Convention on the Conservation of Migratory Species of Wild Animals
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CLIMATE CHANGE: A PRIMARY THREAT FOR MIGRATORY SPECIES

(Prepared by the CMS Secretariat)

Background

1. There is growing evidence that climate change will become one of the primary causes of biodiversity loss within the 21st century. More than one fifth of plant and animal species are likely to be exposed to an increased risk of extinction as a result of global warming of only 2-3 degrees Celsius above preindustrial levels (Fischlin et al. 2007). It is evident that fauna and flora have already been significantly affected by recent climate change (e.g. Walther 2002, Parmesan & Yohe 2003, Parmesan 2006). Amongst these are numerous migratory species, many of which are already suffering declines as a result of climatic changes (Robinson et al. 2005, Both et al. 2006, Møller et al. 2008).

2. The process of animal migration is closely linked to climatic conditions. It is commonly considered an adaptation to benefit from temporal and spatial variation in resource availability. Evolutionary selection pressure has been strong for animals to arrive at the optimal time at key sites, such as those for breeding, wintering, stop over or moulting. As the climate changes, these spatial-temporal optima are likely to shift. Those shifts already being observed are outlined in the following paragraphs. Species persistence will depend on how well and how fast they adapt in already heavily fragmented and anthropologically impacted ecosystems.

Temporal shifts in migration

3. Migratory species are particularly vulnerable to climate change due to their complex life cycles, often crossing multiple biomes in the process. Distinct responses to climate change have been observed in migratory populations, especially for avian species. Temporal changes, specifically the advancement of spring migration, have been particularly frequently encountered in the northern hemisphere. In response to the recent increase in spring temperatures many migratory birds have been arriving earlier to breed (e.g. Gienapp 2007, Pulido & Berthold 2004, Møller et al. 2004, Gordo 2007). Similar observations have been made for fish (Perry et al. 2005). Being unable to arrive at the optimal time due to climate change has been linked to a decline in breeding success (Dunn 2004, Visser et al. 2004). It is worth noting that relatively few data are currently available for the southern hemisphere. In contrast to elsewhere, the majority of birds studied here have delayed rather than brought forward their arrival and breeding dates (Barbraud & Weimerskirch 2006).

Spatial shifts in migration

4. Spatial responses to climate change have included a change in migration distance and direction, commonly leading to shifts in species' range. Migration distance has been shown to elongate as well as shorten (Carey 2009), even to the extent of a complete switch to a sedentary lifestyle. This often results in a change of range states, which may have profound implications for conservation management structures, such as CMS agreements. In Denmark, for example, 35-40% of bird species are expected to disappear in the next 80 years, but a similar number of new bird species is expected to move to Denmark during this time (Huntley et al. 2008). Avian range shifts in the northern hemisphere have tended to move in a northerly direction, but with many exceptions in a westerly, easterly and even southerly direction. It has been suggested that the ranges of migratory species may shift far more than those of sedentary species (Price & Root 2001).

Factors influencing species vulnerability

5. Responses to climate change tend to be species-specific, making it difficult to identify individual policy interventions to reduce the impact of climate change on migratory species. Despite the urgent need it has not yet been possible to make general recommendations for taxonomic or geographically clustered groups of species (Fischlin et al. 2007). The research currently conducted by the Zoological Society of London (ZSL) for CMS is aimed at reducing this gap in our knowledge by identifying those Appendix I species that are particularly threatened by climate change (UNEP/CMS/ScC16/ Inf.8).

6. While it is often technically feasible to predict the preconditions for species survival in a habitat for the future, it is currently extremely challenging to predict how vegetation and the associated faunal assemblages will move from one habitat to another in today's heavily anthropogenically altered habitats (Faaborg et al. 2010). There are however a number of factors, which have been identified to correlate with high species vulnerability, and which are outlined in UNEP/CMS/Conf.9.24 and elsewhere (e.g. Robinson et al. 2005, Robinson et al. 2008, Foden et al. 2008). A brief update of recent relevant findings is provided below.

