at this stage.

Figure 2. Problem tree for the Eurasian Curlew, on breeding grounds and non-breeding grounds.



3. POLICIES AND LEGISLATION RELEVANT FOR MANAGEMENT

3.1. International conservation and legal status of the species

The status of the Eurasian Curlew under the main international legislative instruments for conservation is summarised in Table 5.

Table 5: International conservation and legal status of the Eurasian Curlew.

Global Status ⁶	AEWA ⁷	Bonn Convention ⁸	CITES	Bern Convention ⁹	EU Birds Directive ¹⁰
Near Threatened, NT	<i>arquata</i> : A4 <i>orientalis</i> : A3c <i>suschkini</i> : A1c	II	Not listed	III	Annex II/2

3.2. National policies, legislation and ongoing activities

Beside international agreements, the Eurasian Curlew is included in several national Red Lists and subject to national conservation legislation, as listed below:

Austria: Nature conservation legislation is governed by 9 different local government departments. Implementation of regulations, action plans and conservation measures vary between the regions. Existing conservation measures include habitat management through agri-environment schemes and the designation of SPAs for breeding Eurasian Curlew.

Belarus: No information was received during the formation of this ISSAP.

Belgium: No information was received during the formation of this ISSAP.

Bulgaria: No information was received during the formation of this ISSAP.

Denmark: Fully protected at all times and not a quarry species. Existing conservation measures include habitat management through agri-environment schemes, site protection and disturbance-free zones for non-breeding birds on game reserves.

Estonia: Not a quarry species. Category 3 species under national conservation legislation meaning at least 10% of known breeding sites should be protected. Existing conservation measures include habitat management on nature reserves. National action plan produced in 2013.

⁶ IUCN Red List of Threatened Species. A taxon is Near Threatened (NT) when it has been evaluated against the criteria but does not qualify for Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) now, but is close to qualifying for or is likely to qualify for a threatened category in the future.

<http://www.iucnredlist.org/details/22693190/0>

⁷ AEWA Status of the Populations of Migratory Waterbirds. “A4” in Table 1 of the AEWA Action Plan denotes a species listed as Near Threatened (NT) by the IUCN. “A3c” in Table 1 of the AEWA Action Plan denotes a population numbering between 25,000 and around 100,000 individuals and considered to be at risk as a result of showing a significant long-term declines. “A1c” in Table 1 of the AEWA Action Plan denotes a population with less than 10,000 individuals. http://www.cms.int/documents/appendix/appendices_e.pdf

⁸ The Convention on Migratory Species. Species listed on Appendix II represent migratory species with an unfavourable conservation status that would benefit from international co-operation organised by tailored agreements. http://www.cms.int/documents/appendix/cms_app1_2.htm

⁹ Convention on the Conservation of European Wildlife and Natural Habitats. Species listed on Appendix II are protected. <http://conventions.coe.int/Treaty/en/Treaties/Html/104.htm>

¹⁰ Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. Species listed on Annex II/2 can be hunted in listed Member States which have a defined hunting season for the species

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0147:EN:NOT>

Finland: Fully protected at all times and not a quarry species. Existing conservation measures include habitat management through agri-environment schemes, designation of SPAs for breeding and staging birds, protection of coastal meadows, and habitat management through agri-environment schemes.

France: Curlew is a game species. Curlew can be legally hunted at certain sites and habitats along the coastline of the Atlantic, the English Channel and the North Sea. Certain coastal habitats are excluded. A moratorium is currently in place prohibiting the taking of Curlew at terrestrial sites. The open season runs from the first Saturday in August until the end of January. Existing conservation and management measures include hunting-free reserves, habitat management through agri-environment schemes, and habitat management and legal predator undertaken by hunters. A national management plan was produced in 2013 (Fouquet 2013).

Germany: Fully protected at all times and not a quarry species. Existing conservation measures include habitat management through agri-environment schemes, nest and brood protection measures, site protection and site restoration.

Greece: No information was received during the formation of this ISSAP.

Guinea: No information was received during the formation of this ISSAP.

Guinea-Bissau: No information was received during the formation of this ISSAP.

Hungary: No information was received during the formation of this ISSAP.

Iran: No information was received during the formation of this ISSAP.

Iraq: No species-specific protection. No national assessment of the species. Curlew benefit from wetland conservation efforts for species assemblages e.g. the marshlands in southern Iraq. Most hunting occurs in south, where average annual hunting bag is approximately 200-300 (Mudhafar Salim, pers. comm.)

Italy: No information was received during the formation of this ISSAP.

Ireland: Fully protected at all times and from October 2012 no longer a quarry species under the Wildlife (Wild Birds) (Open Seasons) (Amendment) Order 2012. Existing conservation measures include a coordinated monitoring scheme of wintering birds as part of I-WeBS, monitoring of breeding population on the Shannon Callows, peat cutting restrictions on 11 SACs and habitat management and predator control on Shannon Callows through NPWS Breeding Wader Grant Scheme. Curlew is included as a priority species in the national Upland Bird Conservation Action Plan.

Kazakhstan: No information was received during the formation of this ISSAP.

Kuwait: Fully protected under Kuwaiti environmental law, although illegal killing occurs.

Latvia: No information was received during the formation of this ISSAP.

Lithuania: No information was received during the formation of this ISSAP.

Mauritania: No information was received during the formation of this ISSAP.

Morocco: No information was received during the formation of this ISSAP.

Netherlands: Conservation measures include agri-environment schemes and trial studies using electric fencing to protect nests from predators.

Norway: Fully protected at all times and not a quarry species. Currently listed as Near Threatened, but due to be upgraded to Vulnerable on the Norwegian Red List (unpubl. 2015). No specific conservation measures for Curlew are currently in place, though may benefit from measures through National Action Plans for Corncrake *Crex crex* and Black-tailed Godwits *Limosa limosa*. Standardised annual spring and autumn migration counts have occurred at Birdlife/ Norway Lista Bird Observatory and Jomfruland Bird Observatory from 1980 onwards. Surveyed through Birdlife/ Norway NOFs Breeding Bird Survey from 1995 onwards - now part of program for terrestrial monitoring in Norway (TOV). Regional monitoring of breeding Curlew, Lapwing *Vanellus vanellus* and Oystercatcher *Haematopus ostralegus* in has occurred from 1997 onwards in Jæren, Rogaland County.

Oman: Fully protected. Waterbird surveys of Barr al Hikman are planned for every 3-years.

Poland: Fully protected at all times and not a quarry species. Existing conservation measures include nest and brood protection measures, head starting (the taking and incubating of eggs in captivity followed by the release of the chicks) and predator control. A national action plan is currently being developed.

Portugal: Classified as Least Concern. Not a quarry species. Majority of important wintering sites are protected.

Romania: No information was received during the formation of this ISSAP.

Russia: *arquata* is listed in the regional Red Data books for most administrative regions of European Russia (e.g. Oblasts, Krays, Autonomous Republics). Curlew is a game species in several regions. The open season runs from the third Saturday of August till the end December. No bag limits exist because Eurasian Curlew is not a popular quarry species. No hunting bag data exists to provide an estimate on total number of birds shot or trends.

Saudi Arabia: No information was received during the formation of this ISSAP.

Senegal: No information was received during the formation of this ISSAP.

Slovenia: No information was received during the formation of this ISSAP.

Sweden: Fully protected at all times and not a quarry species. Listed as vulnerable on the Swedish Red List. Existing conservation measures include private nest and brood protection measures at a small number of sites as well as generic agri-environment options (no curlew-specific options are available).

