

Climate change and migratory species: a review of impacts, conservation actions, indicators and ecosystem services



Summary for Policy Makers



Department
for Environment
Food & Rural Affairs



JNCC



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Foreword

Many of the world's most iconic species migrate as part of their life-cycles: whales, dolphins and marine turtles; elephants, large carnivores and antelopes; and a whole range of birds. Migration is key to the survival of these species; they are finely adapted to specific habitats that change with the seasons. It has been known for some time that climate change has the potential to adversely impact migratory species. This new review presents a summary of recent scientific evidence that indicates that the impacts of climate change are being felt by migratory species *now*. The review finds that these impacts could have catastrophic implications for many migratory species.

These impacts are both to the habitats that migratory species rely on for their survival, and to the phenomenon of migration itself. Ecological changes linked to climate change are already having an impact on the survival of migratory species. For example, wildfires and extreme weather events have led to the destruction of important habitats. Significant changes in the distribution, numbers and overall ecology of migratory species have also already been observed. For example, changes are being reported in patterns of migration, including the routes used, and in the timing of the migration. These impacts on migratory species have the potential to disrupt ecosystem functioning and cohesion globally, thereby impacting the services these ecosystems provide to humanity.

Migratory species provide many human benefits, including as a source of nutrition, economic development and services such as pollination, seed dispersal and pest control. Migratory species are essential parts of well-functioning ecosystems; hence the conservation of migratory species is an important part of the answer to both the biodiversity crisis and to the climate change crisis. **There can be no 'net zero' without nature recovery.** Through the delivery of nature-based solutions to climate change mitigation and adaptation, governments can achieve win-win solutions.



The Convention on the Conservation of Migratory Species of Wild Animals (CMS, 1979), also known as the Bonn Convention, is the global treaty that addresses the conservation and sustainable use of migratory animals and their habitats. The key issue of climate change was first discussed at the fifth meeting of the CMS Conference of the Parties (CoP5) in 1997 and has been addressed at multiple subsequent CoPs. CMS CoP11 adopted a comprehensive programme of work on climate change, and in 2017, CMS CoP12 adopted Resolution 12.21 which, *inter alia*, urges Parties, despite the remaining uncertainty surrounding the full scale of the impacts of climate change on migratory species, not to delay related decision making and action, and to assess what steps are necessary to help migratory species cope with climate change.

This review was commissioned by the Government of the United Kingdom of Great Britain and Northern Ireland, through the Joint Nature Conservation Committee (JNCC), as a significant contribution to the work of CMS and to raise global awareness about the impacts of climate change on migratory species that are already being observed. The key findings of the review are provided in this summary for policy makers, together with key messages and recommendations.



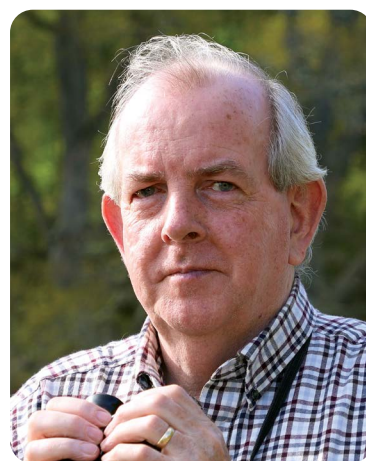
A handwritten signature in black ink that reads "Amy Fraenkel".

Amy Fraenkel,
CMS Executive
Secretary



A handwritten signature in black ink that reads "Gemma".

Gemma Harper,
CEO Joint Nature
Conservation Committee



A handwritten signature in black ink that reads "Colin Galbraith".

Colin Galbraith,
CMS CoP-Appointed
Councillor for Climate Change



Introduction

Biodiversity is declining globally at unprecedented rates, and climate change is one of the major drivers of biodiversity loss. There are well documented increases in global temperatures, alongside increases in the frequency of extreme weather events, global sea level rise and ocean acidification, and decreases in snow and ice cover. Whilst there is global action to limit greenhouse gas emissions that drive these changes, emissions are projected to increase for at least the remainder of this century.