7. Long-distance migrants are thought to be more vulnerable than short-distance ones because - while away at their distant wintering grounds - they cannot predict when spring starts on their breeding grounds (Both et al. 2010). This "mismatching" becomes particularly problematic when the climate at one critical site changes differently to that of another site within the migratory route of a species. There is good evidence that some declines in avian species are already resulting from this "phenology mismatch hypothesis" (Jones & Cresswell 2010).

8. Mismatching of species presence with food supplies such as insects for birds or krill for cetaceans is a further concern (Dunn 2004). The more specialized the diet of a migratory species is, the more likely it is to be at risk (Vegvari 2010).

9. Species that will reach natural barriers such as the Arctic Ocean as a result of their shift in range are likely to be particularly threatened with extinction. Polar species and those dependent on high elevation habitat such as black-necked cranes (*Grus nigricollis*, CMS Appendix I) are likely to be at high risk. An increase of only a 1^{o} Celsius in global temperatures has been estimated to reduce the suitable habitat of birds breeding at high elevation by more than 50% (Rodenhouse et al. 2008). Resolution 9.9 on migratory marine species recognizes the accelerating threat of climate change to marine species, especially in the Arctic region, and requests the Scientific Council to take action.

10. The sex determination process of many migratory reptiles (e.g., marine turtles) is temperature dependent. There is a significant risk that these species will suffer from skewed sex ratios and demographic collapse due to rapid climate change. However, critical data are lacking, making it difficult to assess how individual species will be affected (Mitchell & Janzen 2010).

11. There are many other broader climate-related threats, which will have a considerable impact on migratory populations, often even outweighing the vulnerability factors outlined below and elsewhere (Foden et al. 2008). Changes in water regime (lower water tables, drought) and wide-ranging habitat loss resulting from climate change have been identified as threats likely to affect the greatest number of terrestrial migratory species (Robinson et al. 2005). With these large-scale factors such as habitat loss it is not a straightforward task to identify which geographic or taxonomic entity is likely to be hit hardest; detailed assessment and modeling is generally required.

12. Fundamentally, the evolutionary potential of a species to adapt to contemporary climate change is critical to its survival. Those species whose migrations are dependent on endogenous clocks and rigid *Zeitgebers*, such as photoperiod, are likely to have the most difficulty in adapting to climate change (Carey 2009). Recent evidence from migratory blackcaps (*Sylvia atricapilla*) suggests that microevolution is feasible for birds that migrate short to average distances and that these birds can genetically adapt at sufficient speed to climate change by migrating shorter distances (Pulido & Berthold 2010). It was shown that under intense selection pressure birds can become resident and that this behavioural change is genetically controlled.

CMS mandate and achievements

13. Whether a species will persist and survive contemporary climate change will depend on their ecological and physiological traits, their evolutionary potential and in certain cases also on the efforts undertaken by humans to prevent their extinction. It is the last of these elements, with which CMS is particularly concerned.

14. The climate change mandate of the Convention on Migratory Species was significantly widened with Resolution 9.7 in 2008 following Resolution 8.13 and several research reports in previous years (for a review see UNEP/CMS/Conf.9.24). The British Trust for Ornithology's publication in 2005 on "Climate Change and Migratory Species" funded by the UK's DEFRA is probably the most outstanding in terms of impact and relevance to CMS species to date (UNEP/CMS/Inf. 8.19; Robinson et al. 2005). The 4th Assessment Report of the IPCC incorporated this report in its meta-analysis and specifically featured the impact of climate change on migratory birds (e.g. see Chapter 4, Box 4.5; Fischlin et al. 2005). The recommendations of the DEFRA report are still immediately relevant to CMS policy, but have not been fully reflected in CMS policy. The Scientific Council revisiting this substantial publication is likely to be beneficial.