Tunisia: Legally protected since 2000 through Article 7 of the national hunting decree. Control of hunting activities is in place. No specific conservation measures for Curlew are currently in place. Included in the national list of rare and threatened species.

Turkey: Fully protected at all times and not a quarry species. Listed as Least Concern in the national Red List. An annual mid-winter waterbird census at ~ 100 wetlands based on look-see counts has been running since 1967. 24 curlews ringed in Samsun, Kızılırmak delta, 2010 as part of research into avian influenza. The birds were ringed, aged and released after cloacal and oropharyngeal sampling. No recoveries reported yet.

Ukraine: No information was received during the formation of this ISSAP.

United Arab Emirates: No information was received during the formation of this ISSAP.

United Kingdom: Fully protected at all times and not a quarry species under the Wildlife and Countryside Act 1981 the Wildlife and Natural Environment Act (Northern Ireland) 2011. Species is amber-listed in the national list (Birds of Conservation Concern 3). Existing conservation measures include habitat management through agri-environment schemes and the designation of SPAs for breeding and non-breeding Curlew.

Uzbekistan: Game species. Annual bag limits are set and hunting typically occurs between mid-September to mid-November.

Yemen: Protected in 1995 under Article 12 of the Environmental Protection Law No. 26. In Yemen the Curlew is a passage migrant and winter visitor recorded from late June to late April. Based on limited data, a best guess estimate places the mid-winter population of <1,000 individuals, with a smaller number on passage (more in autumn than spring). Most birds occur on the intertidal flats along the Red Sea coast, many fewer on the Arabian Sea coast. No gatherings exceed 100 birds, but c5 sites regularly hold >50. Socotra has a wintering/migrant population of <100 birds.

Table 6: Membership of Range States in Multilateral Environmental Agreements.

<i>Principal range state for Eurasian Curlew</i>	<i>Member State bound by EU Directives and policies</i>	<i>Beneficiary of EU European Neighbourhood Policy</i>	<i>Party to AEW</i>	<i>Party to CMS</i>	<i>Party to Bern</i>	<i>Party to CBD</i>	<i>Party to Ramsar</i>
Austria	Yes		No	Yes	Yes	Yes	Yes
Belarus	No	Yes	No	Yes	No	Yes	Yes
Belgium	Yes		Yes	Yes	Yes	Yes	Yes
Bulgaria	Yes		Yes	Yes	Yes	Yes	Yes
Denmark	Yes		Yes	Yes	Yes	Yes	Yes
Estonia	Yes		Yes	Yes	Yes	Yes	Yes
Finland	Yes		Yes	Yes	Yes	Yes	Yes
France	Yes		Yes	Yes	Yes	Yes	Yes
Germany	Yes		Yes	Yes	Yes	Yes	Yes
Greece	Yes		Applying	Yes	Yes	Yes	Yes
Guinea	No		Yes	Yes	No	Yes	Yes
Guinea-Bissau	No		Yes	Yes	No	Yes	Yes
Hungary	Yes		Yes	Yes	Yes	Yes	Yes
Iran	No		No	Yes	No	Yes	Yes
Iraq	No		No	No	No	Yes	Yes
Ireland	Yes		Yes	Yes	Yes	Yes	Yes
Italy	Yes		Yes	Yes	Yes	Yes	Yes
Kazakhstan	No		No	Yes	No	Yes	Yes
Kuwait	No		No	No	No	Yes	Yes
Latvia	Yes		Yes	Yes	Yes	Yes	Yes
Lithuania	Yes		Yes	Yes	Yes	Yes	Yes
Mauritania	No		No	Yes	No	Yes	Yes
Morocco	No	Yes	Yes	Yes	No	Yes	Yes
Netherlands	Yes		Yes	Yes	Yes	Yes	Yes
Norway	No		Yes	Yes	Yes	Yes	Yes
Oman	No		No	No	No	Yes	Yes
Poland	Yes		No	Yes	Yes	Yes	Yes
Portugal	Yes		Yes	Yes	Yes	Yes	Yes
Romania	Yes		Yes	Yes	Yes	Yes	Yes
Russia	No	Yes	No	No	No	Yes	Yes
Saudi Arabia	No		No	Yes	No	Yes	No
Senegal	No		Yes	Yes	No	Yes	Yes
Slovenia	Yes		Yes	Yes	Yes	Yes	Yes
Sweden	Yes		Yes	Yes	Yes	Yes	Yes
Tunisia	No	Yes	Yes	Yes	No	Yes	Yes
Turkey	No		No	No	Yes	Yes	Yes
U.A.E	No		No	No	No	Yes	Yes
U.K	Yes		Yes	Yes	Yes	Yes	Yes
Ukraine	No	Yes	Yes	Yes	Yes	Yes	Yes
Uzbekistan	No		Yes	Yes	No	Yes	Yes
Yemen	No		No	Yes	No	Yes	Yes

3.3. Ongoing coordinated activities

There have been no previous international working groups for this species. An informal international working group was set up during the development of this ISSAP. This group will be formalised and expanded under AEWA to form the inter-governmental AEWA Eurasian Curlew International Working Group (AEWA EC IWG) in 2015. The EC IWG will coordinate the implementation of the ISSAP.

An EU Management Plan for Curlew (Jensen & Lutz 2006) was adopted for the period 2007-2009, but was not updated. A new EU project was launched in 2015 concerning species action planning for priority species in the EU and as part of this initiative will be produced a EU multi-species action plan for grassland waders, including the Curlew.

4. FRAMEWORK FOR ACTION

The **long-term** goal of this plan is to restore the AEWA populations of the Eurasian Curlew to favourable conservation status¹¹, as demonstrated by its assessment as Least Concern against IUCN Red List criteria.

The **purpose** (i.e. over the next ten years) of this plan is to conserve important breeding and non-breeding habitats, increase breeding success, maximise juvenile and adult survival, and address key knowledge gaps. The plan therefore sets the following four **objectives**:

- 1) Ensure sufficient and adequate habitats;
- 2) Increase productivity;
- 3) Increase survival rates;
- 4) Fill key knowledge gaps.

The following nine **results** are required to achieve these four objectives:

1. Ensure sufficient and adequate habitats

- 1.1. Important breeding sites for Eurasian Curlew are appropriately protected and managed.
- 1.2. Important staging, stopover and wintering sites for Eurasian Curlew are appropriately protected and managed.

2. Increase productivity

- 2.1. The impact of farming operations on breeding success is minimized and beneficial farming practices are supported and encouraged.
- 2.2. Land management techniques that reduce levels of nest and chick predation to those associated with stable or increasing populations are promoted and investigated.

3. Increase survival rates

- 3.1. Any harvest, if undertaken, is sustainable.

4. Fill key knowledge gaps

- 4.1. The necessary data and information required to make an informed assessment of the conservation status of *N. a. suschkini* is obtained.
- 4.2. The necessary data and information required to provide a better understanding of *N. a. arquata* and *N. a. orientalis* populations in Russia is obtained.
- 4.3. Survey, monitoring and research activities on *N. a. arquata* are undertaken to address knowledge gaps and improve population and demographic estimates.
- 4.4. The impact of other poorly-understood threats is investigated.

In order to achieve these results, this ISSAP lists 32 actions that are grouped under the overarching objectives¹², summarised below. Table 5 lists each action and provides detailed information on: the result that each action will deliver towards; the Range States in which actions will take place; the timescales for completing actions; the level of priority afforded to each action; and the organisations responsible for the action.

¹¹ As defined by Article 1 of the Convention on Migratory Species.

