UNEP

CMS

CONVENTION ON MIGRATORY SPECIES

Distribution: General

UNEP/CMS/ScC17/Inf.12
21 September 2011

Original: English

17[TH] MEETING OF THE
CMS SCIENTIFIC COUNCIL
Bergen, 17-18 November 2011
Agenda Item 12.0

PROCEEDINGS OF THE UNEP/CMS TECHNICAL WORKSHOP ON THE IMPACT OF CLIMATE CHANGE ON MIGRATORY SPECIES: THECURRENT STATUS AND AVENUES FOR ACTION

6-8 JUNE, 2011, TOUR DU VALAT, CAMARGUE, FRANCE

CMS COP10 Norway
Networking for Migratory Species
Bergen, 20-25 November 2011

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Proceedings of the UNEP/CMS Technical Workshop on the Impact of Climate Change on Migratory Species: the Current Status and Avenues for Action

Tour du Valat, Camargue, France
6-8 June, 2011

1. Introduction and background

Climate change is likely to become one of the primary drivers of biodiversity loss within the current century. Since the process of animal migration is closely connected to climatic factors, migratory species will be considerably affected. Currently, widespread shifts in the timing, direction and strength of migration can already be observed, as well as the first population declines as a result of climate change. Measures takento mitigate climate change can also have significant negative impacts on migratory species, which need to be recognized and addressed in parallel to the rapid development of renewable energy, biofuel and other agricultural measures, as well as geo-engineering.

Climate change has been explicitly addressed within the framework of CMS since 1997. Beyond the international legal implications, this mandate has given rise to a number of policy reports on species' vulnerability to climate change, as well as guidelines and specific incorporation into daughter agreements and action plans. The CMS Scientific Council, the dedicated Scientific Council Working Group on Climate Change and a number of observers of CMS meetings have regularly reviewed the mandate and guided relevant policies.

Leading up to the Tenth Conference of the Parties (COP10), the UNEP/CMS Secretariat convened a technical workshop on climate change that had been called for by Resolution 9.7 from COP9 in 2008. Experts from academia, NGOs, IGOs and government agencies specializing in the interactions of migratory species and climate change, as well as the legal and policy context, met at the Tour du Valat Research Station in France from 6-8 June 2011. The aim was to make the most recent interdisciplinary findings available to decision makers at COP10 and the almost 150 countries that have signed one or more CMS Family instruments. Specifically, the objectives of the workshop were to assess the current impact of climate change on migratory species, to review progress under the CMS climate change mandate and to draft recommendations for action on climate change to be adopted by COP10 in the form of a resolution. The German Ministry for the Environment, Nature Conservation and Nuclear Safety financially supported the workshop.

2. Overview of recommendations

The detailed recommendations have been collated in the form of a draft resolution, which will be reviewed by participants, the CMS Scientific Council and by external assessors on an open-access and voluntary basis leading up to COP10. In order to record the status of discussions at the workshop the first draft of the resolution is included in Annex I, however for the most recent working draft and for the final Resolution text adopted at COP10 in November 2011, please consult the CMS website www.cms.int.

The recommendations focused on the following matters: interpretation of the Convention text in the light of climate change, species assessments and monitoring, mapping and scenario planning, species and population management, ecological networks and protected area design, mitigation, tertiary effects, emerging issues, development and conservation, coordination amongst and within Parties and coordination of the UNEP/CMS Secretariat with others. The discussions surrounding each of these subjects are outlined in section 4 and the resultant formal recommendations form the bulk of the climate change resolution in Annex I.

3. Workshop presentations and opening addresses

3.1 Opening addresses

Mr. Jean Jalbert, DirectorGeneral of Tour du Valat, opened the meeting and welcomed participants to the Camargue and the Research Centre. Mr. Borja Heredia from the UNEP/CMS Secretariat welcomed experts and asked them to act as a "think tank" for the coming days and to translate their research and knowledge into applied actions. Their recommendations would directly feed into a climate change resolution for CMS Parties to adopt at the forthcoming Tenth Conference of the Parties in November. Mr. Heredia thanked the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety for financially supporting the meeting, the French Ministry of Ecology, Sustainable Development, Transport and Housing for facilitating the meeting preparations and Tour du Valat for hosting the technical workshop. Mr. Colin Galbraith, Vice-Chair of the CMS Scientific Council and Chair of the CMS Climate Change Working Group, expressed his gratitude to the supporters of the meeting and was pleased to finally be in Tour du Valat, having heard much about the excellent work being done here.

3.2 Introduction to the aims and objectives of the workshop

Ms. Aline Kühl from the UNEP/CMS Secretariat provided an overview of CMS structure and then outlined the climate change mandate of the Convention and its daughter agreements. The process of migration was closely linked to climatic factors. Across different taxonomic groups the impacts of climate change could be observed, such as range shifts and changes in the timing of life-history events. The increasing mismatching of ecological interactions, to which long-distance migrants were particularly susceptible, was of considerable concern. Because of the complicated interactions between climate change and biodiversity, it was difficult to make detailed policy recommendations. From 1997 onwards there had however been a number of CMS decisions, specifically Recommendation 5.5, Resolution 8.13 and Recommendation 9.7, calling for the threat of climate change to be addressed. Outputs had included a number of literature surveys, research projects on indicators and the identification of those migrants that were most threatened by climate change. The workshop had been convened in order to review the current climate change mandate of the Convention and in order to seek expert guidance on climate change action that the treaty could facilitate.

3.3 The impact of climate change on migratory species – an overview

Mr. James Pearce-Higgins from the British Trust for Ornithology outlined how climate change was affecting migratory species, with a focus on avian literature since most data was available for birds. Mechanisms were complex, including changes in disease prevalence due to climatic change, changes in predation, competition and extreme events. Different rates of warming in different regions were a particular challenge for migratory species since it could lead to phenological mismatch, which had been shown to affect several long-distance birds, in particular those inhabiting deciduous woodlands. Factors such as a lack of food or an inability to shift migration time made a species decline more likely when mismatch was occurring. Given the difficulty and effort required to monitor migratory species and the resultant delay in producing specific recommendations for action, it might be more effective to use species indicators. BTO had in a previous study for CMS developed 18 potential indicators for which long-term data was available, however further research was needed. Recommendations for climate change action included specific land management to assist colonizers and to increase resilience, as well as the protection of large and heterogeneous sites.

3.4 The potential of migratory species to adjust to climate change

The evolutionary consequences of climate change and the potential of species genetically and behaviourally to adjust to climate change were the focus of the presentation given by Mr. Francisco Pulido from the Complutense University of Madrid. Avian lifecycles were better understood, nevertheless there was little data available on impacts from Africa and the entire southern hemisphere, as well as from less seasonal habitats. An inability of species to adapt to climate change was likely to lead to population declines. It was interesting that there was a tendency for long-distance migrants to be more dependent on genetic change in order to adapt to climate change, whereas short-distance migrants could also make use of their phenotypic plasticity and adapt more quickly that way. Under sufficient selection pressure, blackcaps (*Sylvia atricapilla*) had been shown to switch from a migratory to sedentary lifestyle within two generations. However, it was not known how widespread this high rate of change was. The theoretical advantages of a reduction in migration distance were clear, specifically the lower cost of migration, better information about climatic conditions at the next site and earlier arrival, which in turn might have implications such as reduced competition and better food availability. It was assumed that a latitudinal shift in wintering areas was the most common evolutionary response to climate change in order to adapt to the phenological changes at the breeding area. Speciesthatwere most likely to adjust successfully to climate change were generalists, those with large phenotypic plasticity, especially those adapted to fluctuating environments, as well as species with large population sizes.

3.5 Understanding the impact of climate change on migratory species and identifying the implications for adaptation

Ms. Vicky Jones from BirdLife International illustrated results of bio-climate modelling, which were available for birds in Europe, much of Africa and parts of Asia and South America. The sensitivity, adaptive capacity and exposure of a species to climate change was considered and individual species maps were then overlaid toassess, for example, the suitability of the Important Bird Area (IBA) network in future. It was evident that the IBA network continued to be important, but that there was significant fluctuation in species, often with a >50 per cent change in bird species composition. Changes in land-use were often interacting with a species' direct response to climate change. It was important to ensure that mitigation action such as biofuel and renewable energy did not have a negative impact on migratory species. Depending on the expected turnover of emigrants and colonists at individual IBA sites, the local management measures (e.g. fire, flood and grazing managements; site expansion, stepping stones, corridors, translocation) could be adjusted to assist species in adapting to climate change. Ms. Jones made detailed recommendations on adaptive management, site networks, the broader landscape and monitoring. It was important to remind oneself of the biases in available data, where much more monitoring data was available from developed countries compared with developing ones. There was an urgent need to balance out these biases.

3.6 The impact of climate change on marine mammals

Mr. Daniel Palacios from the US National Oceanic and Atmospheric Administration (NOAA) compared the impact of climate change on marine and terrestrial ecosystems, pointing out that trophic interactions were an essential consideration in the marine environment in this context since most marine mammals fed on zooplankton and higher-trophic-level organisms; herbivory, in contrast, was very rare. Appropriate long-term monitoring was essential in order to tease apart climate changefrom natural climatic oscillations such as the El Niño Effect or the Pacific Decadal Oscillation. Ocean acidification was likely to have wide-ranging negative impacts on marine migrants due to the strong dependence on calcifying organisms that are an important component of the basal food chain. Recent predictions suggested that most changes in marine mammal diversity would take place at mid- and higher latitudes. Factorsthat were likely to make individual species more susceptible to climate change included reduced prey density, inability to switch prey, warmer waters that could lead to an increase in pathogens and interact with pollutants and tertiary effects (i.e. whereby changes in human behaviour due to climate change resulted in additional impacts). Unfortunately there were few adaptation or mitigation measures that CMS Parties could take to assist marine mammals in coping with climate change. In coastal zones it was possible to assist, for example, by ensuring connectivity of key sites and by having marine protected areas, which would allow populations to reproduce successfully and replenish the wider population.

Mr. Salvatore Cerchio from the Wildlife Conservation Society continued the presentation on marine mammals by taking a broader perspective, including all threats and outlining how, with the assistance of a three-axis-model, management plans could be drawn up. The three axes to consider were environmental susceptibility, the pristine state of the resource and adaptive capacity of the people within the species range. GIS maps depicting vulnerability across the species' range could be drawn up, which allowed for different threats to be overlaid. Spatial planning of conservation measures could be more easily designed as a result and in the case of migratory species it was possible to manage at a population-specific rather than site-specific level.

3.7 The impact of climate change on ungulate migrations, with a focus on Central Asia

Mr. Navinder Singh from the Swedish University of Agricultural Sciences provided an in-depth presentation on the conservation status of long-distance migrants on land and what role climate change played in this context. The drivers of migration in terrestrial ecosystems ranged from predator escape, breeding optimization, disease avoidance and genetic reasons to climatic ones such as vegetation tracking and avoidance of harsh climatic conditions. Not only migration drivers, but also migration characteristics and the response to individual threats were very much species-specific. Climate change was further exacerbating this already complex situation. Reproductive success was already declining in caribou due to trophic mismatching in response to climate change and population declines had been predicted for wildebeest (*Connochaetes taurinus*). There was an urgent need to collate sufficient ecological information, especially related to the threat distribution in space, to set up long-term monitoring and to address threats other than climate change in parallel, which often posed a more immediate threat to populations. Climate change adaptation needed to be incorporated into national strategies and amongst other matters, it was important to focus on ecosystem management and connectivity in order to make entire landscapes more resilient to climate change. Spatial vulnerability assessments linked to ecological network design provided powerful tools. However, care needed to be taken to make these sufficiently flexible to adapt to shifting species ranges in the light of climate change. Recommendations for a framework of action for monitoring and decision-making were made, which were elaborated in the ensuing discussion (see 4. and Annex III).

3.8 Climate change and migratory species – vulnerability assessments and next steps

Ms. Monika Böhm from the Zoological Society of London gave an overview of a project aimed at identifying those CMS Appendix I species that were most vulnerable to climate change, in line with CMS Resolutions 8.13 and 9.7. The study had been a preliminary one and it was now important to discuss next steps. The ZSL research for CMS had produced in-depth assessments ofclimate change vulnerability for 45 species (44 CMS Appendix I and 1 CMS Appendix II species). These assessments had focussed on the interplay of species exposure, susceptibility and adaptability to analyze the overall vulnerability to climate change, as well as synergistic threat processes. Turtles ranked high in the final threat index due to the combined impact of sea level rise, sensitivity of the sex ratio to temperature, ocean acidification and a range of anthropogenic factors, which were likely to exacerbate climate change impacts. Krill-feeding cetaceans also ranked high. The overlap of high climate change vulnerability and high vulnerability ranking on the IUCN Red List was noticeable. However, high vulnerability ranking on the IUCN Red List was primarily due to reasons other than climate change. This suggests that it is vital to minimise other threats in order to maximise adjustment potential of species to climate change by increasing population sizes (see 3.6 above). Recommendations for follow-up from the study included increasing the number of species assessed, integrating the methodology used with that employed by IUCN (see presentation by IUCN) and to develop monitoring to improve the data available for the assessment. It was important to incorporate the recommendations from the ZSL project into the species-specific action plans within the CMS Family. Fundamentally, mitigation action was essential and therefore a stronger network amongst the biodiversity- and climate-change relevant treaties was needed.

3.9 IUCN's global red flag indicating species threatened by climate change

Following on from ZSL's presentation, Ms. Wendy Foden from IUCN, provided an overview of a much wider "red flag" assessment under IUCN which had the same aim as the ZSL project, but applied to the entire IUCN Red List. Specifically, IUCN had developed a quantitative methodology to identify those species within the Red List that were most susceptible to climate change. This methodology was undergoing peer-review andprinciples of the approach had already been included in section 12.1.

ofthe 8th version of the IUCN Red List Guidelines, which was adopted by the SSC Standards and Petitions Subcommittee in March 2010. It was the first time that the results of the assessment were being presented. The sensitivity of a species to climate change, its adaptability and exposure were considered within a framework of 25 detailed traits, such as environmental triggers connected to migration time which might be disrupted. Assessments had been completed for birds, amphibians, warm-water reef-building corals and South African *Proteaceae*. Global maps of climate threat included, for example, good news indicating thatbirds in the Congo Basin and Australia, tended to be relatively less exposed to climatic change than in other areas such as the Amazon Basin despite these species having biological traits making them particularly sensitive to climatic change. Corals were generally very sensitive to climate change andthe coral triangle in south-east Asia was found to have highest numbers of climate change susceptible species. While the"red flag" was aimed to act as an overall early warning system at a global scale, additional detailedassessmentswere needed for adaptation planning at finer scales. The data available was however sufficient to implement "no regret" measures.

