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Waterbirds

GRAHAM AUSTIN
British Trust for Ornithology, The Nunnery, Thetford, IP24 2PU

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EXECUTIVE SUMMARY

- Overwintering distributions of many coastal waders have shifted in recent decades. From a UK perspective this initially meant that many species developed more easterly and northerly distributions. Latterly, numbers of some species appear to be increasing further east in Europe and falling on the east coast of Britain as the general eastward shift continues.
- These changes in distribution appear to be driven by waders taking advantage of new opportunities to over-winter on sites offering better feeding conditions closer to their Arctic and sub-Arctic breeding ranges rather than being negative impacts.
- In the future, however, these newly developed distributions may make populations more susceptible to the intermittent severe weather events to which they are particularly vulnerable.
- Similar distribution changes are probably occurring in wildfowl although the evidence is less robust.
- The effects of climate change on the mainly Arctic and sub-Arctic breeding grounds of waterbirds over-wintering in the UK can be expected to be detrimental. Main impacts are likely to be loss of habitat, a northwards shift in suitable habitat resulting in increase migration costs and increased predation pressure. These impacts may outweigh the benefits of milder weather on the wintering grounds.
- There is little evidence as to how the impacts of climate change on the prey base of over-wintering waterbirds is affecting their numbers.
- Our own efforts to mitigate climate change including improved sea-defences and the renewable energy industry and its supporting infrastructure may also have adverse affects on these birds through loss of habitat, disturbance, displacement and possible direct mortality.

FULL REVIEW

Introduction

The open coast, estuaries and inshore waters of the UK are of international importance for the vast numbers of waders and certain species of wildfowl that they support over winter. Additionally, a small number of waterbird species breed around the UK coast. Climate change has already affected many species of waterbird inhabiting coastal areas and is expected to do so increasingly in the future.

1. What is already happening?

Current climate change has already been shown to have affected the over-wintering distributions of many waders in the UK (Austin & Rehfisch, 2005) and more widely in north-west Europe (Maclean *et al*., 2008). Further changes may be expected both in response to climate change that has occurred to date and to future climate change.

In addition to the effects of a changing winter climate, the populations of waterbirds wintering in the UK may also be affected by climate change on their breeding grounds or at migration stop-over sites (Robinson *et al*., 2005), though current evidence is sparse.

National and regional changes in winter weather caused by climate change can have impacts on the survival rates and distribution of waders. It has been shown that wader mortality is high during periods of severe winter weather (Clark N.A., 1982; Clark J.A., 2004); therefore, as winters become milder, it is expected that survival rates will increase. However, it has been shown that the wintering distribution of these birds has changed rapidly in response to climate change during recent years (Austin & Rehfisch, 2005; Rehfisch *et al.,* 2004; Rehfisch & Austin, 2006; Maclean *et al*., 2008) and it may be that these species are not so much being forced to redistribute by climate change but rather taking advantage of new opportunities presented, at least in the short-term, by climate change. Thus, in response to increasingly mild winter weather, an increasing proportion of the UK wintering population of eight out of nine common and widespread waders studied, i.e. Eurasian oystercatcher, ringed plover, grey plover, sanderling, dunlin, red knot, bar-tailed godwit and redshank, now winter on the more productive yet relatively colder east coast of Britain (in particular, estuaries in the southern North Sea and in the eastern English Channel) while numbers in the south-west of Britain (estuaries in the Western Channel and Celtic Sea and in the Irish Sea) have declined. It is not that the latter have necessarily become less suitable as overwintering sites. Indeed, milder winter weather in the west probably means that these regions are more hospitable in absolute terms than they were in the past. Rather, eastern sites have become relatively more attractive because birds are able to take advantage of richer feeding in the more muddy east coast sediments with a much reduced risk of cold weather mortality (Austin & Rehfisch, 2005). Furthermore, these shifts in distribution mean that birds are now wintering closer to their breeding grounds as the migration routes of most species brings them first to the north and east coasts of Britain. Consistent with this, the over-winter distributions of several species of waders (ringed plover *Charadrius hiaticula*, purple sandpiper *Calidris maritime* and turnstone *Arenaria interpres*) over-wintering on the UK's open coasts have shifted northwards towards their breeding grounds in Iceland, Canada and Greenland (Rehfisch *et al*., 2004). Maclean *et al.,* (2008) similarly showed that the north-west European wintering distribution of redshank *Tringa totanus* had shifted north-west, towards its predominant Icelandic breeding grounds, this contrasting with the easterly shifts of other species whose European wintering populations originate from Scandinavia, Siberia and Greenland. It should also be noted that numbers of many of these species have begun to decline in the east of the UK in the most recent winters (Austin *et al.,* 2008), the implication being that increasing numbers of birds over-winter in countries to the east, consistent with the distributional shift occurring at a European scale (Maclean *et al*., 2008) and observations of increased numbers over-wintering on the Dutch Waddensea (Hustings *et al.,* 2008).

