

# Climate change and migratory species Vulnerability assessments and next steps

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Convention on the Conservation of Migratory Species of Wild Animals (CMS)  
Technical workshop

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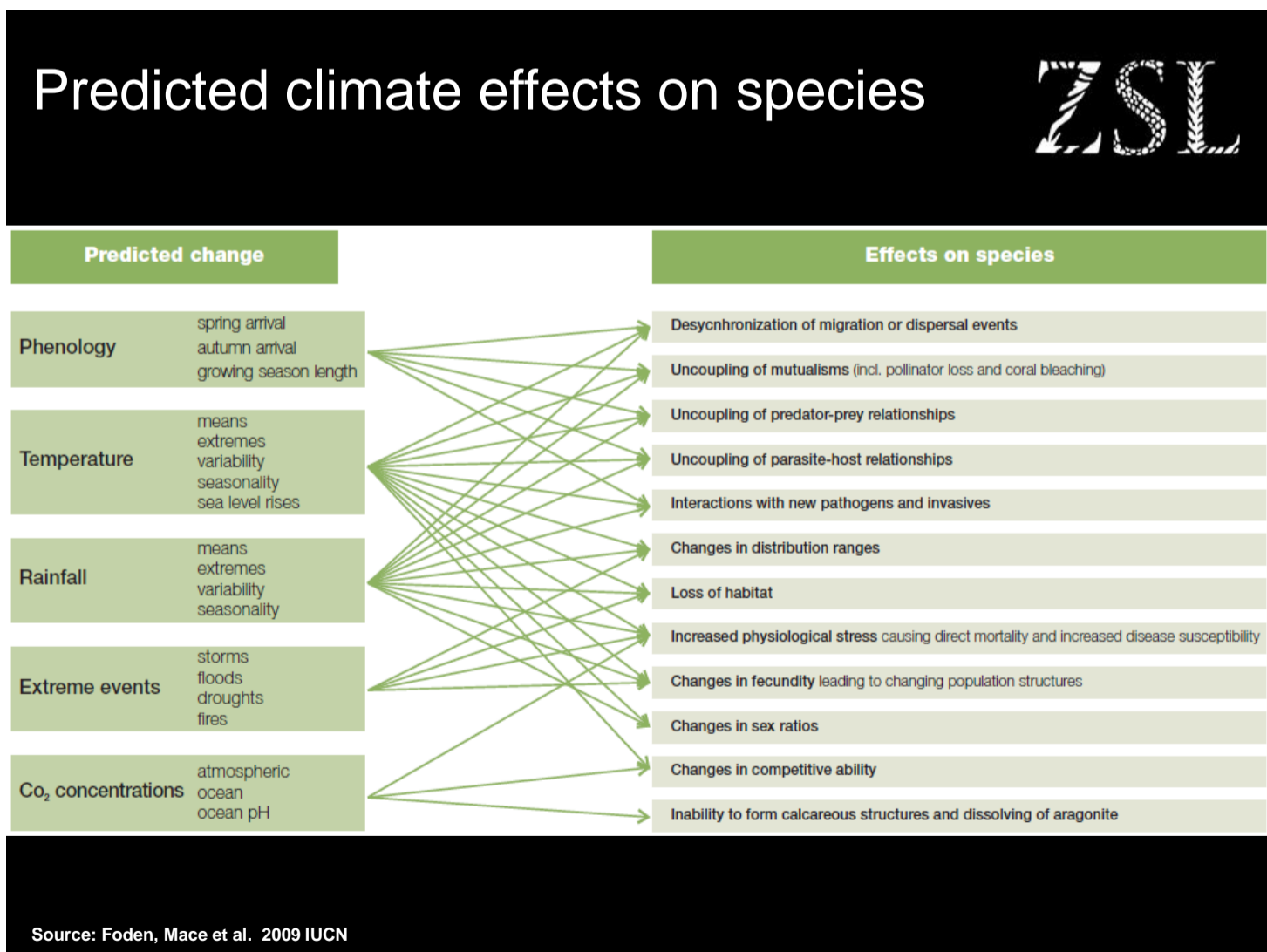
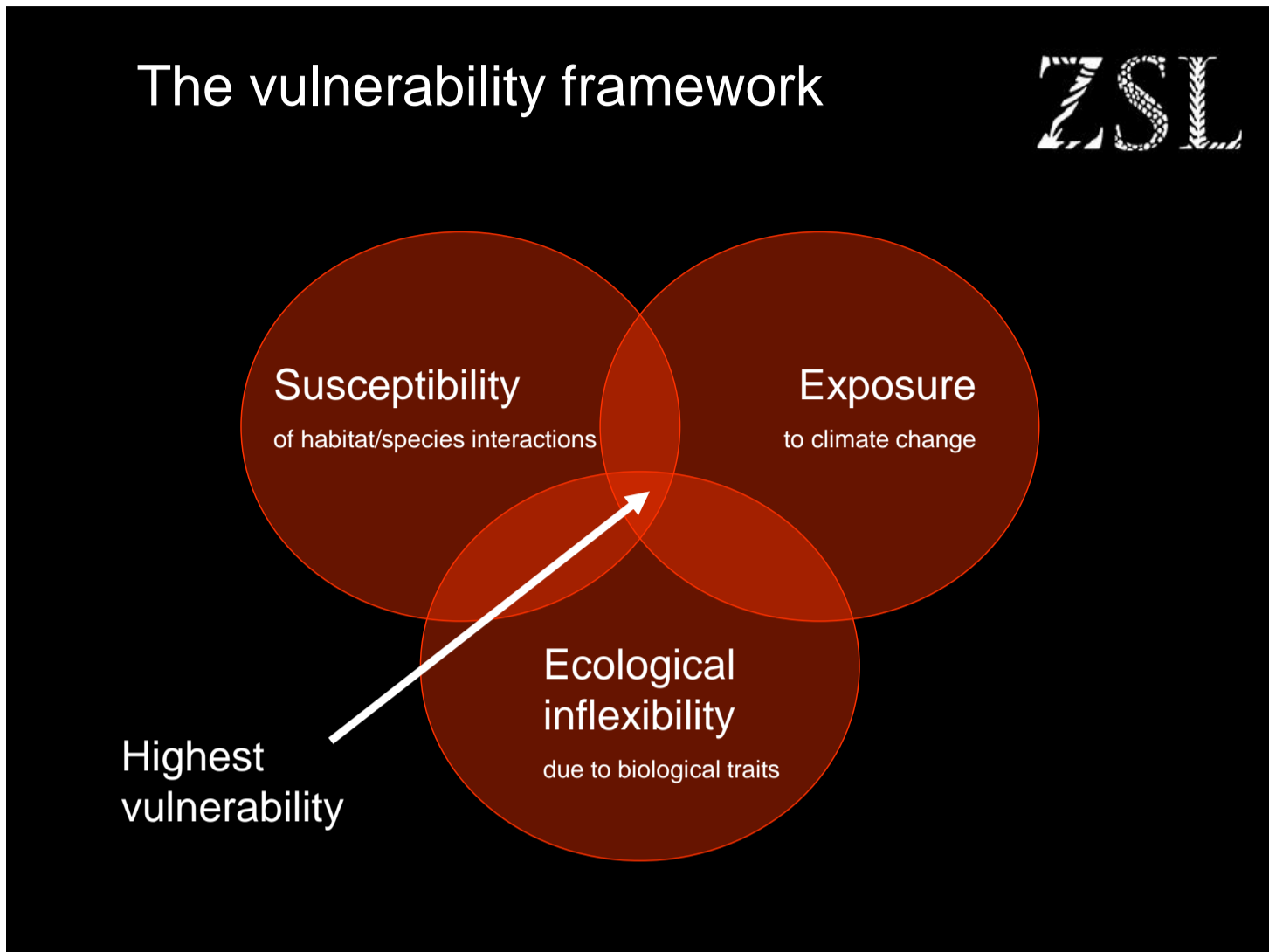
## Central questions