3.10 Evolution of waterbirds in the Mediterranean countries from 1970 until today: the impact of land-use change and climate change

Mr. Thomas Galewski from Tour du Valat illustrated how Mediterranean waterbird populations had responded to climate change and other threats, such as land-use change. While overall waterbird populations had doubled in size since the 1970s, there had been increases in the west and decreases in the east. Increases in the west might be connected to less hunting for fish-eating birds, warmer wintersthat had led more cranes (*Gruidae*) and white storks (*Ciconia ciconia*) to overwinter in Europe, as well as new resources linked to more saltpans, for example. There was an overall influx of warm-dwelling waterbirds and generalist species, which could be observed at Tour du Valat in recent decades. The water management in the Camargue had a noticeable impact on species' presence. While the artificial flooding all-year round benefited species such as the mute swan (*Cygnus olor*), many specialized species dependent on reedbeds and seasonal marshes were declining.

Mr. Michel Gauthier-Clerc from Tour du Valat focussed on the Camargue flamingo (*Phoenicopterus roseus*) population, which was managed by Tour du Valat and would be visited as part of the workshop excursion. Both active and abandoned saltpans provided suitable refuge for the species. In southern Spain and Tunisia where saltpans tended to be abandoned, there was a noticeable climate change link, with breeding success being correlated with higher precipitation. In the Camargue however, the water regime was actively managed and while it was well known that higher water levels and earlier flooding were connected with higher breeding success, this was not linked to climate change but economic decision-making. Locally, increases in Little Egret (*Egretta garzetta*), Squacco Heron (*Ardeola ralloides*) and Glossy Ibis (*Plegadis falcinellus*) could be observed. The last mentioned was linked to habitat recovery.

3.11 A national perspective on effectively addressing the threat that climate change poses for migratory species, with a focus on migratory birds

Mr. Grzegorz Rąkowski, CMS Scientific Councillor for Poland, illustrated the outcomes of a report on the impact of climate change on migratory birds in Poland, which was part of Poland's contribution to the implementation of CMS Resolution 9.7 on climate change. Out of the 114 CMS-listed birds breeding in Poland from 1960-2010, at least59 per cent had been affected by climate change, the majority being waterbirds. Species ranges were noticeably shifting, mostly in a northerly direction, with quite a number of species no longer breeding in Poland and a significant number of newcomers. Earlier arrival and a shortening of migration route were being observed in numerous species. Some species, such as the reed warbler (*Acrocephalus scirpaceus*), were nesting twice per season in response to climate change. It was important to note that land use had a more significant impact on migratory species in Poland today compared to climate change; therefore any conservation action should consider the entire array of threats. Recommendations for actions targeting climate change included single species action plans for those species most vulnerable to climate change, integrating climate change more firmly into ornithological research and monitoring and active protection of critical habitat sites.

3.12 The CMS and climate change: a legal perspective

Mr. Arie Trouwborst from Tilburg Law School had conducted legal analyses and published reports on the climate change mandate of a number of biodiversity treaties, including CMS. He noted that many of the earlier biodiversity treaties, such as CMS (1979), had been drafted before climate change had been recognized as a serious threat in the international policy arena. The provisions of the Convention thus did not explicitly address climate change. Within the treaty provisions there were parts favouring adaptation. However, the definitions of "historic coverage" and "range" could be seen as a legal obstacle to adaptation. Mr. Trouwborst analyzed the climate change mandate of the entire CMS Family, including Memoranda of Understanding. It was noteworthy that specific climate change decisions and technical guidance were only available under the CMS and AEWA treaties, not for the six other regional Agreements. Some of the Memoranda of Understanding recognized climate change as a threat and called for research or adaptation measures. Recommendations for the COP10 climate change resolution included specific adaptation measures, promotion of the participation of "future range states" in CMS daughter agreements and clarification of the terms "historic coverage" and "range".

4. Discussion and recommendations

The recommendations for CMS Party action made at the workshop were manifold and diverse, yet there was noticeable common ground between participants. There was broad consensus that the management tools within the context of climate change remained the same, but that their application and priorities would change. Any action addressing climate change should be taken in the broader context of global change, by incorporating all threats such as habitat destruction or exploitation into the planning process. Measures at the level of ecosystem management aimed at assisting species in helping themselves were considered much more realistic and cost-effective than micromanagement. Only in exceptional circumstances would measures such as assisted colonization be fruitful, and only if Parties adhered to the most recent IUCN guidelines. Adaptive management was of fundamental importance to any intervention.

Participants recommended a framework for decision-making to lead Parties along the planning and monitoring process, and to prevent interventions from stalling due to uncertainty. The framework proposed can be found in Annex III. Parties needed to ensure that irreversible tipping points were avoided whereby entire migration pathways were lost or permanent habitat change occurred. The phenomenon of mass migration should be more prominently recognized within CMS as worthy of specific protection.

The importance for Parties to pay due attention to past climate change decisions, specifically Resolution 8.13 and 9.7, was emphasized. Resolution 9.7, for example, stated that uncertainty should not halt action, which today rang more true than ever before. The importance of the precautionary principle was underlined. The implementation of "no regret" measures, which had proven to be fail-safe, should be made a priority. Furthermore, it was recognized that the identification of those species most vulnerable to climate change should remain a key priority. Adaptation measures had not been spelled out in great depth by past CMS decisions; this was something that participants hoped to rectify in the COP10 Resolution on climate change. The recommendations and discussions surrounding these can broadly be categorized under the following headings.

4.1 Implications of shifts in species range for CMS interpretation and processes

As proposed by Arie Trouwborst in his presentation and his explanatory note to the Convention (Annex VI), participants agreed that in the light of climate change it was not necessarily constructive for conservation efforts to try to approach "historic coverage" (Article I, paragraph 1 (c) (4) of the text of the Convention) of a species distribution and abundance. In the light of climate change, historic coverage may no longer be a meaningful concept, not least with regards to geographic coverage since species ranges were already shifting significantly. Further discussion on this subject was needed. Moreover, participantsnoted that the term "range" in Article I, paragraphs 1 (f) and 1 (h), was also not sufficiently forward-looking. It was unclear how the predicted future range of a species should be considered.

4.2 Monitoring

Monitoring featured heavily in the workshop discussions, not least because the effectiveness and specificity of conservation was dependent on a good understanding of the situation. Monitoring the impact of climate change and not only the impact of weather required long-term datasets, establishment of baselines and a certain level of "climate literacy" amongst those collecting and analyzing the data.For certain species, especially for marine mammals, it was important to closely monitor prey populations, too, to fully understand the dynamics of the system. CMS`s role in facilitating exchange of monitoring results between countries was recognized. This would be much needed to determine whether a species range was shifting or whether the population was declining, for example. The use of individual migratory species as climate change indicators to predict the response of a larger group of migratory species had been proposed by the British Trust for Ornithology (see Newson et al. 2009, see related CMS literature, Annex II), specifically the use of Trans-Saharan Songbirds. Participants agreed that it would be valuable to follow-up on this study and assess whether indicators could be used as a cost-effective and sufficiently precise indicator tool, which would be particularly valuable for data deficient species. Experts further noted that participatory monitoring by engaging local people or industry (e.g. fisheries, tourism) in data collection or analyzing data that was being collected in a different context provided a further avenue for cost-effective monitoring. Other benefits from participatory monitoring included awareness raising.

There had been considerable progress in the identification of those CMS-listed species that were most vulnerable to climate change, primarily thanks to the ZSL study presented by Monika Böhm, which covered approximately half of the Appendix I species. More species would need to be assessed, however, and the methodology would need to be revised to become more quantitative. As outlined by Wendy Foden in her presentation, IUCN´s global assessment had just been completed for a number of taxonomic groups including birds. This would be particularly useful for the identification of vulnerable species that were not yet listed on CMS Appendices. Experts recommended that results from both methods are compared and that any species identified as particularly susceptible to climate change by the IUCN assessment should be considered for CMS listing by Parties. A common methodology for the timely identification of these species was much needed.

4.3 Mapping and scenario planning

Recent technology advances in tagging and geographic tracking devices such as geo-locators and satellite tags had revolutionized our understanding of migratory ecology in space and time. Since much of the impact of climate change on migratory species had implications on the spatial dynamics of populations, such as range shifts, participants agreed that it was vital to develop maps and scenarios, ideally based on historical baseline data and shifting baselines, to guide conservation action. Such sensitivity and predictive mapping would also allow for the anticipation of barriers to migration and assist future range states in their decision-making. In line with the overall recognition that all threats to migratory species should be assessed together, it was recommended that maps illustrating threats for species at spatio-temporal scales would be extremely helpful. From such maps one could see, for example, not only how infrastructure was distributed, where transport routes were present and potentially presenting a barrier, where and how habitat was being degraded, but also where designated protected areas were located.

In line with Resolution 9.7 participants emphasized that negative impacts of climate change mitigation had to be avoided at all cost, especially today when there was considerable growth in biofuels and renewables, for example. Renewable energy development, such as wind or solar farms, was very much driven by resource availability (e.g. wind, sun, tidal currents). It was essential that potential negative impacts on the environment were taken into account early on in the planning of renewable energy projects. To guide climate change mitigation it would be helpful to create zoning maps where, for example, in the green zone development could take place since there was a negligible impact on migratory species, in the orange zone there would have to be a more detailed assessment of whether the identified negative impacts could be minimized and where red zones were no-go areas for development. Environmental and Strategic Impact Assessments were indispensible in the planning process for climate change mitigation measures.

4.4 Population management

Several general characteristics were identified for the management of migratory species in the context of climate change. Managers should aim for populations that were as resilient and adaptive to climate change as possible, for example by aiming for sufficient genetic variation and large population size, including all the factors that impact population size. Assisted colonization, the transportation of species to a new range predicted to be favourable for persistence under future climate scenarios, should only be considered a last resort, not least because migratory species tend to be highly mobile. It was, however, noted that a number of species listed on the CMS Appendices occupied transboundary ranges rather than being biologically migratory. Wendy Foden reported that IUCN was just in the process of finalizing guidelines for assisted colonizationfor submission at the 2012 World Conservation Congress, which experts agreed should be used as the standard guidelines within the context of CMS.

4.5 Ecological networks and protected area design

Experts welcomed the emphasis on ecological networks as a tool for migratory species conservation by COP10. This would allow for the close integration with an ecosystem management approach and a stronger focus on habitats. In the context of climate change care would need to be taken to ensure networks consisted of large and heterogeneous patches, with particularly strong protection of source populations. Marine Protected Areas, for example, tended to act as core breeding grounds if protection and size were adequate. In the terrestrial and freshwater environment care needed to be taken to ensure connectivity of the patches.

Since the presence of migratory species in any one area was very much seasonal, experts recommended that the use of seasonal protected areas should be applied more widely. For ungulates such as the Saiga Antelope this had been an effective measure to protect calving sites, for example. Implementation required the early presence of law enforcement personnel when migrants arrived to a designated seasonal protected area.

The need to work at the landscape level was further recognized as a way to address habitat degradation resulting from, *inter alia*, large-scale land use changes, infrastructure development and agricultural intensification.

4.6 Mitigation

It could be argued that measures aimed at mitigating climate change were currently more damaging to migratory populations than climate change itself. It was evident that the expansion of mitigation activities such as renewable energy, biofuels and other agricultural measures were expanding on a large and global scale. Wind farms could potentially cause high bird and bat mortality if sites were not selected carefully and other precautions before and after construction taken. The cutting of natural forests for biofuel plantations were also highlighted as a key threat. Judging from current IPCC discussions, geo-engineering, specifically carbon capture and storage, were also likely to grow and potentially have extreme consequences for biodiversity. Experts recommended that CMS should continue to try to bring the specific impacts on migratory species to the attention of Parties, Non-Parties, the private sector and civil society and promote practical solutions. Coalitions with other bodies with an overlapping objective were encouraged.

4.7 Tertiary effects

Only recently had the phenomenon of tertiary effects come to international attention. The term "tertiary effects" referred to the changes in human behaviour resulting from climate change that in turn resulted in additional impacts. For example, due to global warming new shipping routes were now available in the Arctic, which were leading to increased disturbance and exploitation of marine migrants. Similarly, areasthat previously could not be mined or otherwise exploited due to permafrost were now being increasingly developed leading to habitat destruction, especially in Siberia, which was an important breeding ground for many migratory birds. CMS Parties should be called upon to anticipate and proactively minimize tertiary effects on migratory species. Given the large scale of the problem, it would be beneficial for the biodiversity-related Multilateral Environmental Agreements to coordinate their response together. The importance of mapping and the incorporation of measures aimed at climate change mitigation in the context of tertiary effects were recognized.

4.8 Emerging issues

Long-distance migrants appeared to be particularly vulnerable to climate change due to phenological mismatch whereby the climatic conditions in different parts of the species range were changing at a different rate. This could result in sub-optimal migration timing, a reduction in fitness and eventually in population decline. From the avian literature there was a growing number of migrants declining due to mismatching. Experts agreed that there was little that Parties could do in terms of reducing mismatching in the light of contemporary climate change. However, the other threats affecting a species such as habitat decline and overexploitation were often more immediate and often could be reduced. It was vital, as mentioned above, that threats were not addressed individually, but together, including their respective interactions such as tertiary effects. Other emerging issues included a predicted increased spread of pathogens with increasing temperatures, impacts on the distribution of invasive species and changes in ecosystem composition on an unprecedented scale. It was important for the scientific community to continue to assess emerging issues, to share their insights with the CMS Scientific Council and for the scientific advisory bodies of different biodiversity-related treaties to consult together.

It was noted that recent research by Mr. Francisco Pulido and others showed that blackcaps (*Sylvia atricapilla*) could within two generations become partially migratory, with a number of non-migratory individuals present within the population given sufficient selection pressure. Thus there was theoretically a possibility given favourable environmental conditions and sufficient time that migrants remained at a site all yearround and gave up their migratory behaviour. CMS should continue to monitor changes in migrants and modify recommendations regularly as the ranges and behaviour of different species changed. It was, however, unclear at this stage how widespread the ability to stop migrating was amongst migratory species.