There is already compelling evidence that animals and plants have been affected by climate change over the last few decades. Impacts on their genetic evolution, physiology, morphology, behaviour, phenology, abundance and distribution have been seen, all acting to alter animal communities and the wider ecosystems of which they are part. The impacts of climate change vary globally, with impacts mediated through changes in precipitation more important in the tropics than at higher latitudes, where temperature is currently the main driver of change.

Migratory species of wild animals not only require suitable habitats at each end of their migration route but also suitable conditions and habitats en route. They are subject to a wide range of environmental influences due to the often large distances travelled and their reliance on a wide range of natural resources, making them particularly likely to be affected by climate change at some point in their life-cycles. The complexities of uncertain migratory connectivity, and the difficulty in undertaking assessments of population processes throughout the full life-cycle of migratory species, make it particularly challenging to fully understand and predict the impacts of climate change, and to assess climate change vulnerability in migratory species.

Migratory species face a variety of threats from climate change including loss of suitable habitat; increased frequency of extreme weather events; wide-scale changes in ecosystem functioning including the spatial and temporal distribution of prey; direct effects including changing of sex ratios in hatchlings (e.g. turtles); and phenological or timing shifts of life-cycle events including migration itself. Importantly, these threats are in addition to other human-induced impacts, such as overexploitation and direct habitat loss due to increasing levels of unsustainable development in key habitats around the world.



This review, commissioned by the Government of the United Kingdom of Great Britain and Northern Ireland, through a contract to the British Trust for Ornithology funded by the Department of Environment, Food and Rural Affairs via the Joint Nature Conservation Committee, surveys the evidence on the impacts of climate change on migratory species, updating previous reviews conducted in 2005 (BTO 2005), 2006 (UNEP/CMS 2006) and 2010 (UNEP/CMS/ZSL 2010).

Part 1 documents a review of literature which was carried out to identify the impacts of climate change on each group of migratory species listed on CMS Appendix I and Appendix II. A range of climate change threats on migratory species were identified, research gaps identified and potential conservation responses outlined.

Part 2 summarises the results of a literature review of conservation interventions that have previously been employed on migratory species in the context of climate change. Key considerations for the conservation of migratory species are outlined, providing examples of studies that have demonstrated these. Additionally, an assessment was undertaken of climate change indicators created since 2009, and those with potential to assess climate change impacts on migratory species were identified.

Part 3 summarises a review of the potential roles migratory species can have as key components of ecosystems, particularly through providing nature-based solutions related to climate change. It highlights examples where the conservation of migratory species may also contribute to wider benefits for people and ecosystems, to help decision makers begin to consider these issues in a cross-cutting and holistic way.

Key messages

1

Migratory species provide essential ecosystem services to society

Migratory species are integral to the ecosystems they live in. They support vital ecosystem services that both mitigate the impacts of climate change and increase resilience to climatic hazards. For example, whales facilitate the transfer of nutrients between oceans and store vast amounts of carbon in their bodies, while antelopes can reduce the risk of wildfires through their grazing patterns.

2

Climate change is already having catastrophic impacts on many migratory species and their ability to provide ecosystem services

Migratory species face a variety of threats from climate change, including loss of suitable habitat, increased frequency of extreme weather events and wide-scale changes in ecosystem functioning. Direct effects are already being seen in many migratory species, including poleward range shifts, changes in the timing of migration, and reduced breeding success and survival. These negative impacts limit the capacity of migratory species to provide ecosystem services that benefit humanity.

3

Interventions to address the impacts of climate change on vulnerable migratory species are needed now

There is an urgent need to identify migratory species that are vulnerable to climate change, and to act now to help vulnerable migratory species adapt to a changing climate. Comprehensive and well-connected protected area networks, that conserve and restore ecosystems, will support species in moving to new locations in response to climate change. More direct human interventions, such as translocating individuals to new areas, may be required for some species. Importantly, robust monitoring is needed to understand the success of any interventions and to inform future actions.