Although, similar analyses have not been undertaken for wildfowl there is much anecdotal evidence supported by bird counts to suggest that increasing numbers of many species are taking advantage of ice-free waters in the Baltic countries, waters formerly unavailable throughout much of the winter while they remained frozen. Many of these wildfowl species winter around the UK coast although for many numbers inland are greater and so the relationship of trends to changes in the marine environment alone are less clear.

Thus, currently, many waterbirds (in particular, waders) appear to be responding to take advantage of new opportunities presented by climate change rather than being disadvantaged. While there may be concern regarding the declines of waders that are occurring in response to climate change at a regional level, this stems from making an introspective appraisal of a much larger response and it would be incorrect to consider such local declines a negative response to climate change within those regions.

2. What could happen in the future?

The short-term, seemingly beneficial, responses to current climate change described above may not offset potential long-term detrimental impacts of both current and future climate change. For most waterbirds over-wintering in the UK, their breeding grounds are extralimital, substantially in Arctic and sub-Arctic areas (Wernham *et al*. 2002; Delany et al. 2009). These areas are subject to the greatest current and future prediction of rising temperature and this will directly impact these species on their breeding grounds as vegetation zones move northwards. For some species this may ultimately result in greater migration distances as they are limited in the extent to which they can redistribute on the wintering grounds by the availability intertidal habitat which is concentrated around the UK and southern North Sea coastline of western Europe. These birds may also be exposed to new levels of predation pressure on their breeding grounds as predators move north tracking northward shifts in vegetation zones. Some species, currently limited to breeding in the most northerly latitudes may lose much their favoured breeding habitat. Thus, although these changes are affecting these birds on their remote breeding grounds, the effects can be expected to manifest themselves in changes in productivity and annual survival that will impact the numbers arriving to over-winter on the European coast. From a UK perspective, this potential decline in wader numbers across Europe, together with increasing numbers of birds over-wintering further east suggests that we could see a decline in many of our internationally important over-wintering waterbird populations.

While we have seen short-term gains for some waterbirds on their UK wintering grounds with milder winters, these benefits may be off-set in the medium- and long-term. There are grounds to speculate that there may be as yet unseen issues in that the short-term gains from the redistribution on the wintering grounds may be leading these species into ecological traps where environmental conditions are less stable within the new range. Waders, in general, are vulnerable to severe weather (Clark, 2009) and, within the UK, close to their energetic limits during the winter (Piersma, 1994). Redshank, for example, have a notoriously low resistance to severe weather events (Clark, 2004) and so, while standing to benefit substantially from milder winters would still be vulnerable to short-term severe weather incidents which may be expected to be more intense further east.