15. The CMS Secretariat has been actively implementing Resolution 9.7 during the inter-sessional period since CMS COP9, including activities aimed at Parties to take action. Adaptation and research measures relating to climate change have started to be incorporated into a number of Action Plans, such as the one on White-winged Flufftails (*Sarothrura ayresi*), as mandated by paragraph 12 of the Resolution. Species ranges under future climate

change scenarios have been predicted by collaborating organizations and incorporated into species meetings (e.g. Great Bustard Memorandum of Understanding).

16. With the assistance of the ZSL, the bioclimate database (www.bioclimate.org) has been expanded to cover scientific literature on climate change and migratory species (paragraph 6. Resolution 9.7). This open-access online database for literature on climate change requires further investment and has the potential to become a key resource for science-based policy making in the climate change and biodiversity sector.

17. The CMS Secretariat has been reaching out to a number of other MEAs, NGOs and academic institutions to improve the technical assistance offered to CMS Parties with regard to climate change, as mandated by section 11 of Resolution 9.7. The Secretariat presented the threats that climate change poses to migratory species and the CMS mandate to other MEAs (e.g. Bern Convention), Parties and Non-Parties (e.g. Republic of Korea) and other conservation organizations, such as IUCN. At UNFCCC COP15 in Copenhagen the Convention had a conference booth and made direct contact with delegates emphasizing the need for action and importance of migratory species, for example highlighting the fact that migratory species can act as early indicators of climate-induced biological change. Preliminary results of the ongoing ZSL research project, which is outlined below, were presented.

18. Parties contributed to increase the capacity in the CMS Secretariat to address climate change matters by creating at COP9 a new post for an Associate Scientific and Technical Officer. The incumbent has been in the post since June 2010, devotes approximately one fifth of her work time to climate change and is supervised directly by the Scientific and Technical Officer.

19. The 15th Scientific Council highlighted that there is a significant need for policy makers to obtain an overview of the impact of climate change on migratory species and obtain regular updates on newly emerging threats, so that measures can be taken to conserve the species in question. However, currently there are only two types of assessments available: (1) model predictions for habitat and species range shifts and (2) species-specific assessments for only a relatively small number of species. On this basis it is difficult to identify which species are most threatened and what action is likely to have the largest positive conservation impact.

20. There is currently no assessment system in place to identify which migratory species are most threatened by climate change and require urgent attention. CMS is addressing this need with the assistance of the ZSL, as mandated by paragraph 2 of Resolution 9.7 (Party mandate). Research is being conducted to identify those CMS Appendix I species, which are most likely to become more endangered due to climate change (UNEP/CMS/ScC16/Inf.8). The threat categories developed illustrate that wide-ranging species are generally vulnerable, with turtles being particularly threatened. Marine mammals, waterbirds and seabirds tend to also be strongly affected by climate change. A more detailed assessment of waterbirds within the African-Eurasian Flyways is available elsewhere (AEWA/MOP 4.27). The ZSL assessment, as well as the methodology used, is to undergo full review by the Scientific Council.

21. IUCN is currently developing a “red flag” system for its Red List to indicate that a species is particularly threatened by climate change. This wider warning system is likely to be particularly useful to highlight those species which are not yet identified through CMS listing or

other measures as threatened. The ZSL project, on the other hand, provides a more detailed view of more than 40 CMS Appendix I species. It is for the 16th Scientific Council to advise on how to proceed with regard to assessing the remainder of Appendix I and all of Appendix II.

Outstanding matters where Scientific Council guidance is required

22. A regional workshop on climate change and migratory species is mandated by paragraph 8 of Resolution 9.7. There are several needs that the workshop could address. Firstly, the methodology to identify the species most threatened by climate change could be reviewed. Secondly, the workshop could assess Party needs and/or capacity building for managing migratory species with regards to future climate change scenarios (para. 5, Res. 9.7). This could include monitoring of climate-induced biological change. Thirdly, the workshop could focus on how to design and manage critical site networks with climate change in mind. The Scientific Council is requested to advise on what subjects the workshop should focus on. Offers to host the workshop would be welcome.