¹² The order of objectives does not reflect any level of priority

This section of the plan lists the actions that will deliver towards the results listed above. For each action, an assessment of its urgency and importance is given (under the column “Priority”) as well as the timescale under which it should be achieved.

Key to priority ratings:

Critical: actions delivering towards results that will **help prevent** a rapid population decline of >30% over 10 years (i.e. to address ‘critical’ threats)

High: actions delivering towards results that will **help prevent** a population decline of 20-30% over 10 years (i.e. to address ‘high’ threats)

Medium: actions delivering towards results that will **help prevent** relatively slow, but significant, declines of 10-20% over 10 years (i.e. to address ‘high’ threats)

Low: actions delivering towards results that will **help prevent** local population declines or which is likely to have only a small impact on the population across the range. *For certain Range States these actions could still be high priority at national level.*

Other: a Result that is not possible to categorise with the above priority ratings.

Key to timescales:

Continuous: an ongoing or annual action

Short-term: completed within the next 1-3 years

Medium-term: completed within the next 1-5 years

Long-term: completed within the next 1-10 years

Actions under Objective 1 - Ensure sufficient and adequate habitats

Results	Action	Priority	Timescale	Responsibility
1.1. Important breeding sites for Eurasian Curlew are appropriately protected and managed.	<p>1.1.1. Ensure all breeding sites of international importance for Eurasian Curlew are protected under the Ramsar Convention and/or the EU Birds Directive, as appropriate¹³.</p> <p>Applicable to: All Range States with breeding populations.</p>	Critical	Short-Medium	Government conservation agencies
	<p>1.2.1. Ensure all other important breeding sites for Eurasian Curlew are protected under national or federal legislation, as appropriate, giving consideration to sites that host large populations as well as sites of importance for the purposes of maintenance of the breeding range.</p> <p>Applicable to: All Range States with breeding populations.</p>	Critical	Short-Medium	Government conservation agencies
	<p>1.3.1. At protected sites of importance for Eurasian Curlew:</p> <ul style="list-style-type: none"> • Inform central and local government of the importance and location of designated sites and/or sites proposed for future designation. • Raise awareness of protected sites and Eurasian Curlew breeding requirements amongst relevant user-groups (e.g. farmers, hunters, foresters, tourism bodies). • Regularly review management plans to ensure they include appropriate measures to conserve Eurasian Curlew populations and the habitats they require. <p>Applicable to: All Range States with protected sites.</p>	Critical	Short	Government conservation agencies & NGOs
	<p>1.4.1. At all important breeding sites (i.e. protected and non-protected sites):</p> <ul style="list-style-type: none"> • Ensure appropriate land management practices are being carried out (see objective 2 for further details). 	Critical	Continuous	Government conservation agencies & NGOs

¹³ For each subspecies, population thresholds for internationally important sites are those containing > 1% of the biogeographic population (Table 1).

Results	Action	Priority	Timescale	Responsibility
	<ul style="list-style-type: none"> Respond to potential negative impacts from proposed developments using Ramsar's Avoid-Minimise-Compensate planning framework¹⁴. Potential threats are likely to involve those relating to large-scale agricultural change, forestry, wind turbines, residential/commercial developments, oil/gas developments, tourism, and increased disturbance that may be associated with each. <p>Applicable to: All Range States with breeding populations.</p>			
1.2. Important staging, stopover and wintering sites for Eurasian Curlew are appropriately protected and managed.	<p>1.2.1. Designate all non-breeding sites of international importance for Eurasian Curlew under the Ramsar Convention and/or the EU Birds Directive, as appropriate¹⁵.</p> <p>Applicable to: All Range States with internationally important non-breeding populations. Existing sites have already been prioritised for Range States in the Arabian Peninsula¹⁶.</p>	Critical	Short-Medium	Government conservation agencies
	<p>1.2.2. Designate other important non-breeding sites for Eurasian Curlew under national or local legislation, giving consideration to sites that host large populations as well as sites of importance for the purpose of maintaining range.</p> <p>Applicable to: All Range States with non-breeding populations.</p>	Critical	Short-Medium	Government conservation agencies
	<p>1.2.3. At protected sites of importance for Eurasian Curlew:</p> <ul style="list-style-type: none"> Inform central and local government of the importance and location of designated sites and/or sites proposed for future designation. Raise awareness of protected sites and Eurasian Curlew non-breeding requirements amongst relevant user-groups (e.g. fisheries interests, hunters, etc). 	Essential	Immediate	Government conservation agencies & NGOs

¹⁴ For details, see Gardner *et al.* 2013 (available online at <http://ramsar.rgis.ch/bn/bn3.pdf>)

¹⁵ For each subspecies, population thresholds for internationally important sites are those containing > 1% of the biogeographic population: see table 1.

¹⁶ Notify Important Bird Areas (IBAs) in the Arabian Peninsula that were identified as important staging and wintering sites for *N. a. orientalis* in *Proceedings of the 10th Conservation Workshop for the Fauna of Arabia: Shorebirds of the Arabian Peninsula* (Porter *et al.* 2009) as Ramsar Sites.

Results	Action	Priority	Timescale	Responsibility
	<ul style="list-style-type: none"> Regularly review management plans for protected sites to ensure they are appropriate for the purposes of the conservation of Eurasian Curlew populations and the habitats they require, paying particular attention to the threats identified in this ISSAP. <p>Applicable to: All Range States with non-breeding populations.</p>			
	<p>1.2.4. Respond to potential negative impacts from proposed developments using Ramsar's Avoid-Minimise-Compensate planning framework¹⁷. Potential threats are likely to involve those arising from proposals relating to drainage, large-scale agricultural change, forestry, wind turbines, residential/commercial developments, oil/gas developments, tourism, and increased disturbance or pollution that may be associated with each.</p> <p>Applicable to: All Range States with non-breeding populations.</p>	Critical	Immediate/ Continuous	Government conservation agencies & NGOs working with planning and industry

Actions under Objective 2 - Increase productivity

Results	Action	Priority	Timescale	Responsibility
2.1. The impact of farming operations on breeding success is minimized and beneficial farming practices are supported and encouraged.	<p>2.1.1. Within important breeding sites:</p> <ul style="list-style-type: none"> Raise awareness amongst farming communities of the importance of the area for Eurasian Curlew, and highlight the critical role of farming in conserving the species. Work proactively with farming communities to encourage the uptake of beneficial management practices such as delayed mowing of grasslands, appropriate grazing regimes, stock reduction to minimise nest trampling, conservation and management of wetlands, and minimising other detrimental field operations (e.g. rolling, spraying, etc.) and disturbance during the breeding season. 	Critical	Continuous	Government conservation agencies & NGOs

¹⁷ For details, see Gardner *et al.* 2013 (available online at <http://ramsar.rgis.ch/bn/bn3.pdf>)