Which species are particularly vulnerable to climate change  
and why?

How can science best inform policy?

ZSL report for CMS on Climate Change Vulnerability and  
Migratory Species (Aylin McNamara & Paul Pearce-Kelly)



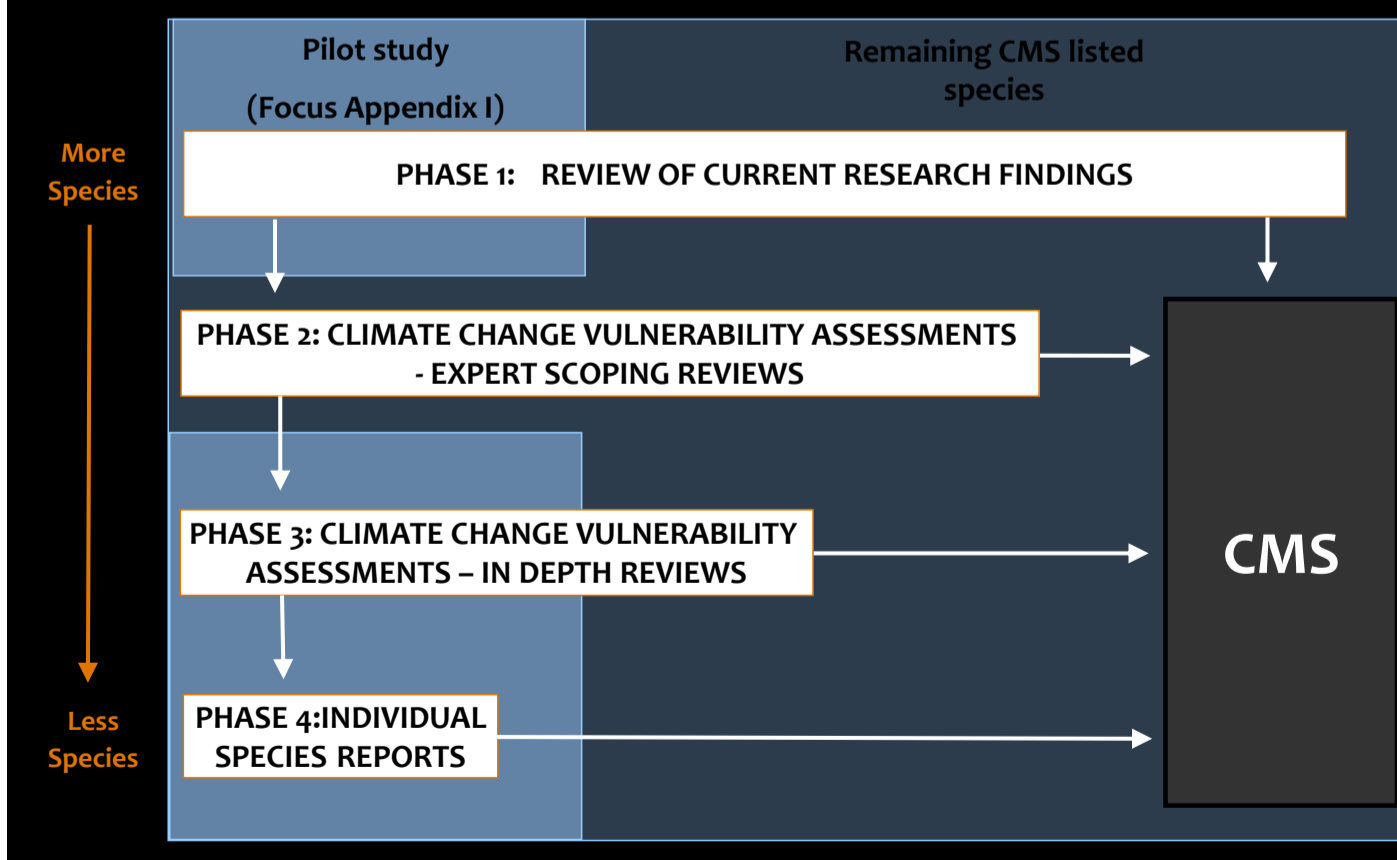
## Project objectives



- Develop and pilot an assessment process on CMS listed species to review vulnerability to climate change
- Preliminary review of CMS Appendix I listed species for climate change vulnerability
  - 44 case study Appendix I species
  - 1 species from Appendix 2 - narwhal
- Recommend development, testing and future priorities



## Recommended phases for assessment



## Climate change vulnerability assessments



### Method

Compilation of peer review literature.

- Each species evaluated against 4 risk factors:

- Vulnerability of habitat/s
- Ecological flexibility
- Species interactions
- Synergistic threat processes



## Information gathered for each species



### 1. Vulnerability of habitat/s

- Resilience to change
- Climatic changes projected for habitat area
- Impact that projected changes will have upon the habitat

### 2. Ecological flexibility & adaptation potential

- Degree of specialisation
- Environmental triggers and phenological cues
- Evidence of adaptation in the past
- Dispersal ability
- Reproduction rate & resilience

### 3. Vulnerability of species interactions

- Changing dynamics of predator/ prey/ competitor interactions
- Impacts upon mutualisms/ symbiosis