4

International co-operation to recover migratory species provides nature-based solutions to climate change

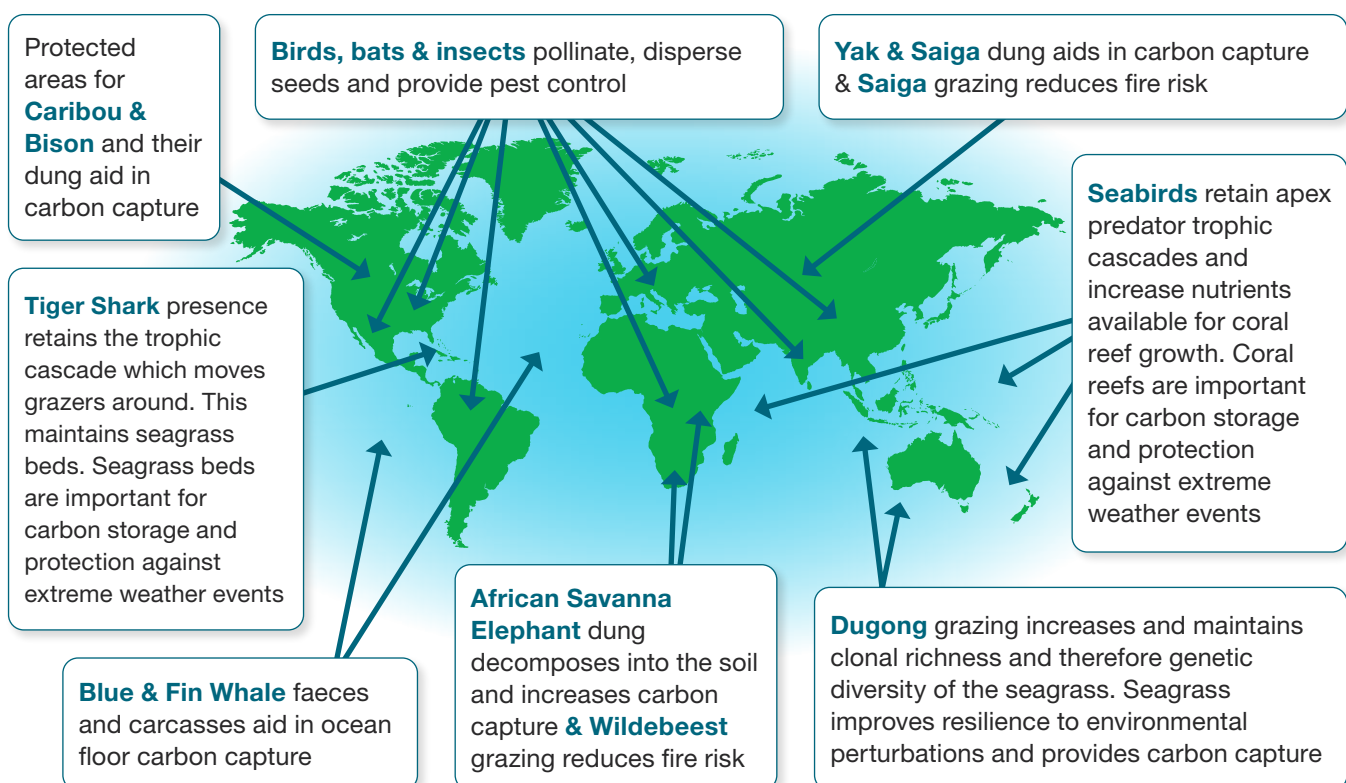
Nature knows no borders. The recovery of migratory species is dependent on collective action across migratory routes. Countries working together to protect and restore shared ecosystems can enable the recovery of migratory species, while gaining benefits from nature-based solutions for climate change mitigation and adaptation. Co-operation and sharing of information between countries is crucial for maximising the success of any actions.