4.9 Development and conservation

It had long beenrecognized that the poorest members of society would be hit hardest by climate change and that these were also the people who tended to depend most on wild species for their food, livelihood and income. It was vital therefore for all measures called for in the COP10 Climate Change Resolution to pay due attention and make the connection to communities and livelihoods. Capacity building at the local level, training in "climate change literacy" and an emphasis on measures such as participatory monitoring were essential tools for CMS Parties to consider. More widely, experts would welcome a stronger emphasis on local people within CMS instruments, specifically with regards to creating incentives amongst communities for conservation.

4.10 Coordination amongst and within Parties and coordination of the UNEP/CMS Secretariat with others

There would be much added value for more integration in the climate change policies amongst Multilateral Agreements. With this in mind the CMS Scientific Council, other decision-making organs of the Convention and the Secretariat should strengthen their collaboration with,*inter alia*, CBD, Ramsar, the Bern Convention and UNFCCC. Linkages with the IPCC, possibly at expert level, would also be fruitful. The Climate Change Resolution should further call upon the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) to provide guidance to CMS Parties, specifically with regards to recommendations for specific adaptation measures, in which CMS Parties should engage. The mapping and scenario-planning objectives (4.3) would particularly benefit from IPBES support.

Climate change required a highly interdisciplinary response, which at a national level required close cooperation between environment, energy, mining, agriculture, national development and other ministries. It was important for national and regional policies to be fully coherent, which required regular dialogue and consultations. Especially with regards to land use planning it was important to consider environmental and social aspects in synchrony and to include Strategic Environmental Assessments in order to be able to obtain a broader view of the regional ecological network and how migratory species fitted into it.

4.11 Other matters

Experts called for an online library where relevant decisions to climate change and migratory species would be collected, including guidelines available for good practice adaptation and mitigation action. The UNEP/CMS Secretariat offered to create a similar space on the CMS webpage as had been created for the CMS Working Group on Flyways as an initial step towards an E-library, which was welcomed.

5. Follow-up and closure of the meeting

It was agreed that the report of the meeting and the draft resolution would be reviewed by workshop participants in July. A wider peer-review of the resolution by other experts and Scientific Councillors was envisaged thereafter in order to present Parties with the latest guidance on which action they should be taking to reduce the negative impacts of climate change on migratory species.

At the close of the meeting at 6pm on 7th June 2011 the chair thanked the staff of Tour du Valat for their excellent support in hosting the meeting; the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety for its generous financial assistance making the workshop possible in the first place; the French Ministry of Ecology, Sustainable Development, Transport and Housing for facilitating meeting preparations; the UNEP/CMS Secretariat for their excellent preparation and organization; and last, but not least, the participants for their superb contributions and for identifying exactly which measures CMS Parties ought to be focussing on. Mr. Galbraith highlighted that the timing of the workshop was perfect to feed the most recent scientific findings into CMS climate change policy and that he was looking forward to presenting the resultant resolution to CMS Parties at COP10 in November.

Annex I

DRAFT RESOLUTION ON
MIGRATORY SPECIES CONSERVATION
IN THE LIGHT OF CLIMATE CHANGE

Recognizing that climate change is adversely impacting migratory species and the phenomenon of mass migration;

Acknowledging that changes in human activities as a result of climate change, including adaptation and mitigation measures, may have the most immediate negative impact on migratory species;

Recalling CMS Recommendation 5.5, CMS Resolutions 8.13 and 9.7, Resolution 4.14 of the African-Eurasian Waterbird Agreement (AEWA), Resolution 4.14 of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) on climate change and migratory species, and *conscious* that their implementation requires urgent attention;

Acknowledging the report "Climate Change Vulnerability of Migratory Species" by the Zoological Society of London (ZSL) and the report of the CMS Working Group on Climate Change, which were presented at the 16th meeting of the Scientific Council;

Noting with satisfaction the outcomes of the UNEP/CMS Technical Workshop on the impact of climate change on migratory species (6-8 June 2011), *thanking* Germany for financially supporting the Workshop,and *recalling* the recommendations submitted to the Workshop by the Scientific Councillors from Costa Rica, Ecuador, Mauritius, Senegal and Uganda;

Recognizing that mitigation measures, such as renewable, low carbon, and "clean" energy development, may significantly affect migratory species and their habitats, and that further research and impact assessments, especially for new technologies, such as tidal and wave power, are required;

Recalling CMS Resolution 7.5 on wind turbines and migratory species, which, *inter alia*, calls for the application of strategic environmental impact assessment procedures to identify appropriate construction sites and instructs the Scientific Council to develop guidelines for the construction of offshore wind farms aimed at minimizing the negative impacts on migratory species;

Noting CBD Decision X.33 on biodiversity and climate change which calls for, *inter alia*, specific measures for species that are vulnerable to climate change, including migratory species, and recognizing the important role of traditional knowledge and the full involvement of indigenous and local communities in planning and implementing effective climate change mitigation and adaptation activities, as well as the need to develop appropriate ecosystem and species vulnerability assessments;

*Further noting*Ramsar Resolution X.24 on climate change and wetlands;

Conscious of the relevance of the research undertaken by IUCN to assess the climate change susceptibility of IUCN Red List species;

Welcoming the outcomes of the three climate change workshops conducted under the auspices of the International Whaling Commission (IWC) to date;

The Conference of the Parties to the
Convention on the Conservation of Migratory Species of Wild Animals

1. *Urges* Parties, Signatories of CMS instruments and Non-Parties exercising jurisdiction over areas that a migratory species is expected to inhabit, stay in temporarily, cross or overfly on its normal migration route in the near future due to climate change, to participate in CMS and relevant CMS instruments, in order to promote adequate conservation measures in the light of climate change;

2. *Further urges* Parties and Signatories of CMS instruments to enable and support the full participation withinCMS of those states, where migratory species are expected to occur, stay in temporarily, cross or overfly on its normal migration route in the near future due to climate change;

3. *Requests* the Scientific Council, with the assistance of the UNEP/CMS Secretariat, to draft Guidelines on measures needed to help migratory species adapt to climate change, in line with the request of the Working Group on Climate Change made during the 16th meeting of the Scientific Council;

Species population management and monitoring

4. *Encourages* Parties to employ adaptive management and the ecosystem approach in addressing climate change impacts, and to monitor the effectiveness of their conservation actions in order to guide ongoing efforts;

5. *Urges* Parties, the Scientific Council, IUCN and relevant organizations to:

   a) identify those Appendix I and II listed species, as well as other migratory species on the IUCN Red List, which are most susceptible to climate change, and subsequently consider these for uplisting on the CMS Appendices, as appropriate;
   b) promote a standardized methodology for evaluating species susceptibility to climate change;
   c) prepare single species action plans for the identified most vulnerable Appendix I species;

6. *Requests* Parties, conservation stakeholders and relevant organizations to:

   a) strengthen research on the interactions of climate change and migratory species, including the impact on habitats and local communities dependent on the ecosystem services provided by these species;
   b) improve the resilience of migratory species to climate change, *inter alia*, by reducing other threats in order to maintain or increase population size and genetic diversity;
   c) consider *ex situ* measures and assisted colonization, including translocation, as a last resort measure for those migratory species most severely threatened by climate change;

7. *Encourages* Parties, Signatories of CMS instruments and relevant organizations to develop and implement monitoring regimes which are adequate for distinguishing true declines in populations from transboundary range shifts and for analysing the impact of climate change on migratory species, *inter alia*, through the following measures:

   a) ensure that monitoring is maintained in the long-term, using comparative methodologies;

b) communicate and share monitoring results regularly with neighbouring and other range states;
c) continue to identify indicator species as a proxy for wider migratory species assemblages, habitats and ecosystems, following on from preliminary work presented at COP9 (UNEP/CMS/Inf.9.22), with particular emphasis on finding indicators for species that are data deficient or otherwise difficult to monitor;

Critical sites and ecological networks

8. *Urges* Parties, when implementing Resolution 10.3 on ecological networks and related instruments, to improve the resilience of migratory species and their habitats to climate change in order to achieve, *inter alia*, the following objectives:

a) ensure that individual sites are sufficiently large in size and heterogeneous in terms of species composition, habitat and topography;
b) strengthen the physical and ecological connectivity between sites, permitting dispersal and colonization when species distributions shift;
c) consider the application of seasonal protected areas for protecting seasonal critical sites;

Climate change mitigation and adaptation, and land use planning

9. *Requests* Parties and relevant organizations to evaluate and reduce the additional impacts on migratory species resulting from changes in human behaviour due to climate change, the so-called “tertiary effects”, such as increased shipping and exploitation in the Arctic ocean areas, which are caused by retracting ice;

10. *Urges* Parties, multilateral development banks and the energy sector to ensure that any climate change mitigation and adaptation action, such as bioenergy production, geo-engineering or flood protection, has appropriate environmental safeguards in place and that any project is subject to strategic and environmental impact assessment requirements and takes into account CMS-listed species;

11. *Further urges* Parties to develop environmental sensitivity and zoning maps, which include critical sites for migratory species, as an essential tool for selecting sites for climate change mitigation and adaptation projects;

12. *Calls upon* Parties and the energy sector to make the post-construction monitoring of environmental impacts, including those on migratory species, a standard requirement for climate change mitigation and adaptation projects, especially wind power, and to ensure that such monitoring continues for the duration of plant operation;

13. *Encourages* Parties and the energy sector to ensure that where impacts on migratory species are significant, renewable energy and other climate change mitigation or adaptation structures are operated in ways that minimize migratory species mortality, such as short-term shutdowns or higher turbine cut-in speeds, with regard to wind farms;

Capacity building

14. *Instructs* the UNEP/CMS Secretariat to pursue capacity building initiatives on the issue of climate change and migratory species, by promoting regional workshops on national implementation of the CMS climate change mandate, subject to available resources;

15. *Encourages* Parties and relevant stakeholders to make use of available funding mechanisms, such as REDD+, to support the maintenance of ecosystem services, with the close involvement of local communities, in order to ultimately improve the conservation

status of migratory species;

16. *Promotes*, with a view to ensuring that Parties have access to the best available scientific information on which to base decision, the publication of periodic scientific reviews concerning:

    a) the impacts of climate change on migratory species,
    b) the potential for conservation management to increase the resistance and resilience of populations to climate change,
    c) the impacts of anthropogenic climate change adaptation and mitigation on migratory species;

Cooperation and implementation

17. *Instructs* CMS Focal Points and Scientific Councillors to provide national UNFCCC Focal Points with expert guidance and support on how migratory species can be affected by adaptation and mitigation activities, such as renewable energy and bioenergy development, and to collaborate closely in order to develop joint solutions aimed at reducing negative impacts on migratory species;

18. *Instructs* the UNEP/CMS Secretariat and the Scientific Council to strengthen synergies between CMS and CBD, UNFCCC, UNCCD, the Ramsar Convention, the Bern Convention, the IWC and other international instruments, in order to more effectively address the threats which climate change poses to biodiversity, whilst recognizing the distinct mandates and independent legal status of each treaty and the need to avoid duplication and to promote cost savings;

19. *Calls upon* CBD, UNFCCC, UNCCD, the Ramsar Convention, the Bern Convention, the IWC and other international instruments, such as the Biodiversity Liaison Group and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), to engage in and support the development and implementation of the CMS climate change mandate;

20. *Requests* Parties and other states to include the measures contained in this Resolution in their national climate change strategies, National Biodiversity Strategies and Action Plans (NBSAPs) and other relevant policy processes, ensuring that mitigation or adaptation activities do not result in a deterioration of the conservation status of CMS-listed species;

21. *Requests* Parties, UNEP, the Global Environmental Facility (GEF), multilateral development banks and other national and international donors to provide financial resources for the implementation of this Resolution, which is dependent on adequate external resources;

Annex II

A G E N D A

Day I: RESEARCH UPDATE
Moderator: Aline Kühl

9.00-9.30: Opening addresses

Jean Jalbert, Director General, Tour du Valat

Borja Heredia, Scientific & Technical Officer, UNEP/CMS Secretariat

Colin Galbraith, Chair of the CMS Working Group on Climate Change

9.30-9.55: Introduction to the aims & objectives of the workshop
Aline Kühl, Associate Scientific & Technical Officer, UNEP/CMS Secretariat
A brief overview will be given of the climate change mandate and its implementation under the Convention, as well as avenues for policy development to address the threat which climate change poses for migratory species. See Resolution 9.7 and background information.

09.55-10.00: Short coffee break

10.00-10.30: The impact of climate change on migratory species – an overview
James Pearce-Higgins, British Trust for Ornithology (BTO)
Climate change is already having a noticeable impact on migratory species across the globe, such as a shift in migration timing, migration routes and also declines in populations. The presentation will provide an overview of the interactions between climate change and migratory species, illustrate how migratory species could be used as indicators in this context and focus on how different taxonomic groups listed on CMS Appendices are or will be affected.

10.30-11.00: The potential of migratory species to adjust to climate change
Francisco Pulido, Complutense University of Madrid
To what extent can migratory species adjust to climate change? What lessons can we learn for the conservation of different taxonomic groups? Which factors influence the vulnerability of a migratory species to climate change?

11.00-11.30: Understanding the impact of climate change on migratory species and identifying the implications for adaptation
Vicky Jones, Birdlife International
Which migratory birds will be particularly hard hit by climate change? Which measures could improve their adaptive capacity?

11.30-12:00 Apéritif

12.00-13.30: Lunch

13.30-14.30: The impact of climate change on marine mammals
Daniel Palacios, National Oceanic and Atmospheric Administration (NOAA) and
Salvatore Cerchio, Wildlife Conservation Society (WCS)
Marine mammals are being particularly hard-hit by global warming and ocean acidification. What is the current status and outlook for the migratory species in the marine environment, especially at the

poles? What measures beyond climate change mitigation are likely to be beneficial to reduce the vulnerability of migratory marine mammals?

14.30-15.00: The impact of climate change on ungulate migrations, with a focus on Central Asia

Navinder Singh, Swedish University of Agricultural Sciences

The migratory patterns of large ungulates such as Mongolian Gazelles, Bactrian Camels and Saiga Antelopes are closely related to vegetation and freshwater dynamics and therefore linked to climate change. Shifts in migration dynamics have led to increased vulnerability, for example due to a higher encounter rate of barriers to migration and competition with livestock. Which species are particularly affected and which measures should be taken by CMS Parties?