Results	Action	Priority	Timescale	Responsibility
	<ul style="list-style-type: none"> Support the restoration of degraded habitats (e.g. lowland wet grassland, lowland raised bogs, etc). <p>Applicable to: All Range States with breeding populations.</p>			
	<p>2.1.2. Ensure appropriate agri-environment options and other conservation support schemes are (1) available and adequately-funded to support farmers and other land managers in carrying out conservation management and (2) targeted to where they will deliver the greatest benefit.</p> <p>Applicable to: All Range States with breeding populations</p>	Critical	Short	Government conservation agencies & NGOs
	<p>2.1.3. Ensure wider agricultural support mechanisms are available to maintain agricultural activity at important breeding sites at risk from land abandonment.</p> <p>Applicable to: All Range States with breeding populations</p>	Medium	Medium	Government agricultural departments, Government conservation agencies, NGOs & farming bodies
<p>2.2. Land management techniques that reduce levels of nest and chick predation to those associated with stable or increasing populations are promoted and investigated.</p>	<p>2.2.1. At important breeding sites where high levels of nest and chick predation are either known or suspected to be responsible for breeding population declines:</p> <ul style="list-style-type: none"> Promote the uptake of, and monitor the effectiveness of, different land management techniques designed to reduce predation pressure through non-lethal means (e.g. manipulation of patch dynamics, removal of landscape features associated with habitat fragmentation and increased predation rates - such as small woodlands, scrub, perch posts, pylons, etc). Investigate the effectiveness of predator control as a potential conservation tool (in tandem with habitat management) in scenarios when achieving optimal habitat conditions may not be feasible in the short-term. <p>Applicable to: All Range States with breeding populations that are declining due to high rates of predation.</p>	Critical	Medium	Government conservation agencies, NGOs & academic institutions

Actions under Objective 3 – Increase survival

Result	Action	Priority	Timescale	Responsibility
3.1. Any harvest, if undertaken, is sustainable.	3.1.1. Launch an adaptive harvest management (AHM) process for the portion of the <i>N. a. arquata</i> population that spend part of the life cycle in France where hunting is permitted. Applicable to: France.	Other	Short	AEWA, Government conservation agencies, Hunting representatives & NGOs
	3.1.2. Reinstate a complete moratorium of hunting in France until the AHM process has established its recommendations which are to be implemented if and when hunting is re-opened. Applicable to: France.	Other	Short	Government conservation agency
	3.1.3. Quantify the level of hunting in southern European Russia as a first step towards an AHM process for the eastern European portion of the <i>N. a. arquata</i> population. Applicable to: Russia.	Other	Short	Government conservation agencies & NGOs
	3.1.4. Ensure that where Eurasian Curlew are a protected species, the law is enforced and that illegal killing is minimised through the most appropriate means (e.g. provision of information and advice to hunters). Applicable to: All Range States.	Other	Continuous	Government conservation agencies & NGOs
	3.1.5. Take immediate action to reduce hunting pressure on <i>N. a. suschkini</i> whilst the wider knowledge gaps concerning this subspecies are being addressed. Applicable to: Russia and Kazakhstan.	High	Short	Government conservation agencies

Actions under Objective 4 – Fill key knowledge gaps

Result	Action	Priority	Timescale	Responsibility
4.1. The necessary data and information required to make an informed assessment of the conservation status of <i>N. a. suschkini</i> is obtained.	4.1.1. Conduct coordinated surveys on breeding grounds to (1) identify the delimitations of the breeding distribution, (2) identify whether there are areas of intergradation with <i>N. a. orientalis</i> (i.e. a hybrid zone), and (3) produce a revised breeding population estimate. Applicable to: Kazakhstan & Russia.	Other	Short	Government conservation agencies & NGOs
	4.1.2. Undertake migration studies using satellite-tagging to identify (1) key migration routes, (2) possible staging and stopover sites and (3) the wintering range. Applicable to: Kazakhstan & Russia.	Other	Short	Government conservation agencies & NGOs
	4.1.3. Informed by the results of satellite tagging, coordinate follow-up surveys to assess the potential importance of staging, stopover and wintering sites. Applicable to: Subsequent Range States that emerge to be of importance for <i>N. a. suschkini</i>.	Other	Medium	Government conservation agencies & NGOs
	4.1.4. Informed by the above, undertake an assessment of threats throughout the life cycle and identify subsequent conservation and research priorities. Applicable to: Kazakhstan, Russia and subsequent Range States that emerge to be of importance for <i>N. a. suschkini</i>.	Other	Medium	Government conservation agencies & NGOs
	4.1.5. Set up an appropriate monitoring programme that will enable sufficient data collection to produce future population trends (e.g. repeat surveys at a sample of breeding sites and/or regular monitoring at non-breeding sites that emerge to be of importance to <i>N. a. suschkini</i>). Applicable to: Kazakhstan, Russia and subsequent Range States that emerge to be of importance for <i>N. a. suschkini</i>.	Other	Medium	Government conservation agencies & NGOs

Result	Action	Priority	Timescale	Responsibility
4.2. The necessary data and information required to provide a better understanding of <i>N. a. arquata</i> and <i>N. a. orientalis</i> populations in Russia is obtained.	4.2.1. Design a suitable sampling methodology (e.g. repeat surveys at a sample of breeding sites) and/ or undertake analysis of Russian Atlas data to provide improved breeding population estimates and trends for both <i>N. a. arquata</i> and <i>N. a. orientalis</i> in Russia. Applicable to: Russia.	Other	Short	Government conservation agencies, NGOs and academic institutions
	4.2.2. Undertake a programme of migration studies using satellite-tagging of birds on breeding grounds to: <ul style="list-style-type: none"> Identify the key migration routes and the wintering locations of both subspecies (this will be complementary to Action 6.1. which will undertake similar work in Europe). Identify the extent of overlap between <i>N. a. arquata</i> and <i>N. a. orientalis</i> breeding ranges. Identify the migratory divides that exists on Russian breeding grounds between <i>N. a. orientalis</i> populations that overwinter in Africa and the Middle East, those that winter in South Asia, and those using the East Asian-Australasian Flyway. Applicable to: Russia.	Other	Short to Medium	Government conservation agencies and NGOs
	4.2.3. Undertake a research project to assess the impact of large-scale land abandonment in European Russia on <i>N. a. arquata</i> (and other species). Applicable to: Russia.	Other	Short to Medium	Government conservation agencies, NGOs and academic institutions
4.3. Survey, monitoring and research activities on <i>N. a. arquata</i> are undertaken to address	4.3.1. Undertake migration studies using satellite-tagging to improve understanding of population connectivity across Europe and West Africa (this will be complementary to Action 5.2. which will undertake similar work in Russia). Applicable to: All Range States (except Russia) that host breeding and non-breeding <i>N. a. arquata</i>.	Other	Short-medium	Government conservation agencies and NGOs

Result	Action	Priority	Timescale	Responsibility
knowledge gaps and improve population and demographic estimates.	<p>4.3.2. Obtain improved estimates for survival rates and productivity by expanding ringing effort, ring reporting, and maintenance of necessary databases (with particular emphasis on populations that spend part of the life cycle in France – see Objective 7).</p> <p>Applicable to: All Range States (except Russia) that host breeding and non-breeding <i>N. a. arquata</i>.</p>	Other	Short-medium	Government conservation agencies, NGOs & EURING
	<p>4.3.3. Support the expansion of productivity monitoring schemes at important breeding sites across the breeding range, so as to gain a better understanding of how productivity varies across the range.</p> <p>Applicable to: All Range States (except Russia) that host breeding <i>N. a. arquata</i>.</p>	Other	Continuous	Government conservation agencies & NGOs
4.4. The impact of other poorly-understood threats is investigated	<p>4.4.1. Further investigate the impact of wind farms on local breeding populations. Address current knowledge gaps including the cumulative impact of multiple wind farms and the population response both during construction and post-construction. Studies should also investigate productivity and potential changes in predation pressure arising from wind farms.</p> <p>Applicable to: All Range States with breeding populations and increasing numbers of wind farms.</p>	Other	Medium to long	Government conservation agencies, NGOs and academic institutions
	<p>4.4.2. Investigate the impact of pollution at wintering sites on adult and juvenile survival rates and subsequent breeding success.</p> <p>Applicable to: Any non-breeding Range States.</p>	Other	Medium to long	Government conservation agencies, NGOs and academic institutions
	<p>4.4.3. Undertake a study that investigates the impact of disturbance on daily energy budgets and individual survival.</p> <p>Applicable to: Any non-breeding Range States.</p>	Other	Medium to long	Government conservation agencies, NGOs and academic institutions

Result	Action	Priority	Timescale	Responsibility
	<p>4.4.4. Investigate the effectiveness of all mitigation techniques designed to offset the loss or degradation of breeding habitat.</p> <p>Applicable to: Any breeding Range States.</p>	Other	Medium to long	Government conservation agencies, NGOs and academic institutions

5. IMPLEMENTATION

International coordination of the implementation of International Single Species Action Plans is a key factor in their successful realization. To ensure the coordination of this Action Plan following its adoption, the UNEP/AEWA Secretariat will convene an inter-governmental AEWA Eurasian Curlew International Working Group once a suitable coordinating agency or organization has been identified. The Working Group will consist of government representatives from all range states as well as national experts, designated by the respective governing bodies charged with the implementation of AEWA. In addition, relevant international conservation and hunting organizations as well as other international stakeholders with a vested interest in the species can be invited to join the Working Group as observers.