23. At COP8 a working group on climate change was set up. The chair of the group successfully convened climate change experts again during COP9 to review and draft Resolution 9.7. While the group was actively engaged during COP9 in 2008, there has been no action since. From the perspective of the Secretariat the need for an intersessionally active working group is pressing. It is therefore proposed that Scientific Councillors be identified for this challenging task, which together with CMS observers and other qualified experts could form such an intersessional working group on climate change.

24. CMS Parties have committed themselves to implementing the CMS climate change mandate through Resolutions 8.13 and 9.7. However, only the United Kingdom has to date significantly invested in doing so. An excellent research review (UNEP/CMS/Inf. 8.19) and an assessment of the use of migratory species as biological indicators of climate change (UNEP/CMS/Inf. 9.22) have been funded by the UK. Since the 15th Scientific Council met in 2008, no voluntary contributions have been received for climate change. A continuation of this trend will make implementation of the Convention's work on climate change impossible. Scientific Councillors are requested to bring the striking discrepancy between the level of threat and financial support to Parties' attention.

25. It is evident that functional networks of habitats encompassing full regional variation are required to assist migratory species in adapting to climate change. The promising results of recent genetic studies outlined above suggest that many species will be able to adapt. Conserving functional habitat networks is likely to be the "common denominator" of most adaptation measures, especially in the light of overwhelming uncertainty surrounding the response of species to climate change. Given CMS's limited capacity and funds, it may therefore be fruitful to focus more strongly on appropriate critical site development for migratory species, at least with regard to terrestrial and avian species.

26. There is also a need for protected areas and legal entities such as CMS agreements to adjust flexibly to climate change related species range shifts. Mobile protected areas focussing on only seasonally critical habitat may provide a useful addition, such as the mobile *zakazniks* that were used by the Soviet Union to protect the calving grounds of the Saiga antelope *Saiga tatarica* in spring (CMS Appendix II, Gordon et al. 2004). Parties should also introduce flexibility in their framework legislation in order to gain agility in the designation of new sites that will facilitate species adaptation to climate change.

Action requested:

The 16th Scientific Council is requested to:

a. Consider the establishment of an intersessional working group on climate change;

b. Identify suitable experts and a chair for the intersessional working group on climate change;

c. Revisit recommendations made by Robinson et al. 2005;

d. Identify key gaps in current research on the interactions of climate change and migratory species and encourage the closing of these gaps such as our understanding of the impact of climate change on non-avian species or in the southern hemisphere;

e. Review the latest available information on the current and predicted conservation status, in relation to the possible consequences of climate change, of all Arctic migratory marine species listed on the CMS Appendices and consider whether additional marine species warrant (Resolution 9.9);

f. Assess how the vulnerability of the remaining CMS Appendix I species and Appendix II species should be assessed (section 2, Resolution 9.7) and identify potential funding sources;

g. Seek avenues for research and dialogue on the effects of climate change on migratory marine species with other Multi-lateral Agreements and other relevant organizations (Resolution 9.9);

h. Consider whether CMS should engage more closely with the UNFCCC Nairobi Programme and submit an action pledge;

i. Raise awareness of the threat that climate change poses to migratory species;

j. Encourage Parties and Non-Parties to incorporate climate change into their national monitoring strategies;

k. Encourage and plan further critical site networks, which are designed to be well-connected under future climate change scenarios;

l. Evaluate how the legal rigidity of protected area systems could be overcome, including the application of seasonally restricted and mobile protected areas;

m. Bring the discrepancy between climate change threat and funding available to address this threat to the attention of CMS Parties and advise on the agenda and focus of the regional workshop and explore possible host countries; and

n. Report back to the 10th Conference of Parties on the outcomes and findings of the activities listed above.

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