15.00-15.30: Coffee break

15.30-18.00: Development of recommendations for inclusion in CMS' policy based on Day I

Chair: Colin Galbraith

Based on the discussions today and the background documentation provided, this open session is aimed at brainstorming and collecting research priorities and policy recommendations for inclusion in CMS's climate change policy, specifically the climate change resolution.

Day II: RECOMMENDATIONS FOR ACTION

Moderator: Borja Heredia

09.00-09.30: Climate change and migratory species – vulnerability assessments and next steps

Monika Böhm, Zoological Society of London (ZSL)

Presentation of a ZSL research project subcontracted by CMS to develop a preliminary analysis for identifying those species listed on CMS Appendix I that are most vulnerable to climate change. Which factors determine how threatened a species is to climate change? What does this imply for applied conservation measures?

9.30-10.00: IUCN's global red flag indicating species threatened by climate change

Wendy Foden, IUCN

Climate change has been included as an additional threat to the IUCN Red List in the form of a "red flag". Methodology and relevance for CMS listed species will be discussed.

10.00-10.30: Evolution of waterbirds in the Mediterranean countries from 1970 until today: the impact of land-use change and climate change

Michel Gauthier-Clerc, Thomas Galewski & Arnaud Béchet, Tour du Valat

How are wetlands and waterbirds being affected by climate change? Observations from Tour du Valat.Evaluation of adaptation options.

10.30-11.00: Coffee break

11.00-11.30: A national perspective on effectively addressing the threat that climate change poses for migratory species, with a focus on migratory birds

Grzegorz Rąkowski, Institute of Environmental Protection, Poland

11.30-12.00: The CMS and climate change: a legal perspective

Arie Trouwborst, Tilburg Law School

Legal analysis of the current role of the CMS regime regarding the adaptation of migratory species to climate change. What are the main challenges and what should be taken into account when drafting the climate change recommendations for CMS COP10?

12.00-12.30: Recommendations submitted by CMS Scientific Council members

Presentation of specific input to the workshop from the Scientific Council working group on climate change and the CMS Scientific Council.

12.30-13.30: Lunch

13.30-15.00: Collate and review recommendations from Day I & II

Chair: Colin Galbraith

Collate and prioritize recommendations to adopt a final set of recommendations for inclusion in the COP10 climate change resolution.

15.00-15.30: Coffee break

15.30-18.00: Collate and review recommendations from Day I & II, continued

Chair: Colin Galbraith

Final discussion of the recommendations and adoption by the meeting.

- Closure of the meeting -

Day III: EXCURSION AND GUIDED TOUR OF THE TOUR DU VALAT ESTATE
Guide: Michel Gauthier-Clerc

08.00: Bus will pick participants up at the hotels

Morning: Visit of the flamingo colony at Tour du Valat

Lunch: Centre du Scamadre (North-West Camargue)

Afternoon: Visit of the Scamadre Reserve (bird watching)

19.30: return to hotels

B A C K G R O U N D

Climate change is likely to become one of the primary drivers of biodiversity loss within the current century. Since the process of animal migration is closely connected to climatic factors, migratory species will be strongly affected. Currently, we are seeing widespread shifts in migration timing, direction and strength, as well as the first population declines as a result of climate change. The aim of the proposed workshop is to provide the almost 150 countries which have signed one or more instruments of the UNEP Convention on Migratory Species (CMS) with specific guidance on what action they should be taking to address the threat that climate change poses to migratory species. The workshop's outputs will feed directly into a resolution on climate change which will be tabled for adoption at the Tenth CMS Conference of the Parties (20-25 November 2011, Norway) and build on the strong climate change mandate from COP8 and COP9.

CMS is an international treaty aimed at species management, and therefore in the context of climate change the treaty is a tool for regulating adaptation rather than mitigation. There are of course many interactions with mitigation measures, such as the impact of renewable energy structures on migratory species, but these will not be a priority subject for this adaptation-focussed workshop.

Specific questions which the workshop will address include: How are the different taxonomic groups listed on CMS' Appendices responding to climate change? How are the migratory species in regions which are particularly vulnerable to climate change affected (e.g. the Arctic)? Which migratory species will be most strongly affected by migratory species?Out of those species which will be strongly affected, and which ones can we actually assist through adaptation measures? What are those adaptation measures – how, when and by whom should they be taken? What are the best measures for action in the light of uncertainty? How should ecological networks be designed in this context? Should we use migratory species as indicators of the biological consequences of climate change, and if so, how?Should we focus our conservation efforts on the most threatened species or on those with the best capacity for adaptation? Is translocation something that should be internationally regulated (i.e. through CMS)? Where are the biggest research gaps (subject/taxonomic/regional)?

Relevant CMS decisions and related CMS literature

CMS decisions:

UNEP/CMS (1997).Recommendation 5.5 on climate change and its implications for the Bonn Convention
http://www.cms.int/bodies/COP/cop5/English/Rec5.5_E.pdf

UNEP/CMS (2005).Resolution 8.13 on climate change and migratory species
http://www.cms.int/bodies/COP/cop8/documents/proceedings/pdf/eng/CP8Res_8_13_ClimateChange&MigratorySpecies_E.pdf

UNEP/CMS (2008).Resolution 9.7 on climate change impacts on migratory species
http://www.cms.int/bodies/COP/cop9/Report%20COP9/Res&Recs/E/Res_9_07_Climate_Change_En.pdf

CMS conference and information documents:

UNEP/CMS (2005). Conference document 8.22 on climate change and migratory species (submitted by the UK)
http://www.cms.int/bodies/COP/cop8/documents/meeting_docs/en/Doc_22_Climate_Change_and_Migratory_Species.pdf

UNEP/CMS (2005). Information document 8.19 on climate change and migratory species (submitted by the UK)
http://www.cms.int/bodies/COP/cop8/documents/meeting_docs/en/Inf_19_Climate_Change_Migratory_Species.pdf

UNEP/CMS (2008). Conference document 9.24 on climate change and migratory species
http://www.cms.int/bodies/COP/cop9/documents/meeting_docs/English/Doc_24_Climate_Change_&_Migratory_Species_E.pdf

UNEP/CMS (2008). Information document 9.22 on indicators of the impact of climate change on migratory species (submitted by the UK)
http://www.cms.int/bodies/COP/cop9/documents/meeting_docs/English/Inf_22_Climate_Change_Impact_UK_Report_Eonly.pdf

UNEP/CMS (2008).16th Scientific Council document 8 on climate change: a primary threat for migratory species
http://www.cms.int/bodies/ScC/16th_scientific_council/Eng/ScC16_Doc_08_Climate_Change_Eng.pdf

UNEP/CMS (2010). 16th Scientific Council report of the working group on climate change
http://www.cms.int/bodies/ScC/16th_scientific_council/Report/Annex_II_Report_WG_on_Climate_Change_E.pdf

Others:

Newson, S.E., Mendes, S., Crick, H.Q.P., Dulvy, N.K., Houghton, J.D.R., Hays, G.C., Hutson, A.M., Macleod, C.D., Pierce, G.J. & Robinson, R.A.(2009). Indicators of the impact of climate change on migratory species. *Endangered Species Research* **7**: 101-113.
http://www.dulvy.com/publications/2008/Newson_2008_Endangered%20Species%20Research.pdf

Annex III

Scientific framework to underpin climate change adaptation for migratory species

There are some basic principles for climate change adaptation which can be implemented with a lack of good distributional data, and which rely upon the protection and maintenance of large areas of a network of good quality natural and semi-natural habitats and reducing the extent of other pressures on a species (Hodgson *et al.* 2009, 2011, Lawton *et al.* 2010). Such actions have 'no regrets' because they provide conservation benefit now and, across a broad range of predicted future scenarios. Assessments of species' vulnerability to climate change are an important component of the information needed for prioritising conservation actions and sites under climate change. Assessment methodology is rapidly emerging field, and assessments from as many methods as possible should be considered. These may those based on species distribution models (bioclimatic niche approach) (e.g. Huntley *et al.* 2007, Hole *et al.* 2009), climate change susceptibility frameworks (e.g. Thomas et al., 2010, Foden et al. in prep.) or semi-mechanistic models (e.g. Keith et al., 2008). Surveys should be instigated, or records collated, in order to provide data needed for assessments, and results should be interpreted to. Surveys should be instigated, or records collated, in order to provide distribution data provide more specific information about the importance of different sites and conservation approaches both now and under a changing climate

Monitoring provides an essential basis for understanding the likely impacts and mechanisms of climate change and enables the validation and improvement of vulnerability assessments.Historical and current baselines (Elith & Leathwick 2007, Pearson *et al.* 2007) provide the context for changes in distribution ranges, population sizes and behaviours; grey literature, museum records and secondary data may provide useful sources of such information. If possible, population monitoring should also be instigated in order to monitor change through time. Here an initial appraisal of monitoring methodologies should be conducted to identify potential biases and errors, so that the reliability of the data can be assessed and accounted for in the future. This will be particular important for countries with limited institutional capacity (Singh & Milner-Gulland 2011a). Such abundance information may be used to identify hotspots of monitoring and conservation, detect existing climate change impacts and improve the assessment of future impacts, as well as providing additional information for adaptation (Singh & Milner-Gulland 2011b).

Finally, more detailed research may be undertaken in order to diagnose potential causes of change in populations as a result of climate change to inform specific conservation actions (Pearce-Higgins *et al.* 2010, Pearce-Higgins 2011). If the understanding is sufficient then it may be possible to develop quantitative decision support tools to inform action (e.g. Ratcliffe *et al.* 2005). This framework is set out in Figure 1.

Elith, J. & Leathwick, J. 2007. Predicting species distributions from museum and herbarium records using multi-response models fitted with multivariate adaptive regression splines. *Diversity & Distributions* 13: 265-275.

Hodgson, J.A., Thomas, C.D., Wintle, B.A. & Moilanen, A. 2009. Climate change, connectivity and conservation decision making: back to basics. *Journal of Applied Ecology* 46: 964–969.

Hole, D.G., Willis, S.G., Pain, D.J., Fishpool, L.D., Butchard, S.H.M., Collingham, Y.C. Rahbek, C. & Huntley, B. 2009. Projected impacts of climate change on a continent-wide protected area network *Ecology Letters* 12: 420–431

Huntley, B., Green, R.E., Collingham, Y.C. & Willis, S.G. 2007.*A Climatic Atlas of European Breeding Birds.* Barcelona: Lynx Edicions.

Keith, D. A., Akçakaya, H. R., Thuiller, W., Midgley, G. F., Pearson, R. G., Phillips, S. J., et al. (2008). Predicting extinction risks under climate change: coupling stochastic population models with dynamic bioclimatic habitat models. Biology Letters, 4(5), 560-3.doi: 10.1098/rsbl.2008.0049.

Lawton, J.H., Brotherton, P.N.M., Brown, V.K., Elphick, C., Fitter, A.H., Forshaw, J., Haddow, R.W., Hilborne, S., Leafe, R.N., Mace, G.M., Southgate, M.P., Sutherland, W.A., Tew, T.E., Varley, J. & Wynne, G.R. 2010. *Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network.* Report to DEFRA.

Pearce-Higgins, J.W. 2011.Modelling conservation management options for a southern range-margin population of Golden Plover *Pluvialis apricaria* vulnerable to climate change.*Ibis* 153: 345-356.

Pearce-Higgins, J.W., Dennis, P., Whittingham, M.J. & Yalden, D.W. 2010. Impacts of climate on prey abundance account for fluctuations in a population of a northern wader at the southern edge of its range. *Global Change Biology* 16: 12–23.

Pearson, R.G., Raxworthy, C.J., Nakamura, M. & Peterson, A.T. 2007 Predicting species distributions from small numbers of occurrence records: a test case using cryptic geckos in Madagascar. *Journal of Biogeography* 34: 102-117.

Ratcliffe, N., Schmitt, S. & Whiffin, M. 2005. Sink or swim? Viability of a black-tailed godwit population in relation to flooding.*Journal of Applied Ecology*42: 834–843.

Singh, N.J. & Milner-Gulland, E. J. 2011a.Monitoring ungulates in Central Asia: current constraints and future potentials.*Oryx* 45: 38-49.

Singh, N.J. & Milner-Gulland, E.J. 2011b.Conserving a moving target: planning protection for a migratory species as its distribution changes.*Journal of Applied Ecology* 48: 35-46.

Thomas, C. D., Hill, J. K., Anderson, B. J., Bailey, S., Beale, C. M., Bradbury, R. B., et al. (2010).A framework for assessing threats and benefits to species responding to climate change. Methods in Ecology and Evolution, 2(2), 125-142. doi: 10.1111/j.2041-210X.2010.00065.x.