6. BIBLIOGRAPHY

- Amar, A., Redpath, S. Sim, I. & G. Buchanan. 2010. Spatial and temporal associations between recovering populations of common raven *Corvus corax* and British upland wader populations. *Journal of Applied Ecology* 47: 253-262.
- Austin, G.E., Calbrade, N.A., Mellan, H.J., Musgrove, A.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. & Holt, C.A. 2014. Waterbirds in the UK 2012/13: The Wetland Bird Survey. BTO/RSPB/JNCC, Thetford. <http://www.bto.org/volunteer-surveys/webs/publications/webs-annual-report>
- Baillie, S.R., Marchant, J.H., Leech, D.I., Massimino, D., Eglington, S.M., Johnston, A., Noble, D.G., Barimore, C., Kew, A.J., Downie, I.S., Risely, K. & Robinson, R.A. 2013. BirdTrends 2012: trends in numbers, breeding success and survival for UK breeding birds. Research Report 644. BTO, Thetford. <http://www.bto.org/birdtrends>
- Bainbridge, I.P. & Minton, C.D.T. 1978. The migration and mortality of Curlew in Britain and Ireland. *Bird Study* 25: 39-50.
- Baines, D. 1989. The effects of improvement of upland, marginal grasslands on the breeding success of Lapwings *Vanellus vanellus* and other waders. *Ibis* 131: 497-506.
- Balmer, D., Gillings, S., Caffrey, B., Swan, B., Downie, I. & Fuller, R. 2013. Bird Atlas 2007-11 The breeding and wintering birds of Britain and Ireland. British Trust for Ornithology.
- Bamford, M., Watkins, D. Bancroft, W. Tischler, G. & Wahl, J. 2008. Migratory shorebirds of the East Asian-Australasian Flyway: population estimates and internationally important sites. Wetlands International - Oceania, Canberra.
- Beintema, A.J. & Visser, G.H. 1989. The effect of weather on time budgets and development of chicks of meadow birds. *Ardea* 77:181-192.
- Belik, V. P. 1998. Current population status of rare and protected waders in south Russia. *International Wader Studies* 10: 273-280.
- Berg, Å. 1992a. Habitat selection by breeding Curlews *Numenius arquata* on mosaic farmland. *Ibis* 134: 355-360.
- Berg, Å. 1992b. Factors affecting nest-site choice and reproductive success of Curlews *Numenius arquata* on farmland. *Ibis* 134: 44-51.
- Berg, Å. 1993. Food resources and foraging success of curlews *Numenius arquata* in different farmland habitats. *Ornis fennica* 70(3): 22-31.
- Berg, Å. 1994. Maintenance of populations and causes of population changes of Curlews *Numenius arquata* breeding on farmland. *Biological Conservation* 67: 233-238.
- BirdLife International. 2004a. Birds in Europe: population estimates, trends and conservation status. Cambridge, UK: BirdLife International (BirdLife Conservation Series No. 12).
- BirdLife International. 2004b. Birds in the European Union: a status assessment. BirdLife International, Wageningen, The Netherlands.
- BirdLife International and NatureServe. 2013. Bird species distribution maps of the world. BirdLife International, Cambridge, UK and NatureServe, Arlington, USA.
- BirdLife International. 2014a. Important Bird Areas factsheet: Arquipélago dos Bijagós. Downloaded from <http://www.birdlife.org> on 15/12/2014
- BirdLife International. 2014b. Important Bird Areas factsheet: Banc d'Arguin National Park. Downloaded from <http://www.birdlife.org> on 15/12/2014
- BirdLife International. 2015. European Red List of Birds. Luxembourg: Publications of the European Communities
- Boschert, M. 1992. Organochloro-residues in the clutches of the Curlew *Numenius arquata* from a breeding area in the southern Rhine Valley. *Ecology of Birds* 14: 101-111.

- Boschert, M.** 2001. Großer Brachvogel – *Numenius arquata*. In: Hölzinger, J., & M. Boschert (eds.): Die Vögel Baden-Württembergs. Band 2.2.- E. Ulmer Verlag, Stuttgart.
- Boschert, M.** 1993. Auswirkungen von Modellflug und Strassenverkehr auf die Raumnutzung beim Grossen Brachvogel (*Numenius arquata*). *Zeitschrift für Ökologie und Naturschutz* 2:11-18.
- Boschert, M. & Rupp, J.** 1993. Brutbiologie des grossen Brachvogels *Numenius arquata* in einem Brutgebiet am südlichen Oberrhein. *Die Vogelwelt* 5: 199-221.
- Boschert, M.** 2004. Der Große Brachvogel (*Numenius arquata* [Linnaeus 1758]) am badischen Oberrhein - Wissenschaftliche Grundlagen für einen umfassenden und nachhaltigen Schutz. – Dissertation (PhD-Thesis) Universität Tübingen.
- Brown, D.J., Crockford, N.J. & Sheldon, R.** (comp.) 2014. Drivers of population change and conservation priorities for the Numeniini populations of the world. BirdLife International/International Wader Study Group.
- Broyer, J. & Roche, J.** 1991. The nesting population of Curlew *Numenius arquata* in the Saone basin. *Alauda* 59: 129-135. (in French)
- Burton, N.H.K., Armitage, M.J.S., Musgrove, A.J. & Rehfish, M.M.** 2002. Impacts of man-made landscape features on numbers of estuarine waterbirds at low tide. *Environmental Management* 30(6):857-864.
- Cao, L., Zhang, J., Barter, M. & Lei, G.** 2009. Anatidae in eastern China during the non-breeding season: geographical distributions and protection status. *Biol. Conservation*. 143: 650-659.
- Cotter, G.** 1990. The Curlew. C. I. Thomas & Sons (Haverfordwest) Ltd., Dyfed.
- Cramp, S. & Simmons, K.E.L.** 1983. Handbook of the birds of Europe, the Middle East and North Africa. The Birds of the Western Palearctic. Volume 3: Waders to Gulls. University Press, Oxford.
- Crowe, O. & Holt, C.** 2013. Estimates of waterbird numbers wintering in Ireland, 2006/07 – 2010/11. *Irish Birds* 9:4.
- Currie, D., Valkama, J., Berg, Å., Boschert, M., Norrdahl, K., Hänninen, M., Korpimäki, E., Pöyri, V. & Hemminki, O.** 2001. Sex roles, parental effort and offspring desertion in the monogamous Eurasian Curlew *Numenius arquata*. *Ibis* 143: 642-650.
- Davidson, N.C. & Rothwell, P.I.** 1993. Disturbance to waterfowl on estuaries: conservation and coastal management implications of current knowledge. *Wader Study Group Bulletin* 68: 97-106.
- De Fouw, J. et al. in prep.** Counts of shorebirds at Barr al Hikman, Oman 2008 and 2013; results comparisons and discussion.
- De Jong, A. & Berg, Å.** 2001. Storspoven i Sverige. Resultat av riksinventeringen 1999. *Vår Fågelvärld* 60(2): 6-16. (in Swedish).
- De Jong, A.** 1990. Häckande storspovar i Hössjödalen 1985-90 – Hur mår Västerbottens landskapsfågel? *Fåglar i Västerbotten* 15(3): 98-100. (in Swedish).
- De Jong, A.** 2012. Matching a Changing World – the Importance of Habitat Characteristics for Farmland Breeding Eurasian Curlew. Doctoral Thesis. Swedish University of Agricultural Sciences. Umeå.
- De Jong, A.** 2012. Seasonal sift of foraging habitat among farmland breeding Eurasian Curlews *Numenius arquata*. Doctoral Thesis. *Ornis Norvegica* 35: 23-27.
- Denker, E. & Buthe, A.** 1995. PCB burden and pattern in eggs of the Curlew (*Numenius arquata*) and the Black-tailed Godwit (*Limosa limosa*) from north-west Germany. *Bulletin of Environmental Contamination and Toxicology* 55(6): 886-892.
- Delany, S., Scott, D., Dodman, T. & Stroud, D.** 2009. An Atlas of Wader Populations in Africa and Western Eurasia. Wetlands International.
- Del Hoyo, J., Elliott, A. & Sargatal, J.** 1996. Handbook of the Birds of the World, Volume 3: Hoatzin to Auks. Lynx Edicions, Barcelona, Spain.