5

The CMS facilitates co-ordinated conservation action and can support UNFCCC and CBD delivery

The Convention on the Conservation of Migratory Species of Wild Animals (CMS) is the forum for nations to work together to recover migratory species and realise the societal benefits they provide. By achieving the ambitions of the CMS, countries are directly contributing to achieving the ambitions of the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD). Co-ordinating efforts under such international agreements will not only support the recovery of migratory species but will also be crucial to tackle the intertwined crises of biodiversity loss and climate change. There can be no 'net zero' without nature recovery.

World map showing example migratory species and the climate change-related services they provide, with approximate geographical locations of where they can be found.





Recommendations

Global conservation actions to tackle the issues involved

- Reduce land use change and conversion – one of the greatest threats to migratory species and biodiversity more broadly, and a major source of carbon dioxide (CO₂).
- Establish effective networks of protected areas for migratory species, including a coherent and interconnected network of passage and safe stopover sites.
- Include the conservation needs of migratory species in nature-based climate change mitigation/adaptation strategies.
- Mainstream the climate benefits of conserving migratory species to influence wider decision-making processes.
- Foster international co-operation in the conservation of migratory species to help the conservation and restoration of shared resources.
- Adopt integrated approaches to migratory species conservation, making use of new technologies, such as those that can track species movements in real-time or model future scenarios.

Specific CMS actions

- Undertake further evaluation of the ecosystem functions and services of migratory species and disseminate these to decision makers.
- Propose measures to help facilitate migratory species' adaptation to climate change.
- Provide advice on possible management interventions, including nature-based solutions, in relation to conserving migratory species' habitats, including maintaining or enhancing connectivity and ecosystem integrity.
- Facilitate action on climate change to maximise opportunities for the implementation of the Kunming-Montreal Global Biodiversity Framework, including, but not limited to, area-based conservation measures, connectivity and restoration.
- Develop guidance on the removal of barriers to migration, including providing an interpretation of the term 'barrier', so that there is consistency in the obligation to remove barriers.
- Ensure that management interventions that aim to aid migratory species' adaptation to climate change, and to enhance the ecosystem services they provide, are properly monitored and evaluated, and the results made available to inform decision making.
- Develop a suite of indicators to measure both the impacts of climate change on migratory species and their ability to adapt to climate change.



Wider research and monitoring needs

- Identify those vulnerable species that are likely to be most negatively impacted by climate change, especially those that are likely to need human-mediated interventions, such as translocations, to moderate the impact of climate change in the short term.
- Identify species which have a high probability of changing their migration routes because of climate change, to prioritise possible interventions and policy actions.
- Undertake effective monitoring of conservation actions to develop a robust set of baseline evidence that can inform future interventions.
- Co-operate and share information with other countries to ensure interventions are complementary and concerted in their impact.
- Undertake further research on the ecosystem services migratory species can provide in relation to climate change, especially in the Global South where climate change impacts are currently being felt most greatly.
- Undertake research on the impacts of human adaptations to climate change (e.g. renewable energy infrastructure or agricultural changes) on migratory species.



Findings of the report

Impacts of climate change on migratory species

Increases in temperature

- Globally, temperatures have increased and will continue to do so. There is strong evidence that such increases in temperature have affected most migratory species groups, and these impacts are mostly negative.
- Many seabird species are negatively impacted by increases in sea surface temperature, with well demonstrated effects on survival, breeding success and population abundance.
- Changes in the reproduction and survival of krill associated with the reduction of sea ice are having a negative impact on marine mammals and seabirds that rely on krill as a key food source.
- Rising temperatures can cause heat stress in terrestrial mammals and seabirds, such as penguins and albatrosses, impacting the reproductive output of these populations.
- Poleward range shifts are one of the most frequently demonstrated impacts of climate change on migratory animals; however, whether such impacts are positive or negative depends on the individual species' ecology.
- There is strong evidence for changes in the timing of migration, mostly in response to increased temperatures. Responses vary between species and groups, and impacts on population status may be either positive or negative.

Changes in water availability

- Alongside increased temperatures, in many regions there will be a reduction in water availability, through reduced precipitation or more rapid evaporation, increased frequency of droughts and also increased human abstraction of water, although in some areas rates of precipitation will increase.
- Species occurring in drier temperate and subtropical areas, or relying on freshwater habitats, will be negatively affected whether they are migratory or not.
- The migration of fish and waterbirds is likely to be particularly impacted by loss of wetlands and reduced river flows.