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June 2011

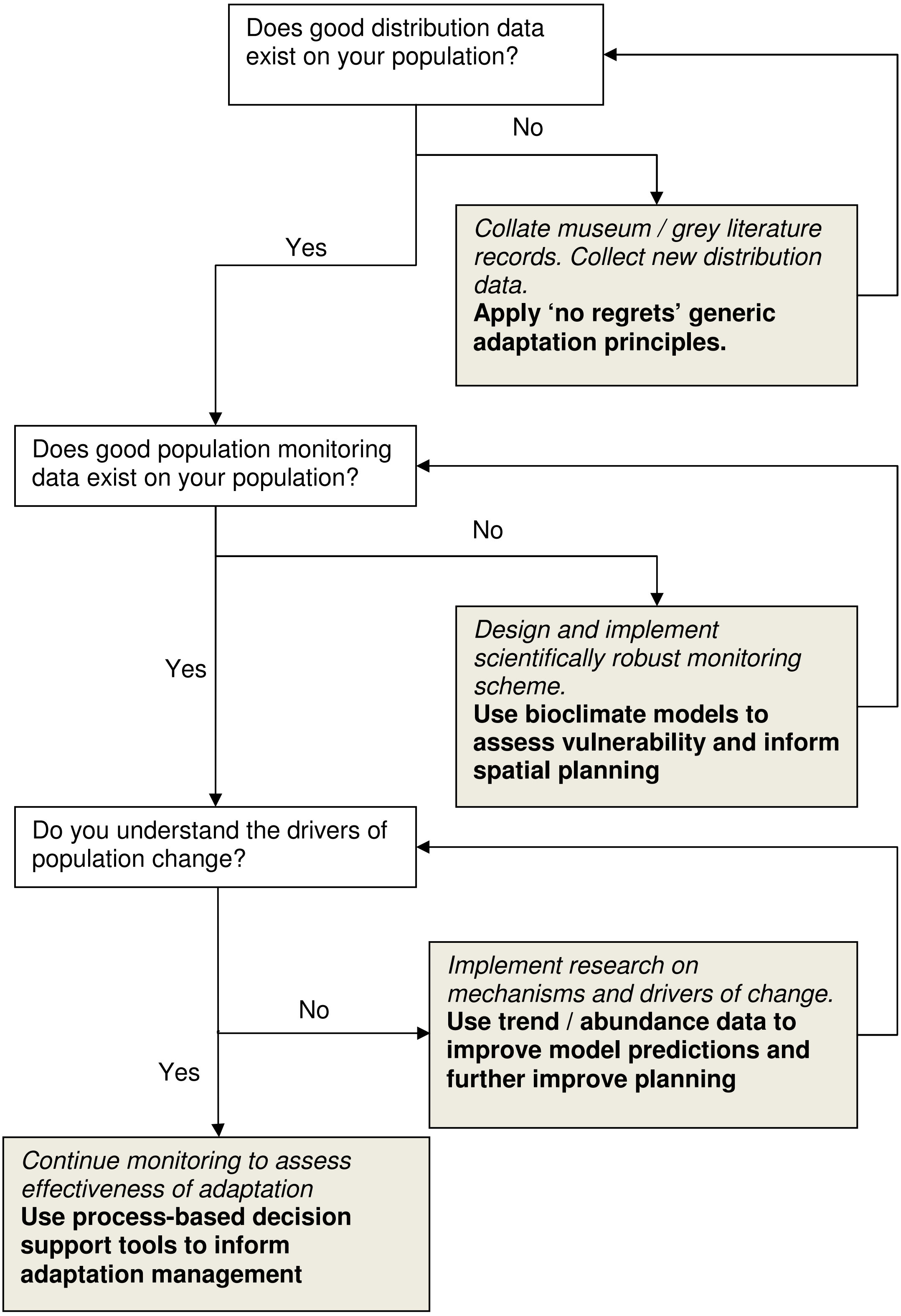

Figure 1. Proposed framework for prioritising monitoring and research in order to underpin climate change adaptation, and outlining the potential tools for adaptation available at different levels of scientific understanding. Within each box of actions (grey) are listed the priorities for monitoring and research (italics) and the priorities for adaptation action (bold).

Annex IV

Abstracts submitted
Technical workshop on the impacts of climate change on migratory species: the current status and avenues for action

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CLIMATE CHANGE AND MIGRATORY SPECIES – VULNERABILITY ASSESSMENTS AND NEXT STEPS

Monika Böhm
Zoological Society of London (ZSL)

With the potential effects of climate change on species and habitats becoming more and more apparent, it is vital to address the central question of which species are particularly vulnerable to the effects of climate change and how we can help their conservation via direct actions and policy decisions. For migratory species, their high mobility may turn out to be an advantage in the face of climate change, but may also be a double-edged sword, as coordination of conservation efforts across countries may be relatively more difficult to achieve.

A pilot study carried out by ZSL for the Convention on the Conservation of Migratory Species of Wild Animals (CMS) developed a methodology for vulnerability assessments of CMS-listed species, focussing on the vulnerability of species and habitats to climate change and the adaptive potential of species. The assessments also addressed the effects of climate change on species interactions and the importance of other anthropogenic threats on a species' ability to withstand climate change impacts.

As a case study and testing cases for the methodology, 44 species listed on Appendix I of CMS were assessed using literature-based evidence collection and expert feedback. The resulting assessments allow the main factors in species' vulnerability to climate change to be determined, so that conservation action can then be targeted at mitigating against these factors.

Results from this pilot study indicate that reptile species are particularly susceptible to climate change as a result of combined impacts of sea level rise, increased temperatures, and ocean acidification affecting vulnerable habitats alongside negative impacts of current anthropogenic threats. Similarly, feeding specialisation may predispose species to be more vulnerable to climate change, as appears to be the case for krill-feeding whales where ocean acidification, changes in ocean circulations and polar ice melt are likely to cause shifts in prey abundance and distribution. The study also highlights that many of the species vulnerable to climate change are species with an already high risk of extinction due to other threat factors. It is vital to build on these results, by expanding the species set for assessment, building a more quantitative methodology to be used in future modelling-based analyses and devising appropriate conservation actions to mitigate climate change vulnerability of migratory species.

UNDERSTANDING THE IMPACT OF CLIMATE CHANGE ON MIGRATORY SPECIES AND IDENTIFYING THE IMPLICATIONS FOR ADAPTATION

Stuart Butchart, Melanie Heath and Victoria Jones
BirdLife International

BirdLife International is assessing climate change impacts on migratory species through a number of different collaborations. These involve modelling projected future distributions of species, assessing susceptibility of species to climate change impacts using information on life history traits to score sensitivity and adaptability, modelling impacts on agriculture, and assessing implications of species distribution shifts for turnover in priority species at key sites for bird conservation (Important Bird Areas). Results to date indicate that: nearly all species will be impacted significantly; most will disappear from half of their current range; range limits will shift hundreds of kilometres; two-thirds to three-quarters will suffer range contraction; a significant proportion of species are in real trouble; and species communities will become disrupted. However, existing IBAs play a key role in mitigating the worst impacts of climate change. The results are helping to inform how to manage individual sites to facilitate adaptation.

Considerations/recommendations for conserving migratory species in a changing climate include adequately protecting and mitigating existing non-climate threats at key sites, implementing. actions that will be beneficial to migratory species regardless of the uncertainty around future conditions, making decisions about management of individual sites for migratory species in the context of the whole site network, managing the broader habitat matrix to maximize habitat connectivity for migratory species, monitoring species, key sites and habitats, integrating biodiversity concerns across sectoral policies; and ensuring that alternative energy sources especially wind and bio-energy do not negatively impact migratory species.

CONCEPTUAL APPROACH FOR ADAPTATION AND RESPONSE IN THE CONSERVATION OF MARINE MAMMALS: DEVELOPING PRIORITIES AND MANAGEMENT PLANS FOR CLIMATE CHANGE.

Cerchio S[1], McClanahan T[1], Palacios D[2], Robards M[1] and Smith B[1].
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Climate change will impact a diverse set of marine mammal species, in a broad range of habitats from arctic to tropical, coastal and fresh water to pelagic (reviewed by Palacios et al. during this workshop). Here we present a conceptual framework to guide policy and management decisions on how best to set priorities for climate change actions. The model is based on that recently proposed for coral reefs (Conserv. Let. 1:53-59, and Conserv. Biol. 23:662-671). For marine mammals, it is recommended that assessment and decisions be made on a population basis. Appropriate actions will depend upon the evaluation of the population on three separate axes: vulnerability, incorporating predicted environmental change, sensitivity of population to changes, and increased anthropogenic impacts resulting from climate changes (tertiary effects); conservation status, describing the health of the population and current level of exploitation/anthropogenic impact; and population adaptive capacity, incorporating the local human social adaptive capacity, current level of population management, and feasibility of mitigation/adaptation measures. Quantitative measures or indices are required for each axis, with some readily available options from existing work, although modification and development is needed. Eight different sets of recommendations are presented based upon all combinations of high vs. low index values for each axis. Prioritization of populations and appropriate actions will vary depending on the effectiveness and feasibility of protective, restorative, adaptive or mitigation measures for any given population.

IUCN'S BIOLOGY-BASED APPROACH TO ASSESSING SPECIES' VULNERABILITY TO CLIMATE CHANGE

Wendy Foden, IUCN

Knowing which species are most vulnerable to climate change impacts is essential for effectively prioritizing the use of the limited conservation resources. IUCN has developed a novel approach to assessing species' vulnerability to climate change which, contrary to traditional methods, provides an opportunity to take into account species biology (e.g. demographic, physiological and ecological traits) and expert knowledge, as well as to assess restricted range species. Based on assessments of individual species' biological sensitivity, their predicted climate change exposure (derived from General Circulation Model projections), as well as their anticipated adaptability to climatic change, the study has assessed relative climate change susceptibility of over 17,000 species. These assessments are intended to accompany the IUCN Red List, serving as a 'red flag' to alert species assessors to a particularly high risk of climate change impacts. Here I present initial findings of a global species assessment, including for the world's birds and amphibians. I discuss the advantages and challenges of applying IUCN's assessment approach to migratory species, and explore ways in which IUCN's approach can support the Convention on Migratory Species' objectives of mitigating climate change impacts.

THE IMPACT OF CLIMATE CHANGE ON MARINE MAMMALS

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The ocean realm contains the largest ecosystems on Earth and consequently many marine mammal species engage in ocean-wide migrations and other large-scale seasonal movements. Unlike in the terrestrial realm, where phenological changes and distribution shifts in response to climate change can be readily detected and monitored, observing these responses in marine species is not often possible. Furthermore, natural climate variations at inter-annual (e.g., El Niño - Southern Oscillation) and inter-decadal (e.g., Pacific Decadal Oscillation) timescales can confound ecosystem-level changes due to anthropogenic climate change. Nevertheless, accelerated melting of sea ice and trophic alterations in polar ecosystems (both Arctic and Antarctic) are clear signs of climate change; it is agreed that these impacts will affect species that rely on sea ice and/or have specialized feeding habits including the hooded seal (*Cystophora cristata*), the polar bear (*Ursus maritimus*), and the narwhal (*Monodon monoceros*). At the global scale, increases in water temperature are expected to result in decreases in biological productivity while a lower pH will negatively affect shell-forming organisms that are prey of marine mammals. Rise in sea level will affect species such as seals, which must come ashore during part of their life cycle and possibly whales that depend on near-shore habitat such as shallow breeding lagoons. The extent to which temperature changes in the ocean will directly affect marine mammals is unclear, but there are indications of some range changes of cetaceans in the North Atlantic that may be temperature-related. Arguably more importantly, a warmer, more acidic and less productive environment will likely result in indirect effects to their populations through food reductions, increased inter- and intra-specific competition, elevated exposure to pollutants and disease factors, and increased interactions with human activities (e.g., shipping, drilling, fishing). In anticipation of these impacts, the scientific community, national management agencies and inter-governmental bodies are organizing efforts to assess the vulnerability of marine mammals to climate change, and to identify measures for adaptation and mitigation. For example, the CLIOTOP (CLimate Impacts on Oceanic TOp Predators) initiative works towards development of a reliable predictive capability for the dynamics of top predator populations and oceanic ecosystems that combines both fishing and climate effects. The International Whaling Commission (IWC) promoted a series of workshops in 1996, 2009 and 2010 toreview, inter alia, the existing evidence for impacts, identify long-term cetacean data sets that can be analyzed and included in models in relation to climate change variables, and generate recommendations and advice to the IWC. Progress has been made toward developing sensitivity indicators to assess vulnerability for cetaceans (e.g. demographic parameters, extent of geographic range, habitat specificity, diet diversity, site fidelity). Among the species particularly vulnerable are those inhabiting restricted habitats, including resident dolphin populations in inshore and freshwater habitats as well as those occupying biologically rich but relatively rare submarine canyons. The IWC workshops have recommended modelling efforts to elucidate the mechanisms through which cetaceans are most likely to be affected by climate change and to identify gaps in data and fundamental research. In this regard they have noted that, while global modelling approaches are a good start, modelling exercises would be most relevant when conducted at regional and finer scales given that ocean ecosystems have their own intrinsic structure and differential responses to climate change, and contain populations or subpopulations that have particular conservation status and human pressures. The IWC workshops have also recommended that baseline data on health parameters, temporal and spatial patterns in disease prevalence and intensity, and the effects of toxicants be monitored in relation to environmental factors. In particular, climate change should be considered as a potential causal factor when investigating Unusual Mortality Events and where animals are found outside of their normal species ranges. It is anticipated that the main impacts in many areas will result from the cumulative effects of increased human uses of the marine environment induced by a changing climate. However, consideration of mitigation and adaptation measures concluded that they pose a challenge because translocation and other interventions are not really possible for marine mammals. It is therefore suggested that a more feasible way to reduce the vulnerability of migratory marine mammals to climate change is to reduce non-climate stressors (e.g., bycatch, noise, habitat destruction and chemical pollution) as much as possible. Finally, these assessments have identified a need for additional information at the regional level and the development of decision-making frameworks (e.g., presentation by Cerchio et al. during this workshop). Future progress is thus likely to come mainly from regional efforts (e.g., workshops, assessments).

THE IMPACT OF CLIMATE CHANGE ON MIGRATORY SPECIES – AN OVERVIEW

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Migrants are regarded as particularly vulnerable to climate change because they experience differential changes in climate during different parts of their life-cycle and range. In this talk, possible mechanisms by which climate change impacts upon migrant species are reviewed, in order to highlight the potential vulnerability of different taxa to climate change, and inform climate change adaptation. Whilst there is increasing evidence of potential impacts operating through changes in food availability (either through phenological mismatch or changes in prey populations) and direct effects of changes in temperature, precipitation or storm events on populations, there is less evidence for other mechanisms being important. The complexities of potential cascades of impact across trophic levels are illustrated using recent changes in the North Sea. Combined, such mechanisms cause changes in the abundance and distribution of species, with potential policy implications for conservation and protected areas. Ongoing work on climate change adaptation is presented. Finally, the potential for indicators to track ongoing impacts of climate change on migratory populations is summarized, for which increased long-term monitoring is key.

THE POTENTIAL OF MIGRATORY SPECIES TO ADJUST TO CLIMATE CHANGE

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Climate changeisa challenge to migratory species because their life-cycles are adapted to specific ecological conditions in different geographical areas at particular times. Changes of conditions or of their phenology will disrupt the synchronisation of migrants with ecological conditions in different areas. This may have a major impact on migratory species, particularly as a consequence of carry-over effects. Adaptation to global change in migratory species thus requires adaptation to environmental changes in different areas and the re-synchronization of the timing of life-cycle events. This may be particularly difficult if in different regions environmental conditions change at different rates.

Species that show high phenotypic plasticity in response to environmental fluctuations will have the highest potential to cope with climatic changes. A high adaptive potential will be found in species with high genetic variation, which is expected in large populations. However, adaptive genetic variation will be lost if the intensity and frequency of extreme weather events (droughts, hurricanes, heat waves, etc.) increases. Long-distance migrants, i.e. species that cross large ecological barriers to reach their non-breeding sites will be limited in their potential to adjust to phenological changesin their breeding areas, because of the rigid control of their life-cycle, and because they cannot gradually shift their wintering sites. Deterioration and loss of habitat in the non-breeding area may strongly affect their rate of adaptation to climate-induced changes in ecological conditions in the area of reproduction.