- Dornberger, W. & Ranftl, H.** 1986. Breeding populations of Curlew, Redshank and Blacktailed Godwit in northern Bavaria (West Germany) 1977-1986. *Anzeiger der Ornithologischen Gesellschaft in Bayern* 25: 189-194. (In German).
- Douglas, D.J.T., Bellamy, P.E., Stephen, L.S., Pearce-Higgins, J.W., Wilson, J.D. & Grant, M.C.** 2014. Upland land use predicts population decline in a globally near-threatened wader. *J. Appl. Ecol.* 51(1):194-203.
- Donaghy, A. & Mellon, C.** 1998. Fields for the Future: Towards the Conservation of Farmland Birds in Northern Ireland. RSPB, Sandy.
- Duriez, O., Ens, B.J., Choquet, R., Pradel, R. & Klaassen, M.** 2012. Comparing the seasonal survival of resident and migratory oystercatchers: carry-over effects of habitat quality and weather conditions. *Oikos* 121: 862–873.
- Eltis, J., Leito, A., Leivits, A., Luigujõe, L., Mägi, E., Nellis, Rein, Nellis, Renno, Ots, M., Pehlak, H.** 2013. Status and numbers of Estonian birds, 2008–2012. *Hirundo* 26(2): 80-112. URL: http://www.eoy.ee/hirundo/file_download/149/Eltis_et_al_2013_2.pdf
- Eriksen, J. & Victor, R.** 2013. Oman Bird List, Edition 7
- Ewing, S., Scragg, E., Butcher, N. & Douglas, D.** 2012. Investigating displacement effect of wind farms on Curlew using GPS tracking technologies: a pilot study. *Unpublished report*.
- Ferns, P.N., Rostron, D.M. & Siman, H.Y.** 2000. Effects of mechanical cockle harvesting on intertidal communities. *Journal of Applied Ecology* 37: 464–474.
- Fitzpatrick, S. & Bouchez, B.** 1998. Effects of recreational disturbance on the foraging behaviour of waders on a rocky beach. *Bird Study* 45: 157-171.
- Foundation Voorne Bird Observatory.** Bird records from the website: <http://www.radioactiverobins.com/snipeswaders/steppe%20curlews%20num%20arq%20sschhini.htm>
- Fouquet M.** 2013. Plan National de Gestion (2014-2018) – Courlis cendré (*Numenius arquata*). ONCFS.
- Fletcher, K., Aebischer, N.J., Baines, D., Foster R. and Hoodless, A.N.** 2010. Changes in breeding success and abundance of ground-nesting moorland birds in relation to the experimental deployment of legal predator control. *Journal of Applied Ecology* 47: 263-272.
- Flint, V.E., Boehme, R.L., Kostin, Y.V. & Kuznetsov, A.A.** 1984. A field guide to the birds of the USSR. Princetown University Press, Princetown, New Jersey
- Galbraith, H., Murray, S., Duncan, K., Smith, R., Whitfield, D. P. & Thompson, D. B. A.** 1993. Diet and habitat use of the dotterel *Charadrius morinellus* in Scotland. *Ibis* 135: 148-155.
- Gardner, R. C., Bonells, M., Okuno, E., Zarama, J. M.** 2012. Avoiding, mitigating, and compensating for loss and degradation of wetlands in national laws and policies. Ramsar Scientific and Technical Briefing Note no. 3. Gland, Switzerland: Ramsar Convention Secretariat
- Gill, F & D Donsker (Eds).** 2015. IOC World Bird List (v 5.2). Accessed on 29 May 2015 from <http://www.worldbirdnames.org/bow/buttonquail/>
- Grant, M., Orsman, C., Easton, J., Lodge, C., Smith, M., Thompson, G., Rodwell, S. & Moore, N.** 1999. Breeding success and causes of breeding failure of curlew *Numenius arquata* in Northern Ireland. *Journal of Applied Ecology* 36: 59-74.
- Grant, M.C.** 1997. Breeding curlew in the UK: RSPB research and implications for conservation. RSPB Conservation Review 11: 67-73.
- Green, R. E.** 1985. The Management of Lowland Wet Grassland for Breeding Waders. RSPB.
- Gunnarsson, U. & Löfroth, M.** 2009. Våtmarksinventeringen – resultat från 25 års inventeringar. Nationell slutrapport för våtmarksinventeringen (VMI) I Sverige. Naturvårdsverket rapport 5925 (januari 2009). (in Icelandic).