Extreme climate events

- The frequency and intensity of storms and other extreme weather events is expected to increase although, by their very nature, the pattern of occurrence is hard to predict.
- Evidence of long-lasting impacts is scattered, but they are likely to be negative where they do occur. Habitat destruction caused by landslides has already been observed at some seabird breeding sites. Individual events are starting to be attributed to climate change – this is no longer a future problem but is happening now.

Oceanic conditions

- Changes in oceanic currents are likely to have far-reaching consequences, altering the nature and functioning of many marine and terrestrial ecosystems. There is strong evidence that migratory seabirds and marine mammals will be impacted, but evidence for other groups (such as migratory fish) is so far apparently lacking, due, in part, to the difficulties of gathering evidence.
- Globally, sea levels are rising rapidly and there is strong evidence that species breeding in low-lying coastal areas will be negatively impacted through loss of habitat, for example turtle nesting beaches, especially in areas with high levels of human developments or exposure to storm surges.
- Changes in salinity and pH of water are predicted as CO₂ emissions increase, but so far there is limited published evidence of impacts on migratory species directly. It should be noted that such changes are having marked impacts on particular marine habitats, such as coral reefs, which will have knock-on impacts on any migratory species that use such habitats as nursery areas, for example.

Conservation actions to facilitate adaptation

- There is increasing confidence, based on increased evidence, that conservation management can help some priority species to adapt to climate change.
- There is an urgent need for those undertaking adaptation actions for migratory species to ensure that they are able to monitor and evaluate the success of such actions, and to make that information available (ideally through open access publication) so that others can learn from it.

- Actions to help people mitigate or adapt to the impacts of climate change (whether through nature-based solutions or grey infrastructure) can have negative consequences for migratory species, such as through collisions with windfarms. Mainstreaming the consideration of impacts of climate mitigation and adaptation actions upon biodiversity (and specifically CMS migratory species) in other sectors will help to reduce such impacts.
- The impacts of climate change on migratory species populations are often uneven in their distribution and magnitude across jurisdictions, and therefore mechanisms need to be found to support conservation across entire ranges. The CMS offers opportunities for such international co-operation, including through formal agreements such as memoranda of understanding, concerted actions and via bilateral arrangements.
- Adaptation strategies can have far-reaching impacts, and thus potential trade-offs and synergies for different stakeholders or through time should be considered. Clear and transparent participatory approaches should be developed to agree on adaptation objectives, as well as an adaptive management framework that incorporates monitoring, evaluation and iterative improvements to activities to ensure their long-term success.

Indicators

- In monitoring the impacts of climate change on migratory species, it is important to develop indicators that are useful for informing and guiding policy decisions. These should be indicative of climate change across a wide range of migratory species and be relatively simple and cost-effective to monitor.
- Different groups of migratory species have very different migration routes and are sensitive to a wide variety of climate change impacts, thus adopting a suite of indicators covering a range of climatic situations will help to give a fuller picture.

Ecosystem services

- Migratory species are important for ecosystem function and climate mitigation, especially when they form a significant part of an ecosystem or aggregate in large numbers at particular times of the year, for example to take advantage of seasonal flushes in food resources, such as ocean upwellings, or seasonal abundance of insects or fruits.
- By virtue of their mobility, many ecosystem services provided by migratory species are related to the movement and dispersal of seeds and nutrients. Given human encroachment on natural habitats, the role of some species in regulating and preventing disease transmission is potentially an emerging consideration.
- Large migratory megafauna can contribute towards climate change mitigation through the decomposition of their faeces, which locks carbon into the soil or seabed, as well as through more complex processes, such as maintaining trophic webs that protect forest or seagrass beds important for carbon sequestration.
- Migratory species can also contribute towards climate change adaptation by enhancing ecosystem resilience; for example, seabird guano increases the nutrients available for coral reef growth, which in turn reduces coastal erosion.

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