Waders, in particular, but also shelduck *Tadorna tadorna*, rely principally on intertidal habitat for foraging and, in the case of waders, saltmarsh is important for providing high-tide roost sites. Loss of both these habitats can be expected as a result of rising sea levels combined with coastal squeeze (Pethick & Crooks, 2000), particularly in locations where sea defences are maintained in the face of rising sea levels. This loss of intertidal habitats is expected to have a negative impact on many waterbirds (Percival, 1998; Galbraith *et al*., 2002; Austin & Rehfisch, 2003), inducing higher winter mortality (Atkinson *et al*., 2004; Burton *et al*., 2006). In time, this increased mortality from habitat loss can be expected to counter, at least to some extent, the benefits associated with increasingly mild winter weather. Especially given that the intertidal habitats of the southern North Sea and the eastern English Channel, where benefits have been greatest, are those most at risk from sea-level rise due to the

substantial extent of low lying coastal margins in those areas and continuing isostatic adjustment since the last ice age.

It has been shown that in at least one species of wader - the knot *Calidris canutus*- that breeding success is affected by density dependent effects on the wintering grounds (Boyd & Piersma, 2001) indicating that the effects of redistribution of birds and loss of habitat due to climate change may be more far-reaching than observed at the local level.

In areas where artificial barriers do not prevent retreat as the sea rises, the shape of the estuaries may change (Austin & Rehfisch, 2003). This will influence sediment composition, in turn leading to changes in invertebrate fauna and ultimately the waterbird community preying upon them. In areas around the southern North Sea and eastern English Channel there is much land adjacent to estuaries that historically was claimed from the sea. Where, through managed realignment, the sea is allowed to breach existing defences and reclaim this low lying land, substrates are predicted to become more sandy as the estuaries widen and opened up to increased wave action. Species that prefer sandier sediments, such as oystercatcher *Haematopus ostralegus*, would be expected to benefit while those preferring muddier sediments, such as dunlin *Calidris alpina*, would be expected to suffer.

Aside from supporting over-wintering birds, the UK coast also provides important staging for migrating waterbirds passing through on autumn and spring passage on route to and from wintering grounds in southern Europe and Africa. Changes in habitat availability and quality due to climate change may be particularly critical to these populations as during stopover at the sites birds must refuel rapidly before making their onward journeys.

Several species of wader have substantial coastal breeding population within the UK. For example, redshank and ringed plover both breed on habitats vulnerable to sea-level rise and coastal squeeze and so could be directly affected throughout their annual cycle.

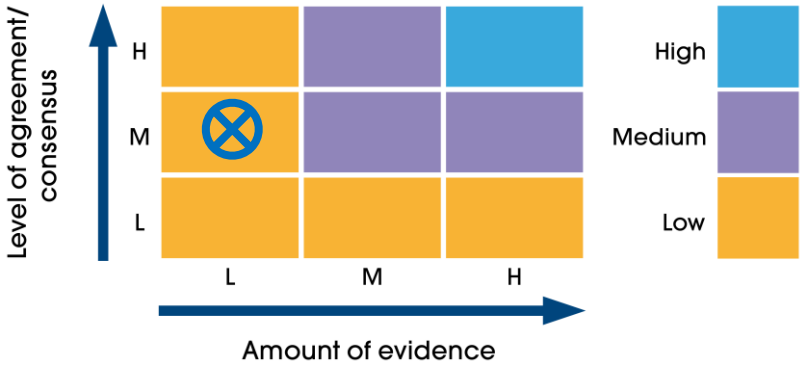
Aside from these direct affects of climate change on the waders themselves we might also expect indirect impacts through changes in their invertebrate food supply. There is, however, no current evidence to support this supposition. However, waders are adaptable and across their winter ranges utilise most prey species that they are likely to encounter eventually in UK waters. Thus, changes in prey species composition due to climate change assisted invasion of southern species into UK waters may not have a marked impact on waders unless overall prey numbers are affected. If, however, changes in the relative availability of shellfish compared to more mobile prey were to shift then this may cause changes in the wader community (Atkinson *et al*., 2010).

Another aspect of climate change is that of rising sea surface temperatures. It is conceivable that waterbirds including piscivourous ducks, divers and grebes wintering around the coasts of the UK could, like seabirds, be affected by changes in the quality of prey. There is, however, no current evidence to support this supposition.