- Hagemeijer, E.J.M. & Blair, M.J.** 1997. The EBCC Atlas of European Breeding Birds: Their Distribution and Abundance. T & AD Poyser, London.
- Holt, C.A., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. & Musgrove, A.J.** 2012. Waterbirds in the UK 2010/11: The Wetland Bird Survey. BTO/RSPB/JNCC, Thetford. 183 pp.
- Hayman, P. Marchant, J. & Prater, A. J.** 1986. Shorebirds. Croom Helm, London
- Harris, S.J., Risely, K., Massimino, D., Newson, S.E., Eaton, M.A., Musgrove, A.J., Noble, D.G., Procter, D. & Baillie, S.R.** 2014. The Breeding Bird Survey 2013. BTO Research Report 658. British Trust for Ornithology, Thetford.
- Haworth, P.F. & Thompson, D.B.A.** 1990. Factors associated with the breeding distribution of upland birds in the South Pennines, England. *Journal of Applied Ecology* 27: 562–577.
- Henderson, I.G., Wilson, A.M., Steele, D. And Vickery, J.A.** 2002. Population estimates, trends and habitat associations of breeding Lapwings *Vanellus vanellus*, Curlew *Numenius arquata* and Snipe *Gallinago gallinago* in Northern Ireland in 1999. *Bird Study* 49: 17-25.
- Hötter, H., Jeromin, H. & Melter, J.** 2007. Monitoring grassland waders breeding in Germany. *Wader Study Group Bulletin* 113: 57–65.
- Hötter, H., Schrader, S., Schwemmer, P., Oberdiek, N., Blew, J., Evans, R. & Lass-Evans, S.** 2010. Status threats and conservation of birds in the German Wadden Sea. NABU Technical Report, Druckhaus Berlin-Mitte, Berlin.
- Huntley, B., Green, R.E., Collingham, Y.C. & Willis, S.G.** 2007. A climatic atlas of European breeding birds. Durham University, The RSPB and Lynx Edicions, Barcelona.
- Isenmann P., Benmergui M., Browne P., Ba A.D., Diagana C.H., Diawara Y. & El Abidine ould Sidaty Z.** (2010). *Birds of Mauritania - Oiseaux de Mauritanie*. Société d'Etudes, Ornithologiques de France, Paris.
- Jensen, F.P. & Lutz, M.** 2006. Management Plan for Curlew (*Numenius arquata*) 2007-2009, Natura 2000 Technical Report-003-2007 under the Directive 79/409/EEC on the conservation of wild bird. Office for the Official Publications of the European Communities, Luxembourg.
- Johnsgard, P. A.** 1981. *The plovers, sandpipers and snipes of the world*. University of Nebraska Press, Lincoln, U.S.A. and London.
- Kipp, M.** 1999. Zum bruterfolg beim Großen Brachvogel (*Numenius arquata*). *LOBF-Mitteilung* 3/99: 47-49. (in German)
- Kipp, M.** 1982. Ergebnisse individueller Farbberingung beim Großen Brachvogel und ihre Bedeutung für den Biotopschutz. Beih. Veröff. Naturschutz Landschaftspflege Bad. Württ. 25: 87-96. (in German)
- Kurlavičius, P. and Raudonikis, L.** 1999. Assessment of the Lithuanian breeding bird abundance. *Ciconia*, Vol. 7: 52-57.
- Kurlavičius, P. and Raudonikis, L.** 2001. Assessment of the Lithuanian breeding bird abundance, 1999-2001. *Ciconia*, Vol. 9: 92-97.
- Kurlavičius, P. (ed.)** 2006. Lithuanian Breeding Bird Atlas. Lututė, Kaunas, Lithuania. [In Lithuanian with English summary.]
- Kılıç D.T. & Eken, G.** 2004. Türkiye'nin önemli kuş alanları—2004 güncellemesi (Important bird areas in Turkey—2004 update). Ankara: Doga Dernegi.
- Klok, T.C., Roodbergen, M. & Hemerik, L.** 2009. Diagnosing declining grassland wader populations using simple matrix models. *Anim. Biol* 59:127–144
- Lappo, E.G., Tomkovich, P.S. & Syroechovskiy, E.S.** 2012. Atlas of the Breeding Waders in the Russian Arctic. Institute of Geography, Russian Academy of Sciences.
- Lauder, C. & Donaghy, A.** 2008. Breeding Waders in Ireland 2008: A review and recommendations for future action. Report to the National Parks & Wildlife Service.

- Lebedeva, E. A. & Butiev, V. T.** 1998. Summer movements of waders in the Samur river delta: preliminary data and review of the problem for the Caspian Sea region. *International Wader Studies* 10: 395-402.
- Mischenko, A. L.** 2004. Estimation of numbers and trends for birds of the European part of Russia. Moscow,
- Mulder, J.L. & Swaan, A.H.** 1992. Body-weight changes of egg-laying Curlews *Numenius arquata*, as monitored by an automatic weighing system. *Ardea* 80: 273-280.
- Musgrove, A.J., Aebischer, N.J., Eaton, M.A., Hearn, R.D., Newson, S.E., Noble, D.G., Parsons, M., Risely, K. & Stroud, D.A.** 2013. Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 106: 64-100.
- Smart, M. & Coutts, K.** 2004. Footdrain management to enhance habitat for breeding waders on lowland wet grassland at Buckenham and Cantley Marshes, Mid-Yar RSPB Reserve, Norfolk, England. *Conservation Evidence* 1: 16-19.
- Maclea, I.M.D., Austin, G.E., Rehfish, M.M., Blew, J., Crowe, O., Delany, S., Devos, K., Deceuninck, B., Gunther, K., Laursen, K., van Roomen, M. & Wahl, J.** 2008. Climate change causes rapid changes in the distribution and site abundance of birds in winter. *Global Change Biol.* 14: 2489–2500.
- Nagy, S. Flink, S. & Langendoen, T.** 2014. Waterbird trends 1988-2012: Results of trend analyses of data from the International Waterbird Census in the African-Eurasian Flyway. Wetlands International, Ede.
- Navedo, J.G. & Herrera, A.G.** 2012. Effects of recreational disturbance on tidal wetlands: supporting the importance of undisturbed roosting sites for waterbird conservation. *J. Coast. Conserv.* 16: 373-381.
- NFUS press release 2014.** www.nfus.org.uk/news/2014/march/rural-development-measures-must-deliver
- O'Brien, M.G.** 2004. Estimating the number of farmland waders breeding in the United Kingdom. *International Wader Studies* 14: 135-139.
- O'Brien, M.G. & Wilson, J.** 2011. Population changes of breeding waders on farmland in relation to agri-environment management. *Bird Study* 58:4, 399-408.
- ONCFS.** 2000. Enquête nationale sur les tableaux de chasse à tir. Saison 1998–1999. Bulletin Technique et Juridique, Office National de la Chasse et de la Faune Sauvage 251: 1–216.
- Oriental Bird Club.** Bird records from the website:
http://orientalbirdimages.org/birdimages.php?action=birdspecies&Bird_ID=1224&Bird_Image_ID=68023&Bird_Family_ID
- Palomino, D. & B. Molina (Eds).** 2009. Aves acuáticas reproductoras en España. Seguimiento de Aves 26: pp 210. SEO/BirdLife. Madrid. (in Spanish).
- Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. & Bullman, R.** 2009. The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology* 46: 1323-1331.
- Pearce-Higgins, J. & Grant, M.** 2006. Relationships between bird abundance and the composition and structure of moorland vegetation. *Bird Study* 53: 112–125.
- Peitzmeier, J.** 1952. Oekologische Umstellung und starke Vermehrung des Grossen Brachvogels (*Numenius arquata* L.) im CberE:m Emmsgebiet. *Natur und Heimat* 12: 3, 1-4.
- Perennou, C., Mundkur, T., Scott, D.A., Follestad, A. & Kvenild, L.** 1994. The Asian Waterfowl Census 1987-91: Distribution and Status of Asian Waterfowl. AWB Publication No. 86. IWRB Publication No. 24. Asian Wetlands Bureau, Kuala Lumpur, Malaysia & IWRB, Slimbridge, UK.
- Pfeifer, R. & Brandl, R.** 1991. The timing of meadow-mowing and its influence on birds. *Ornithologischer Anzeiger* 30: 159-171.
- Porter, R., Samraoui, B., Livet, J., Mallon, D. & Budd, K (eds).** 2008. Proceedings of the 10th Conservation Workshop for the Fauna of Arabia: Shorebirds of the Arabian Peninsula.
- Ratcliffe, D.** 2007. Galloway and the Borders (New Naturalist 101). Collins, London.