EFFECT OF CLIMATE CHANGE ON MIGRATORY BIRDS IN POLAND

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Data on 114 migratory bird species listed in CMS Annexes and found nesting in Poland for last 50 years were examined with respect to climate change impact. Climatic factors affect at least 59 per cent of the total number of the speciesexamined. The most visible effects observed are: shiftsin the ranges of birds nesting area to the north and north-east owing to climate warming, changes of nesting population numbers and the species composition of bird communities at local and country level. As a result of more frequent and more severe floods, the numbers of birds breeding in river valleys are fluctuating. Other climate warming effects on birds include: earlier arrival at breeding grounds and earlier egg-laying, shortening migration routes, as well as more frequent successful overwintering within the Poland's borders. A decline of populations of some species migrating over large distances has also been observed, which is most probably due to climate change impact on birds habitats situated along their migration routes or within wintering areas. The main problems connected with assessment of climate change impact on birds in Poland are gaps in knowledge and strong negative synergistic impacts in bird habitats due to land use change. Most recommended future actions towards protection of migratory birds against the impact of climate change should include: further development of bird monitoring programmes; launching ornithological research focussing on climate change impacts;elaboration of scenarios on the future climate change effects on birds; active protection of bird habitats, as well as elaboration and implementation of single species action plans for most vulnerable/threatened bird species.

UNGULATE MIGRATIONS IN A WARMING WORLD

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Long distance migrations of ungulates driven by a variety of factors, is a widespread phenomenon across the globe. Distance, timing, speed, migratory routes, site fidelity, costs and benefits are some of the characteristics of these migrations, which have consequences on the entire ecosystems. Unfortunately, many of the ungulate species undertaking these perilous journeys face increased threats from overhunting, construction of barriers, habitat loss and more recently climate change resulting in the loss of many of such migrations or other changes in the characteristics of migration. Some of these changes in response to climate change include, timing of migration, shifts in seasonal ranges and calving areas, fragmentation of distributions, reproductive biology and timing of reproduction to synchronize with seasonal shifts resulting in changing population dynamics. Conservation of long distance migratory species is a great challenge in itself, due to vast distances and large number of animals involved and constant movement across seasonal ranges. These difficulties will be further compounded by climate change and hence make conservation even more challenging. Entire migratory pathways might become lost as a result. In order to make conservation strategies effective for ungulates in the light of climate change it is vital to identify those habitats which will change the most and those factors which limit population dynamics. Furthermore, it is important to analyze how the changes in migratory ecology in one habitat affect those in another. There are likely to be seasonal carry-over effects which need to be considered.

In order to prepare for climate change CMS Parties should incorporate climate change adaptation into national conservation assessments, increase the role, size and protection of protected areas, incorporate climate change into gap assessments and develop landscape approaches and connectivity to promote resilience across the entire ecosystem. A plan of action and approach are further discussed.

THE CMS AND CLIMATE CHANGE: A LEGAL PERSPECTIVE

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This legal analysis examines the current role of the Convention on Migratory Species and its daughter instruments regarding the adaptation of migratory species to climate change, and identifies a number of challenges in this respect. Having been adopted before climate change appeared on the intergovernmental agenda, the provisions of the Convention itself do not address the implications of climate change for migratory species conservation. Some general provisions on the protection of migratory species may, nevertheless, further the adaptation of species to climate change. Other CMS provisions could hamper such adaptation, in particular the definitions of 'favourable conservation status' and 'range'/'Range State' in Article I. The most appropriate option for resolving these issues appears to be to include an agreed interpretation of these terms in light of climate change in the next COP resolution on the topic. Action to facilitate the adaptation of species to climate change has already – albeit in general terms – been called for in COP resolutions, and various studies, including vulnerability assessments, have been carried out under CMS auspices. Practice concerning climate adaptation in the context of the 26 CMS daughter instruments has so far been patchy. Only 10 instruments have in some way formally addressed the issue. In most of these cases, action has remained limited to recognizing the threat posed by climate change and calling for further research. The most comprehensive action has been taken under the African-Eurasian Migratory Waterbirds Agreement (AEWA), including commitments by Parties to taking adaptation measures and the provision of detailed guidance on such measures. In sum, the

CMS regime has taken significant first steps in coming to terms with the implications of climate change. At the same time, much potential remains for enlarging the regime's contribution to ameliorating the impacts of climate change on migratory species conservation.

Annex V

Contributions submitted by CMS Scientific Councillors
Prior to the workshop Scientific Council members had the opportunity to contribute to the climate change recommendations resulting from the workshop. The following comments[1] were received from Scientific Council members from Costa Rica, Ecuador, Mauritius, Senegal and Uganda.

COSTA RICA

ACTIONS COSTA RICA HAS BEEN TAKEN TO IMPROVE CLIMATE CHANGE ADAPTATION

Edited by: Jose Joaquin Calvo Domingo, CMS Scientific Councillor, May 2011.

Costa Rica has been known as a country which has taken initiatives in natural conservation resources actions, in order to avoid the cost of climate change impacts for future generations. Consequently, it is important that the planning instruments contain actions to support climate change mitigation as well as measures to enable adaptation, since there are effects that are already developing and manifesting themselves in erratic changes in temperature and precipitation.

The country is strengthening the conservation of the species by following the guidelines issued periodically by the CBD. In particular, it is setting goals that allow the reduction of the rate of loss of species and ecosystems as well as maintaining and improving the conservation of biodiversity found in the country.

In response, the Costa Rican government has conducted studies on gaps in the conservation process (continental diverse environments on land and in inland, coastal and marine waters). Moreover, conservation goals were set with an emphasis on species composition within protected areas.

Subsequently, several strategies have emerged to fill the gaps existing in conservation processes, both general or specific (issues such as fire management, pest and invasive alien species, habitat corridors, control of illegal logging, among others). We conclude that all these conservation efforts seek to improve or maintain biodiversity, but also their resilience (a central element of adaptive capacity). These efforts are considered measures of adaptation to climate change. However, it is worth keeping in mind that these items focus purely on organic matters.

With the growing concern about climate change effects on the presence and functioning of biodiversity and the generation in quantity and quality of ecosystem goods and services in ASP, initiated several efforts to identify adaptation measures and participate in measures mitigation. SINAC [National System of Conservation Areas, the Costa Rican National Parks administrator] has compiled adaptation measures identified in multiple events with professionals through the financial analysis necessary to address the biodiversity sector in Costa Rica. Basically, the efforts currently carried out are focused on maintaining the ecological integrity of the systems and the maintenance of genetic variability through various mechanisms (1) LIFTS II implementation in the three areas of work; (a) coastal & marine, (b) inland aquatic and (c) terrestrial systems, (2) the establishment of new corridors and

[1]Please note that the submissions were proofread and on occassion edited to clarify both meaning and grammar. The Secretariat took care not to amend the meaning of Scientific Council submissions. All submissions made to the Secretariat, including different language versions, are reproduced below.

management of pre-existing corridors and new and (3) the identification of new types of governance.

On mitigation, efforts have been directed towards maintaining and improving forest cover, the implementation of cleaner technologies in industries, the decline in the use of fossil fuels in power generation, alternative urban transport GAM and the establishment of policies related to the goal of being a "carbon neutral country by 2021." This effort has been directed by different government institutions including FONAFIFO. Specifically, within the ASP, mitigation efforts have revolved around four main lines (1) the increase of forest protected areas, (2) the increase in the density of forest cover within the ASP through the restoration and recovery of disturbed areas, (3) stricter application of regulations related to the use of resources and (4) ensuring the conservation of carbon even in the marketing chain for forest products from sustainably harvested from ASP whose status allows it.

Currently in the 2010-2015 Strategic Plan of the National System of Conservation Areas of the Ministry of Environment there are measures to strengthen the adaptive management and mitigation to climate change impacts on ecosystems, in addition to developing and implementing the plan action for biodiversity adaptation to climate change.

ECUADOR

POSSIBLE EFFECTS OF CLIMATE CHANGE ON MIGRATORY AND NON-MIGRATORY BIRDS IN ECUADOR

(seeSpanish version below)

The Earth has experienced periods of climatic change during the course of its history, the Pleistocene being the last age when glacial periods occurred and abrupt changes in the temperature of the Earth led to major catastrophes and mass extinctions. Today the Intergovernmental Panel on Climate Change has estimated that between 1995 to 2006 we experienced the hottest years since 1850, so that now the temperature of the atmosphere has increased by 0.76℃, with the most noticeable rise in last 50 years. If no policy changes occur to reduce the current rise in temperature, it is estimated that by the end of this century the increase could be between 1.1℃ and 6.4℃. The change in temperature is a direct consequence of the greenhouse gas emissions including carbon dioxide (CO_2), methane (CH_2) water vapour (H_2O), chlorofluorocarbons (CFCs) and nitrous oxide (N_2O). The most important of these gases is carbon dioxide, with its increase in the atmosphere mainly due to fossil fuel burning and cement production, exacerbated by deforestation and forest burning. This loss of biomass is critical since it results in reduced sequestration of carbon dioxide from the atmosphere which increases the effect of greenhouse gases and global warming. About 2,500 Gigatons of Carbon (Gt C) exist within the Earth's biomass and 38,000 Gt C in the oceans (almost 37,000 Gt C in the seabed) and on average 1,600 Gt C are part of the natural cycle of exchange between marine and terrestrial ecosystems (IPCC 2007). For this reason, even the smallest changes in ground biomass could be extremely harmful to the “natural” balance of carbon.

Biodiversity, which means according to the Convention on Biological Diversity, the variability of living organisms in all ecosystems, terrestrial, marine and water, and ecological complexity of which they form part, which means diversity between species, within species and ecosystems, is endangered by the causes and consequences of climate change. Changes in temperature in the order of 1.5 to 2.5℃ may affect 35 to 70 per cent of coralspecies, birds and poikilothermic vertebrates, such as amphibians and reptiles (Foden et al. 2008, Campbell et al. 2009). Particularly vulnerable are species with small distribution ranges, isolated or fragmented populations, which occupy higher altitudes in the mountains, as well as species adapted to cold regions (Campbell et al.2009).

Migratory organisms are no less exposed than sedentary ones to changes that occur on Earth due to global warming. Changes are predicted in the ranges of species, including changes in habitats and winter breeding grounds for many migratory species, also forecast changes in migratory habits, the migration phenology (dates of arrival and start of reproduction) and, due to rising sea levels by melting polar regions the area of winter habitat for many species along the coast, especially estuaries and islands, is predicted to be reduced. Populations of highly congregatory migratory birds which have to use wetlands as a stopover site during long-distance migrations (i.e. populations of shorebirds) are especially at risk because of limitations in the area and therefore resources of food and changes in their breeding habitats. For all these reasons it is essential to implement measures to reduce or mitigate the causes and effects climate change worldwide. Two of the most important are deforestation, conversion of forest cover to logging and expansion human populations, and forest fires. The latter especially are a critical factor in global warming and account for between 20 and 40 per cent of greenhouse gas emissions (CBD 2001). In the tropics, in 1998 alone, 1 to 2 billion tons of CO_2 were released equivalent to ⅓ of gas emissions from the burning of fossil fuels worldwide (CBD 2001). Forest fires will increase directly due to the reduction of soil moisture and directly by heating the air.

The effect that climate change is having on the different species of migratory birds are indirect, but the effect against these are direct by which these adversely affect local and migratory bird populations. **One of these is the alteration of the dynamics of water levels in different wetlands, one example is the wetland La Segua.** It was declared as a Ramsar site on 7 June 2000 and is the 5th in Ecuador and 1028th in the world. It is the second largest in the province of Manabi. The wetland La Segua is not yet protected by the state. Located near City Chone it adjoins the village of San Antonio. It has an area of 1,836 hectares, corresponding to the areas of: lagoon, beaches or shores and floodplains, over 20,000 individuals of birds with its 166 aquatic and terrestrial species currently recorded. Around of the lake are patches of dry forest. It is one of the most important sites in Ecuador and therefore the most important in Manabi for the conservation protection and observation of waterfowl.

Important records on the number of individuals to stress are: The American Stork [Wood Stork] (*Mycteria americana*), although not strictly migratory the species is transboundary, moving between both sides of the Andes. Nearly 400 individuals (19/10/2009 by Francisco Sornoza) constitute the largest population on the west side, but this record number of individuals together at one time was a temporary phenomenon, because afterwards scarcity of food led the species to spread out along the coastline and possibly individuals crossed the Andes to the Amazon wetlands, possibly as a result of climate change.

Also the population of the Glossy Ibis (*Plegadis falcinellus*) has a refuge in this wetland with a population of 200 individuals. It is important to emphasize the permanence of the Yellow-breasted Crake (*Porzana flaviventer)* in the wetland, since it is the only place throughout the country where this species is found. It is however difficult to observe this species because it passes hidden among the water hyacinth on the edge of the wetland. The list of northern migratory shorebirds is well represented in the Ramsar site.

The following heron species are important indicators of the constant changes experienced by the ecosystem, even though they are not migratory:Pinnated Bittern (*Botaurus pinnatus)*, Least Bittern (*Ixobrychus exilis)* and Rufescent Tiger-heron (*Tigrisoma lineatum*). They are very well camouflaged in the floating vegetation of the lagoon and it is worth mentioning that these populations are small. In November this year when the flow of the lagoon had almost stopped completely, during the constant monitoring about 100 individuals of*Botaurus pinnatus* were counted, confined in a space that still contained some food and water.

In October 2009 the wetland was in full swing and full of life, with a normal water level and thousands of individuals of different species of birds: a veritable paradise. 41 days later the same wetland, November 30 seemed a rather dry and dreary uninhabited place, without bird species, with many individuals of species fish and birds killed by the drought that hit the province in the space of just 41 days.

Another negative effect of climate change is the lack of food for migratory shorebirds and many of the places where these birds foraged in the past no longer exist or are no longer capable of supporting biological processes and not finding a suitable resting place can be fatal to large populations coming to feed. An example of this was the case of Wilson's Phalaropus (*Phalaropus tricolor)* observed on 10 October 2010 on the island of La Plata (Protected Area) during a long-term surveillance by ornithologists when it arrived at the seashore. Despite seeing the approach of the investigator, it made no move and it was suspected that the bird had just completed a long journey from Central America and possibly the ocean. The bird had exhausted its strength and energy and Isla de la Plata is not an appropriate place for feeding because the island does not have the resources. At least the bird could find them at sea as it is normal to find them swimming in foraging groups on the ocean. This record is very rare as they pass back through Central America in March and April. But the fact that they were still in Ecuador on this date may be an indicator the bird was late in returning to the north, which could possibly be put down to climate change.