We should bear in mind that waterbirds may also be affected by our own efforts to deal with climate change. For example, further construction of coastal defences to protect against rising sea levels is likely to increase coastal squeeze whilst the development of the renewable energy industry, particularly off-shore wind farms and tidal barrages, may lead to changes in habitat availability and in some cases have a direct effect on mortality while support infrastructure may lead to increased disturbance (Drewitt & Langston, 2006).

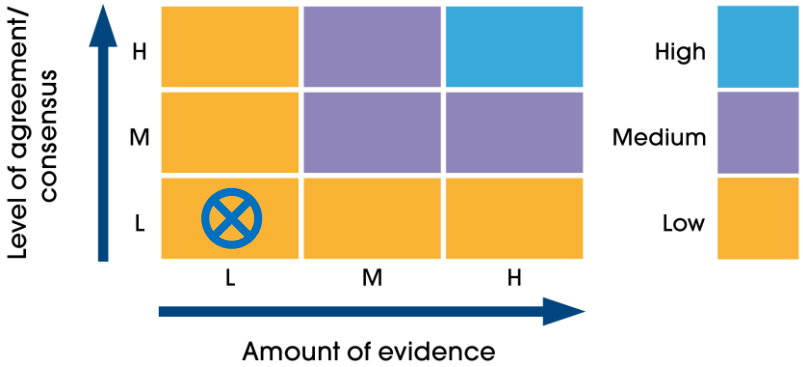
3. Confidence in the science

What is already happening: ***Low***



Aside from the observed changes in over-winter distribution of waders and possibly wildfowl there is little direct evidence for the effects of climate change on waterbirds. Waterbirds face a host of pressure, including amongst others those arising from developments in estuarine habitats, increased disturbance from recreation, shellfisheries and changes in water quality. It is therefore difficult to ascribe changes we monitor in populations to any one factor. Furthermore, assessing the impacts of climate change as it affects these species on their Arctic and sub-Arctic breeding grounds is hampered by the scarcity of basic monitoring let alone focused scientific research.

What could happen: ***Low***



Waterbirds are generally highly mobile and adaptable species. Many species over-wintering in the UK also over-winter in southern Europe and Africa where they inhabit a variety of habitats and feed on a wide range of prey. It is therefore difficult to predict how these species will adapt to climate change on the wintering grounds. It is even more difficult to predict how they may respond on their breeding grounds as there is such a paucity of baseline data.

4. Knowledge gaps

The top priority knowledge gaps that need to be addressed in the short term to provide better advice to be given to policy makers are:

1. Most research focused on the effects of climate change on waterbirds has been derived from programmes that monitor over-wintering populations, something that we in the UK do especially well. However, the waterbirds that the UK hosts breed largely in Arctic and sub-Arctic regions where there is a paucity of monitoring. However, changes in annual productivity and predation

pressure on the breeding grounds may outweigh any changes occurring on the wintering grounds. There is a general consensus amongst scientists that monitoring on the breeding grounds is a priority for the conservation of many of these species.

2. Some long-distance migrants, rely on stop-over areas to refuel before continuing their journies. However, many of these areas are in remote or poorly monitored parts of the flyways and our knowledge of pressures on these areas and number of birds passing through them is scant.
3. To understand changes in waterbird populations in response to climate change it is necessary to develop integrated population models that include annual productivity, adult and juvenile survival and to explore how these are affected by climate change.

5. Socio-economic impacts

Waterbirds are popular with the general public and attract a high level of eco-tourism. Changes in numbers and distributions of these species could affect this relationship.

Many waterbirds are important predators of intertidal invertebrates. In some cases they are seen as competitors with the shellfish industry. Changes in distribution could result in new conflicts. The corollary of this is that waterbirds foraging on intertidal areas occupy a central position in nutrient flow and maintaining the ecological balance. Consequently, changes in numbers in either direction may affect the ecological balance in perhaps unforeseen ways.

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