- Rehfish, M.M., Austin, G.E., Freeman, S.N., Armitage, M.J.S. & Burton, N.H.K.** 2004. The possible impact of climate change on the future distributions and numbers of waders on Britain's nonestuarine coast. *Ibis* 146: 70–81.
- Reichenbach M.** 2001. Windenergie und Wiesenvögel-wie empfindlich sind die Offenlandbrüter? Windenergie und Vögel-Ausmaß und Bewältigung eines Konflikts. Tagungsband 2. Fassung: 52-76.
- Roos, S., Smart, J. & Gibbons, D.** 2012. The predation of wild birds in the UK: an updated review (2007-2011) of its conservation impact and management. RSPB Research Report No. 50. ISBN 978-1-905601-39-4.
- Robinson, R.A.** 2005. Birdfacts: Profiles of Birds Occurring in Britain and Ireland (BTO Research Report 407). BTO, Thetford.
- Roodbergen, M., van der Werf, B. & Hötter, H.** 2012. Revealing the contributions of reproduction and survival to the Europe-wide decline in meadow birds: review and meta-analysis. *Journal of Ornithology* 153: 53-74.
- Sach, G.** 1968. Die Mauser des Grossen Brachvogels (*Numenius arquata*). *Journal of Ornithology* 109: 485-511.
- Scott, D.A. (ed).** 1995. A directory of wetlands in the Middle East. IUCN, Gland, Switzerland, and International Waterfowl and Wetlands Research Bureau, Slimbridge, UK.
- Shimmings, P. & Øien, I.J.** 2015. Bestandsestimater og trender for norske hekkefugler. NOF-Rapport 2015-2
- Smit, C. & Visser, G.J.M.** 1993. Effects of disturbance on shorebirds: a summary of existing knowledge from the Dutch Wadden Sea and Delta area. *Wader Study Group Bulletin* 68: 6-19.
- Smit, C.J. & Piersma, T.** 1989. Numbers, midwinter distribution and migration of wader populations using the East Atlantic Flyway. In: Boyd, H. & Pirot, J.-Y. (eds) Flyways and reserve networks for water birds. IWRB Special Publication No.9. IWRB Slimbridge.
- Snow, D. W.; Perrins, C. M.** 1998. *The Birds of the Western Palearctic vol. 1: Non-Passerines*. Oxford University Press, Oxford
- Stillman, R.A. & Brown, A.F.** 1994. Population sizes and habitat associations of upland breeding birds in the South Pennines, England. *Biol. Conserv.* 69: 307–314.
- Strann, K.B.** 1993. Wintering Curlews *Numerius arquata* at 70 dg. N in North Norway. *Wader Study Group Bulletin* 71: 32–33.
- Stroud, D. A., Reed, T. M. & Harding, N. J.** 1990. Do moorland breeding waders avoid plantation edges? *Bird Study* 37: 177-186.
- Stroud, D.A., Davidson, N.C., West, R., Scott, D.A., Haanstra, L., Thorup, O., Ganter, B. & Delany, S. (compilers)** on behalf of the International Wader Study Group. 2004. Status of migratory wader populations in Africa and Western Eurasia in the 1990s. *International Wader Studies* 15: 1-259.
- Svorkmo-Lundberg, T., Bakken, V., Helberg, M., Mork, K., Røer, J.E. & Sæbø, S. (editors).** 2006. Norsk vinterfuglatlas. Norsk ornitologisk forening, Trondheim. Norway. (In Norwegian.)
- Taylor, R.C. & Dodd, S.G.** 2013. Negative impacts of hunting and suction-dredging on otherwise high and stable survival rates in Curlew *Numenius arquata*. *Bird Study* 60(2): 221-228.
- Thorup, O. (comp.).** 2006. Breeding waders in Europe 2000. International Wader Studies 14. International Wader Study Group, UK.
- Tiainen, J.** 2001. The Finnish agricultural environments. In: Pitkänen, M. & Tiainen, J. (eds.), Biodiversity of agricultural landscapes in Finland. BirdLife Finland Conservation Series 3, pp. 9-12.
- Tiainen, J. & Pakkala, T.** 2001. Birds. In: Pitkänen, M. & Tiainen, J. (eds.), Biodiversity of agricultural landscapes in Finland. BirdLife Finland Conservation Series 3, pp. 33-50.
- Trollet, B. & Fouquet, M.** 2004. Wintering waders in coastal Guinea. *Wader Study Group Bull.* 103: 56-62
- Trösch, S.** 2003. Der Grosse Brachvogel als zunehmender Wintergast im Bodenseegebiet. Ergebnisse der simultanen Schlafplatzzählungen in den Wintern 1999 – 2002 und Beobachtungen zum Verhalten. Eigenverlag, S. Trösch, Stetten, Schweiz.

- Tuellinghoff, R. & Bergmann, H.** 1993. Curlew habitats in Lower Saxony: preferred and avoided structures in the agricultural landscape. *Vogelwarte* 37: 1-11. (In German).
- Urban, E. K.; Fry, C. H.; Keith, S.** 1986. *The birds of Africa vol. II*. Academic Press, London
- Underhill, L. G.** 1997. The atlas of southern African birds. Vol. 1. BirdLife South Africa, Johannesburg.
- Valkama, J. & Currie, D.** 1999. Low productivity of Curlews *Numenius arquata* on farmland in southern Finland: Causes and consequences. *Ornis Fennica* 76: 65-70.
- Valkama, J., Currie, D. & Korpimäki, E.** 1999. Differences in the intensity of nest predation in the Curlew *Numenius arquata*: A consequence of land use and predator densities? *Ecoscience* 6(4): 497-504.
- Valkama, J., Robertson, P. & Currie, D.** 1998. Habitat selection by breeding curlew (*Numenius arquata*) on farmland: the importance of grassland. *Ann. Zool. Fennici* 35: 141-148.
- Van Gils, J. & Wiersma, P.** 1996. Eurasian Curlew (*Numenius arquata*). In: del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A. & de Juana, E. (eds.) 2014. *Handbook of the Birds of the World Alive*. Lynx Edicions, Barcelona. Accessed on 29 May 2015 from <http://www.hbw.com/node/53897>
- van Roomen, M., van Winden, E. & Langendoen, T.** 2014. The assessment of trends and population sizes of a selection of waterbird species and populations from the coastal East Atlantic Flyway for Conservation Status Report 6 of The African Eurasian Waterbird Agreement.
- Vickery, J.A., Tallowin, J.T., Feber, R.E., Asteraki, E.J., Atkinson, Fuller, R.J. & Brown, V.** 2001. Effects of grassland management on birds and their food resources, with special reference to recent changes in fertiliser, mowing and grazing practices in lowland Britain. *J. Appl. Ecol.* 38: 647–664.
- Warnock, N.** 2010. Stopping vs. Staging: the difference between a hop and a jump. *J. Avian Biol.* 41: 621-626.
- Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. & Baillie, S.R. (eds).** 2002. The Migration Atlas: movements of the birds of Britain and Ireland. T. & A.D. Poyser, London. pp 332-335.
- Wetlands International.** 2003. *Strategy and Action Plan for Mire and Peatland Conservation in Central Europe*. Danish National Museum and Wetlands International. Wageningen, The Netherlands.
- Wetlands International & ONCFS.** 2010 Limicoles séjournant en France. pp 50.
- Wetlands International & ONCFS.** 2011 Limicoles séjournant en France. pp 52.
- Wetlands International & ONCFS.** 2012 Limicoles séjournant en France. pp 50.
- Witt, H.** 1989. Auswirkungen der Extensivierungsförderung auf Bestand und Bruterfolg von Uferschnepfe und Großem Brachvogel in Schleswig-Holstein. *Berichte der Deutschen Sektion des Internationalen Rates für Vogelschutz* 28: 43-76. (in German).