Nobody knows for sure how many individuals die each year during migration but the truth is that there could be a considerable number for each species. For years and years there have been records of dead individuals being found as in the case of the lagoon of Ozogoche in the Andes of Ecuador. It is here that many individual Upland Sandpipers (*Bartramia longicauda*) diewhen they cross the lagoon at night at over 4,000 metres altitude, and the winds are very strong and the birds struggle to follow their route to the south, many of them die while crossing over the lake, falling into it, while others fall in the grasslands and die, but there are more records from the lagoon since the current and wind at the lake drag them into a sort of funnel and the local people of the area find them easily floating dead in the lagoon in the morning. This gives rise to the legend that these birds commit suicide each year there during the month of September. The result is that when they cross the Andes many individuals are completely exhausted and no longer have the strength for their journey and then succumb to this. It is the same case of the exhausted Wilson's Phalarope(*Phalaropus tricolor)* on the island of La Plata, but during the day and with no adverse conditions. Possible effects of climatic change mean that foraging sites have less and less food each time and without this the populations of certain migratory bird species are declining.

We recommend

• It is necessary in order to reduce or mitigate the causes and negative effects of climate change globally that Articles 5, 17 and 18 of the Convention on Biological Diversity are implemented. We should try to achieve a reliable system operating at national, regional and global levels to monitor potential effects occurring due to climate change, in all existing systems - marine and aquatic, as well as terrestrial. For this we should seek intersectoral cooperation or a mechanism for the collection of databases comparable impacts on ecosystems, biodiversity and level socio-economic information of the costs that these impacts have on the natural world, such as forest fires, deforestation, and changes in forest cover. In the same way initiatives should aim to strengthen the protection of ecosystems that are vulnerable to forest fires, and prevent illegal logging of forests, especially in areas that are critically important for the conservation of biodiversity nationally and globally, such as hot spots, areas of endemism, and protected areas.

• Article 8 must be implemented and all its subparagraphs, from agenda item 5.6 of the last CBD COP in 2010 on Biodiversity and Climate Change that called on the Parties and other governments, to assess and minimize the negative impacts of climate change and adopt policies for adaptation and mitigation approaches based on ecosystems, considering all the possible impacts of measures mitigation and adaptation on biodiversity.

• Drawing on all this background between migratory and non-migratory species, it is important to continue carrying out censuses and listings on the ground, in order to have updated information. These studies give us guidelines to see more frequent changes, either positive or negative that are happening in each of the areas or localities and thus add each time to the lists the number of species of birds or failing that to note the reduction. It is possible that one of these species found sporadically is not recorded again for a long time, but these records are very important to compare changes in bird behaviour (especially that of migratory species) with climate.

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POSIBLES EFECTOS DEL CAMBIO CLIMÁTICO SOBRE LAS AVES MIGRATORIAS Y NO MIGRATORIAS EN ECUADOR

La tierra ha vivido épocas de cambios climáticos a lo largo de su historia, el Pleistoceno corresponde a la última edad en la que ocurrieron períodos glaciales y cambios abruptos en la temperatura de la tierra que conllevaron grandes catástrofes y extinciones masivas. En la actualidad el Panel Intergubernamental para el Cambio Climático ha calculado que solamente entre los años 1995 hasta 2006 se han experimentado los años más calientes desde 1850, de tal forma que actualmente la temperatura del ambiente ha aumentado en 0.76℃, habiéndose incrementado especialmente en los últimos 50 años. Si no ocurrieran cambios en las políticas para reducir la actual subida de la temperatura del ambiente, se calcula que al final de este siglo la misma subiría entre 1.1℃ y 6.4℃. El cambio de la temperatura ambiental es una consecuencia directa de la emisión de gases invernadero, los mismos que a su vez provienen de diferentes fuentes entre las que se destacan las emisiones de dióxido de carbono (CO_2), metano (CH_4), vapor de agua (H_2O), clorofluorocarbonos (CFs) y óxido de nitrógeno (N_2O). El más importante de estos gases es el dióxido de carbono, su incremento en la atmósfera se debe principalmente a la quema de combustible fósil y producción de cemento, que a su vez se exacerban debido a la deforestación y quema de bosques. Esta pérdida de biomasa es crítica puesto que se reducen las fuentes para el secuestramiento del dióxido de carbono de la atmósfera, lo que incrementa el efecto de los gases invernaderos y el calentamiento global. Alrededor de 2,500 Gt C existen dentro de la biomasa terrestre y 38,000 Gt C en los océanos (prácticamente 37,000 Gt C en los fondos marinos) y en promedio 1,600 Gt C son parte del ciclo natural de intercambio entre los ecosistemas marinos y terrestres (IPCC 2007). Por esta razón, hasta los cambios más pequeños en la biomasa de la tierra podrían ser extremadamente perjudiciales para el balance del carbono en la naturaleza.

La biodiversidad, que significa según el Convenio de Biodiversidad Biológica, la variabilidad de los organismos vivos de todos los ecosistemas, terrestres, marinos y acuáticos, y la complejidad ecológica de la que forman parte, lo que implica la diversidad entre especies, dentro de las especies y de los ecosistemas, se encuentra en peligro por las causas y consecuencias del cambio climático. Cambios en la temperatura en el orden de los 1.5 hasta 2.5℃ podrán causar un impacto en un 35 hasta 70% de las especies de corales, aves y vertebrados poiquilotermos como anfibios y reptiles (Foden et al. 2008 en Campbell et al.

2009). Son particularmente vulnerables las especies con rangos de distribución pequeña, con poblaciones aisladas o fragmentadas, que ocupan los pisos altitudinales más altos en las montañas, especies adaptadas a regiones frías (Campbell et al.2009).

Los organismos migratorios no están menos expuestos que los sedentarios a los cambios que ocurren en la tierra debido al calentamiento global. Se pronostican cambios en los rangos de distribución de las especies, esto incluye cambios en los hábitats de invierno y reproducción de muchas especies migratorias, también se pronostican cambios en los hábitos migratorios, en la fenología de migración (fechas de arribo y de inicio de la reproducción) y, debido a la subida del nivel del mar por el deshielo de las regiones polares, se pronostican reducciones en el área de hábitat de invierno de muchas especies a lo largo del litoral, especialmente estuarios e islas. Las poblaciones de aves migratorias altamente congregatorias que utilizan los humedales como sitio de parada obligatoria durante las migraciones de larga distancia, es decir las poblaciones de playeros, están especialmente en peligro, debido a las limitaciones en área y por ende en recursos alimenticios, y los cambios en sus hábitats de reproducción. Por todas estas razones se hace imprescindible implementar medidas para reducir o mitigar las causas y los efectos del cambio climático a nivel mundial. Dos de las causas más importantes son la deforestación, conversión de cobertura boscosa para extracción de madera y expansión de las poblaciones humanas, y los incendios forestales, estos últimos especialmente son un factor crítico en el calentamiento global ya que corresponden prácticamente del 20 hasta el 40% de las emisiones de gases invernadero (CBD 2001). En la región tropical, solamente en un año, 1998, se emitieron de 1 a 2 billones de toneladas de CO2 equivalentes a 1/3 de las emisiones de gases por quema de combustibles fósiles de todo el mundo (CBD 2001). Los incendios forestales se incrementarán directamente debido a la reducción de la humedad de los suelos y directamente por el calentamiento del aire.

Los Efectos que está causando el cambio climático a las diferentes especies de aves migratorias son indirectos, pero el efecto en contra de éstas son directos por el cual estos afectarán negativamente muchas poblaciones de aves, tanto locales como migratorias. Una de estas es la alteración de la dinámica de los niveles de aguas en diferentes humedales, uno de estos ejemplos es el Humedal la Segua, que fue declarado sitio Ramsar el día 7 de junio del 2000, es el 5to en Ecuador y el 1028 en el mundo. Es el Segundo más importante de la Provincia de Manabí.El humedal la Segua, aún no está protegido por el estado. Se ubica cerca de Ciudad de Chone y colinda con el poblado de San Antonio. Tiene un área de 1.836 hectáreas, que corresponden a las áreas de: Laguna, playas u orillas y llanuras de inundación, superan los 20 mil individuos de aves con sus 166 especies acuáticas y terrestres actualmente registradas. En los alrededores de la laguna se encuentran algunos parches de Bosque Seco. Es uno de los sitios más importantes de Ecuador y por ende el más importante de Manabí para la conservación, protección y observación de aves acuáticas.

Un registros importantes sobre el número de individuos a recalcar son: El segundo censo más grande de *Mycteria Americana*, Cigüeña Americana, aunque no es migratoria, ésta realiza migraciones para ambos lados de los Andes. Oriente y occidente. Cerca de 400 individuos (19.10.09 Por Francisco Sornoza) que viene a ser la población más grande al occidente; pero este registro de individuos juntos fue temporal, ya que luego que escaseó el alimento, la especie se diseminó por todo el litoral o posiblemente los individuos cruzaron los andes a humedales amazónicos que posiblemente puede ser por efectos del cambio climático.

También La población del*Ibis Morito*, *Plegadis falcinellus*, tiene un refugio en este humedal con una población de 200 individuos. Es importante recalcar la permanencia del la *Polluela Pechiamarilla*, *Porzana flaviventer* en el humedal, ya que es el único sitio en todo el País donde se encuentra esta especie. Aunque es difícil de observarla ya que pasa escondida dentro de los lechuguinos en las orilla del humedal. La lista de las aves migratoria boreales limícolas están muy bien representadas en este sitio Ramsar.

Las siguientes garzas: *Botaurus pinnatus* - Mirasol Neotropical; *Ixobrychus exilis* – Mirasol Menor; *Tigrisoma lineatum* – Garza Tigre Castaña; especies que aún no siendo migratorias es importante indicar los constantes cambios que sufre el ecosistema. Se mimetizan muy bien en la vegetación flotante de la laguna y vale la pena mencionar que sus poblaciones son pequeñas. En noviembre de este año, cuando la laguna casi había perdido todo su caudal, durante el monitoreo constante se contó cerca de 100 individuos *Botaurus pinnatus* - Mirasol Neotropical, hacinados en un espacio que aún mantenía un poco de agua y alimento.

En octubre de 2009 el Humedal se encontraba en pleno apogeo y lleno de vida, con un promedio de agua regular con miles de individuos de diferentes especies de aves. Un verdadero paraíso. 41 días más tarde el mismo humedal, al 30 de noviembre parecía un lugar lúgubre inhabitado seco y sin especies de aves, con muchos individuos de especies de peces y aves muertas por la sequía que azotó a a la provincia y en solo 41 días.

Otro de los efectos negativo del cambio climático es la falta de alimentos para aves limícolas migratorias ya que muchos de los lugares donde estas aves forrajeaban en el pasado ya no existen o no son actas para el cumplimiento de los procesos biológicos y al no encontrar los paraderos el efecto puedes ser fatal para poblaciones grandes que llegan para alimentarse, ejemplo de esto es el caso Wilson´s Phalaropus observado el 10 de octubre del 2010 en la isla de la Plata (área Protegida) durante los monitoreos constantes de los ornitólogos arribó a la orilla de la playa sin ejercer ningún tipo de movimiento a pesar de presenciar el acercamiento del investigador, se pudo sospechar que el ave estaba llegando de una larga travesía y posiblemente desde centro América por el océano. El ave había perdido toda su fuerza o energía y la isla de la Plata no es un lugar apropiado para alimentarse ya que la Isla no tiene los recursos. A menos que el ave los encuentre en el mar, como es costumbre encontrarlos en grupos nadando en forrajeo oceánico. Este registro es muy raro ya que pasan por centro América de regreso en marzo y abril. Pero que aún estén en Ecuador en esta fecha, puede ser un indicador que el ave está rezagado en su retorno hacia el norte. Que posiblemente pueden ser efectos del cambio climático.

Nadie sabe a ciencia cierta cuantos individuos mueren cada año en la travesía migratoria pero la verdad es que pueden ser un número considerable en cada especie. Ya que años tras años son registrados individuos encontrados muertos como es el caso de la laguna de Ozogoche en los Andes de Ecuador. En donde mueren muchos individuos de *Bartramaia longicauda* cuando estas hacen su paso por la laguna por la noche a más de 4000 metros de altura, y los vientos son muy fuertes y las aves luchan contra este para seguir su ruta hacia el sur, muchos de ellos mueren al cruzar por encima de la laguna cayendo a la misma, otros caen en el pajonal y también mueren, pero los registros en la laguna son más comunes ya que la corriente y el viento de la laguna los arrastran a un lugar con forma de embudo y los indígenas de la zona los encuentran fácilmente flotando muertos en la laguna en la mañana, y por eso hay la leyenda de que estas aves de suicidan cada año ahí durante el mes de septiembre. El resultado es que al cruzar los andes muchos de los individuos están completamente exhaustos y ya no tienen más fuerza en su travesía y luego sucumben en ésta. Es el mismo caso del Wilson´s Phalarope sin fuerza en la isla de la Plata pero en el día y sin condiciones adversas. Posiblemente los efectos del cambio climático hace que los sitios de forrajeo tengan cada vez menos alimentos o se encuentren sin los mismos, por lo cual las poblaciones de ciertas especies de aves migratorias van disminuyendo.

Recomedaciones

- Es prioritario que para reducir o mitigar las causas y efectos negativos del cambio climático a nivel mundial se lleguen a implementar los artículos 5, 17, 18 del Convenio de Diversidad Biológica en cuanto a tratar de alcanzar un sistema operativo y confiable a nivel nacional, regional y global para monitorear los posibles efectos que están ocurriendo debido al cambio climático en todos los sistemas existentes, tanto marinos, acuáticos como terrestres, para lo cual se buscará la cooperación intersectorial/interinstitucional para la recopilación de bases de datos comparables sobre los impactos en los ecosistemas, en la biodiversidad y a nivel socioeconómico, con información de los costos que dichos impactos a su vez provoquen en la naturaleza, tales como fueran estos incendios forestales, deforestación, y cambios en la cobertura boscosa. De la misma forma se deben fortalecer las iniciativas relacionadas con la protección de los ecosistemas que son vulnerables a incendios forestales, impedir la tala ilegal de los bosques, especialmente en sitios que son críticamente importantes para la conservación de la biodiversidad a nivel nacional y mundial, tales como puntos calientes (Hot Spots en inglés), áreas de endemismo, y áreas protegidas.

- Se debe implementar el artículo 8 y todos sus numerales, del tema 5.6 de la última CBD – COP 2010, sobre Biodiversidad y Cambio Climático que invita a las partes y a otros gobiernos, a evaluar y reducir los impactos negativos del cambio climático, y a adoptar políticas con enfoques de adaptación y mitigación basados en los ecosistemas, considerando todos los posibles impactos de las medidas de mitigación y adaptación sobre la diversidad biológica.

- Tomando como referencia todos estos antecedentes entre las especies migratorias y aquellas que no lo son, es importante los continuos censos y listados en las localidades, con el fin de tener información actualizada. Estos estudios nos darán directrices para poder ver los cambios con más frecuencia, sean positivos o negativos que están sucediendo en cada una de las áreas o localidades y así aumentar cada vez más las listas del número de especies de aves o en su defecto observar la disminución Es posible que una de estas especies encontrada erráticamente no vuelva a ser registrada en un largo periodo de tiempo, pero estos registros son de suma importancia para comparar cambios en el comportamiento de las especies de aves versus clima, especialmente migratorias.

MAURITIUS

NP 87/1, NP 89

Mauritius (Republic of Mauritius) is a Small Island Developing State (SIDS) comprised of two major islands (Mauritius & Rodrigues) and some few small islets. As most small islands, Mauritius is susceptible to the effects of climate change. Our concern is that native biodiversity will obviously be affected, as well as migratory species which are important worldwide. Mauritius has a few migratory species including about one dozen migratory bird species, marine mammals such as whales and reptiles such as the marine turtles.

An analysis of climate change has shown or forecast the following changes:

(1) Increase in mean annual temperature of 0.5 to 3.80 °C by 2100.
(2) Declining trend in annual rainfall but an increase in intensity.
(3) A sea-level rise of between18 – 59 cm by 2100.
(4) Increase in intensity and rate of intensification of tropical cyclones.

Subsequently, the important sectors that are most likely to be affected by climate change impacts are coastal resources, agriculture, water resources, fisheries, health and well–being, land use change, forestry, biodiversity and ecosystems. Obviously, our migratory birds, turtles and marine mammals are likely to be affected. The migratory birds' habitats are the coastal zones, marine turtles lay eggs in coastal zones and increases in sea temperature may influence breeding of migratory species among other things. The same may be true for marine mammals which regularly migrate through Mauritius' waters.

Mauritius has already embarked on strategies to counteract and adapt to the effects of climatic change. Mauritius has already ratified the UN Framework Convention on Climate Change (UNFCCC). There are several *ad-hoc* projects in existence which focus on ecosystem

restoration, reintroduction of native fauna species and flora species and address the importance of sea-level rise (SLR).
However, these projects are limited in scale and scope and are also isolated from underlying development. Additional funding is also required to increase the scale of projects. There are also some projects to mitigate impacts of climate change under the Millennium Development Goals (MDG).

Currently, Mauritius, through the Ministry of Environment & Sustainable Development is involved in a UNDP project “supporting integrated and comprehensive approaches to climate change adaptation.” In this project, there is a section dealing with biodiversity and a Steering Committee has been set up to involve all stakeholders. The National Parks and Conservation Service (NPCS), the Focal Point of CMS has to recommend ways and means for adaptation to climate change of our biodiversity. The project is due to start this year.

However, apart from protection of a migratory bird sanctuary, the migratory birds themselves, little has been done for adaptation of migratory species to effect of climatic change. Apart from funding, there is a need for training local technicians as well as scientists for evaluating, designing and implementing adaptation and mitigation technologies.

SENEGAL

CONTRIBUTION SENEGAL: FOR THE TECHNICAL WORKING GROUP ON IMPACTS OF CLIMATE CHANGE ON MIGRATORY SPECIES

(see French version below)

Dr. Djibril Diouck, Member of the Scientific Council, CMS

Support research efforts on:

- The potential threat posed by climate change (climatic, oceanographic regimes, rising sea levels, etc..) to biodiversity including migratory species and their habitats;
- The vulnerability of biodiversity to climate change (vulnerability of marine, coastal and terrestrial habitats and of the migratory species that are associated with them; social and economic vulnerability of human populations dependent on the use and exploitation of these species and their habitat);
- The impact of climate change on reproduction and the spatio-temporal process of migratory species;

Furthermore, Parties to the Convention should be encouraged to improve their knowledge base for decision making by:

- Considering the integration of the vulnerability of migratory species and their habitats to climate change into the planning and governance processes
- Defining possible avenues for adaptation as well as strategic elements to be taken into account in planning documents.

CONTRIBUTION SENEGAL: POUR LE GROUPE DE TRAVAIL TECHNIQUE SUR LES IMPACTS DU CHANGEMENT CLIMATIQUE SUR LES ESPÈCES MIGRATRICES.

Djibril DIOUCK, Membre de la Commission scientifique, CMS

Soutenir les efforts de recherches sur:

- Sur les risques liés aux changements climatiques (facteurs climatiques, régimes océanographiques, élévation du niveau de la mer, etc.) sur la biodiversité notamment sur les espèces migratrices et leurs habitats;
- La vulnérabilité de la biodiversité face aux changements climatiques (vulnérabilité des habitats marins, côtiers et terrestres et des espèces migratrices qui y sont associées, vulnérabilité sociale et économique des populations humaines dépendantes de l'utilisation et de la valorisation de ces espèces et de leur habitat);
- L'impact des changements climatiques sur la reproduction et la dynamique spatio-temporelle des espèces migratrices;

Par ailleurs, il faut encourager les états Parties à la convention à améliorer leur base de connaissances pour la prise de décision par:

- L'analyse du niveau de prise en compte de l'intégration de la vulnérabilité des espèces migratrices et de leur habitat face aux changements climatiques dans les processus de planification et de gouvernance
- La définition de pistes d'adaptation ainsi que d'éléments stratégiques de recommandation pour leur prise en charge dans les documents de planification.

UGANDA

UGANDA'S CONTRIBUTION TO THE CMS RESOLUTION ON CLIMATE CHANGE IMPACTS ON MIGRATORY SPECIES

1. Parties should map all migratory species and their migratory routes in their respective territorial jurisdictions
2. Joint planning and implementation of conservation programmes by Range States should be enhanced and promoted
3. Efforts to support research into the impacts of climate change on migratory species should be scaled up in order to initiate adaptation and mitigation measures based on sound scientific knowledge. A fund should be established to support such initiatives.
4. Parties should review or initiate new wildlife conservation policies, legislation, plans and strategies to provide wildlife managers with the flexibility, tools and approaches needed to effectively address the impacts of climate change.
5. Support efforts to improve the management of wildlife protected areas and migratory corridors in order to increase the resilience of migratory species to climate change.
6. Focus conservation and wildlife management initiatives on vulnerable species at greater risk of extinction arising from the impacts of climate change.

Selected Legal Issues Concerning the Bonn Convention on Migratory Species and the Adaptation of Species to Climate Change

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Date: 2 June 2011 (an earlier version was submitted and discussed in December 2010)

Introduction

This note focuses on two features in the text of Article I of the 1979 Bonn Convention on Migratory Species (CMS) which are potentially problematic for efforts under the CMS regime to come to terms with the impacts of climate change on migratory species, and to facilitate the adaptation of species thereto.

Problem 1: 'Historic Coverage'

The achievement or maintenance of a 'favourable conservation status' for migratory species is a central objective of the CMS regime. According to Article I(1)(c)(4) of the Convention, one of the conditions to be fulfilled for the conservation status of a species to qualify as 'favourable' is that its distribution approaches 'historic coverage'. This criterion clearly reflects the fact that the Convention was adopted in 1979, well before climate change appeared on the intergovernmental agenda. Presently, under the influence of climate change, the distributions of many species are expected to coincide less and less with areas occupied historically, as they will attempt to move along with shifting suitable 'climate space'. States parties to the CMS are well aware of this. The preamble to CMS COP Resolution 9.7 (2008) notes in this regard that 'climate change is already known to be affecting the [..] distribution [..] of migratory species' and that 'due to climate change, ranges of migratory species are changing.' Given the need to facilitate this adaptation process in order to conserve species in the long term, efforts aimed at having ranges approach 'historic coverage' evidently risk being counterproductive.

Problem 2: 'Range (State)'

As Articles II-VI of the Convention make abundantly clear, two other central – and closely related – concepts in the CMS regime are 'range' and 'Range State'. For present purposes, it is especially significant to note that full participation as party or signatory, as the case may be, in the daughter instruments adopted under Article IV of the Convention is reserved for Range States of the species involved. As COP Resolution 9.7 (2008) observes, 'due to climate change, ranges of migratory species are changing and [..] CMS instruments may need to adapt to these variations.' Obviously, to achieve effective conservation such adaptive action should be undertaken in a proactive manner. It is potentially problematic in this respect that the definition of 'range' in Article I(1)(f) of the Convention – which in turn informs the definition of 'Range State' in Article I(1)(h) – employs the present tense. It defines 'range' to mean 'all the areas of land or water that a migratory species, inhabits, stays in temporarily, crosses or overflies at any time on its normal migration route.' Again, this would seem to reflect the pre-climate change origins of the CMS. It should be noted, however, that similar problems arise with respect to *former* Range States, which also fall outside the scope of 'Range State' as formulated in Article I.

That the definition of 'range' and therefore of 'Range State' in Article I of the Convention can stand in the way of a forward-looking approach to migratory species conservation in the face of climate change, can be illustrated with reference to the 2001 Memorandum of Understanding (MoU) on the Great Bustard. At the 2nd Meeting of the Signatories of the MoU in 2008 it was noted that it would be desirable if a number of states where great bustards do not occur yet but where the birds are expected to turn up in the future as a consequence of climate change, were already to join the MoU. The Meeting was also aware, however, of the hurdle posed by the fact that accession as signatories is possible only for *current* Range States as defined in the Convention. It is convenient to reproduce some of the Meeting's considerations on this point (Report of the 2nd Meeting of the Great Bustard MoU, 11-12 November 2008, par. 25, 27 and 28):

> The options available for [..] the inclusion of those states that are currently not listed as range states but are likely to become range states due to climate change would be assessed by the Secretariat. The findings would be communicated to delegates by email by the end of January 2009.
>
> It was noted that while it would be relatively straightforward to invite further countries currently not listed as range states under the MoU to join as observers, such an arrangement may make participation of these new observers difficult since national funding is not necessarily available. Signatory status would on the other hand facilitate such national funding. As a result it may be more practical in the long-term to suggest to new countries interested in joining the MoU to do so as signatories rather than observers.
>
> The CMS Secretariat is invited to use the example of the Great Bustard MoU to encourage debate amongst member states (e.g. during the forthcoming CMS COP9) on the implications of likely range shifts due to climate change, which may require a change of MoU range.

Options

Several options exist for dealing with the potential problems identified above. These include (1) doing nothing; (2) amending pertinent provisions in the Convention and, especially where the 'Range State' issue is concerned, also in daughter agreements; and (3) clarifying what CMS parties believe to be the correct interpretation, in the context of climate change, of the provisions involved in a COP resolution.

The first option, ignoring the issues, may to some degree be suitable for the 'historic coverage' problem, in the sense that the existence of this criterion in Article I of the Convention is unlikely to lead to major difficulties regarding the implementation of the CMS or daughter instruments in the short term. The 'Range State' issue, however, is likely to make itself felt increasingly, the great bustard example discussed above being merely one out of many. At any rate, leaving issues unresolved which could be clarified is always unappealing from a legal point of view.

The second option, amendment of relevant provisions, could in principle render a satisfactory solution to both problems. The 'historic coverage' issue could be resolved through a relatively modest amendment of the wording of Article I(1)(c)(4) of the Convention, for instance by inserting the words 'the dimensions of' before the words 'historic coverage'. Thus, CMS parties would be directed at achieving distributions of migratory species resembling the *size* of, but not necessarily coinciding *geographically* with, historic coverage. Similarly, amending Article I(1)(f) of the Convention could go a long way to providing a solution to the 'Range State' problem. This could be achieved, for instance, by adding the phrase 'as well as the areas the species is likely to occupy in the future [under influence of climate change]' to the definition of 'range' in this provision. Inevitably, however, both amendments would introduce a measure of legal uncertainty into the CMS framework. Especially the legal consequences of the suggested modification of the meaning of 'Range (State)' are difficult to foretell precisely. It should be borne in mind in this respect that the question at what point in time a state becomes a 'Range State' not only determines the possibility to join relevant daughter agreements, but also entails the applicability of, *inter alia*, the obligations in Article II of the Convention on the strict protection of Appendix I species. This legal uncertainty could well make it harder to gain sufficient support for the amendment in question. This touches on what is probably the greatest drawback of this option, namely the onerous requirements of the procedure for amendment of the Convention laid down in Article X. These include a two-thirds majority for adoption and another two-thirds majority for entry into force. Another downside of the procedure of Article X is that for a long time (and perhaps permanently) different legal regimes will apply to different states parties.

The third option, clarifying the interpretation of the provisions concerned in the context of climate change in a CMS COP resolution, is manifestly easier to achieve and would also secure a more uniform approach. This option would build on the generally accepted rules of treaty interpretation which hold that a treaty is to be interpreted in line with, *inter alia*, its 'object and purpose' – which in the case of the CMS is effective migratory species conservation – and with 'any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions' (Article 31 of the 1969 Vienna Convention on the Law of Treaties, which reflects customary international law). For present purposes, such 'subsequent agreement' could be provided for in the form of a COP resolution clarifying how the Convention's provisions defining favourable conservation status and 'Range (State)' are to be interpreted in light of the need to help migratory species adapt to climate change. Such clarification would build on precedents provided in earlier resolutions, which provided for particular interpretations of other terms employed in Article I of the Convention, namely 'cyclically', 'predictably', and 'endangered' (see CMS COP Resolutions 2.2 (1988) and 3.1 (1991)).

Recommended Action

Given the two potential problems and the various pluses and minuses associated with the three principal options for dealing with them as identified above, the most judicious approach appears to be to strive for clarification of the proper interpretation of the provisions involved in the context of climate change in a CMS COP resolution. This is the case regardless whether amendment of the Convention is also striven for in the longer term. It appears appropriate to adopt this clarification at the 10th COP, in a successor of Resolutions 8.13 and 9.7 on migratory species and climate change.

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