### 4. Interactions with other threat processes

- Habitat loss/ fragmentation
- Exploitation
- Disease
- Invasive species

# Grading scheme



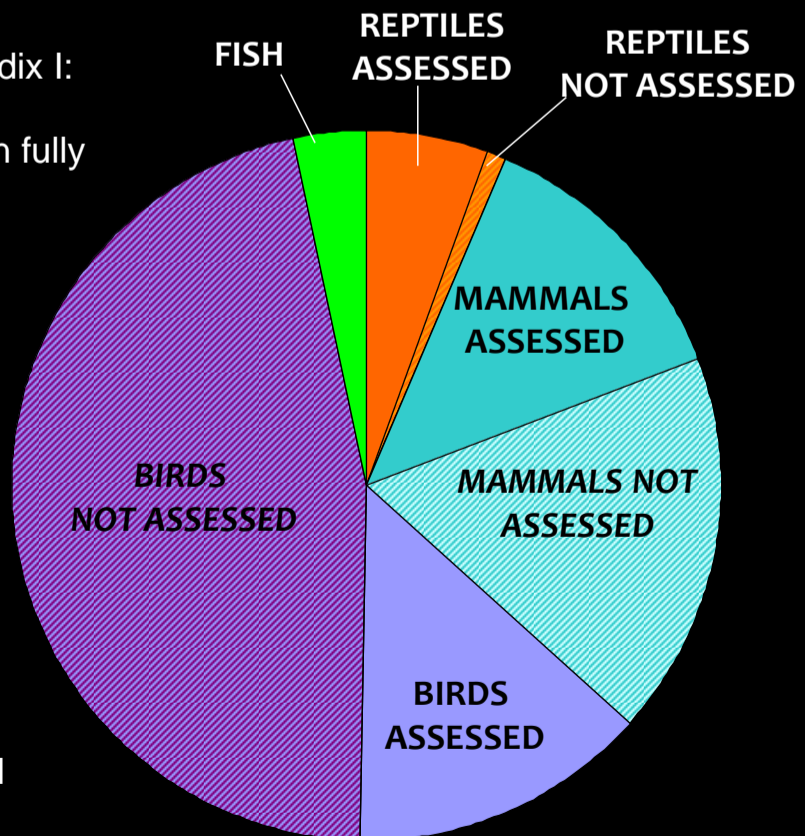
## Levels of vulnerability used to grade species

Impacting factor	Severity of impacting factor					Other considerations
	LOW (1)	LOW / MEDIUM (2)	MEDIUM (3)	MEDIUM / HIGH (4)	HIGH (5)	
<b>Vulnerability of habitat/s:</b>						
Resilience to change >Climatic changes projected for habitat area. >Impact that projected changes will have upon the habitat.	Minimal impact on habitat(s) utilised. Habitat likely endure climatic changes largely unchanged	Some impacts on habitat(s) utilised. Habitat likely to endure climatic changes with few changes	Moderate projected changes within habitat(s) due to climate change. System function and essential niche occupied by species operational to some extent but degraded and fragile.	One or more vital habitat(s) projected to be highly degraded by climatic changes	One or more vital habitat(s) projected to be severely degraded by climatic changes	Ability of the habitat to maintain pace with the projected eco-zone (bioclimatic envelope) shift and any barriers to that shift should be considered. Will habitats shift across large distances? Will changes occur rapidly?
<b>Ecological flexibility and adaptation potential:</b>						
Degree of specialisation	Dynamic species with a wide diet and a broad niche. Species may utilise many habitats. Equipped to manage a changing environment.	Species has a wide niche and a varied diet. Species may utilise a number of habitats.	Some degree of specialisation, some biological requirements, including dietary and habitat, are limited / rare or found in few areas.	Specialised species with a well defined niche. Specific and limited dietary and habitat requirements.	Highly specialised species. Sensitive species with a narrow niche breadth. May be endemic to one region/area.	Ability to adapt to changing conditions and switch food or other resource requirements. Is the species current habitat and/or resource use facultative or obligate? What factors limit species adaptation potential?
Environmental triggers and phenological cues	No fixed dependency on phenological cues or triggers that will be affected by climate change.	Little dependency on phenological cues or triggers that will be affected by climate change and high ability to adapt.	Potential dependency on phenological cues or triggers that will be affected by climate change but some ability to adapt.	Dependency on phenological cues or triggers that will be affected by climate change but some ability to adapt.	Fixed dependency on phenological cues or triggers that will be affected by climate change. Little ability to adapt.	Will changes in environmental triggers lead to phenological mismatch?

# Species evaluated



- Total number of species in Appendix I: 129 Species
- 35% of Appendix I have now been fully assessed.
- CMS Appendix I made up of:
  - 3% Fish species (4) (100% assessed)
  - 7% Reptile species (8) (88% assessed, 7)
  - 29% Mammal species (38) (42% assessed, 16)
  - 60% Bird species (78) (22% assessed, 17)
- Focused on the 'most biologically migrant' species within Appendix I



## Pilot study results



- Which species are most strongly affected?
  - all reptiles assessed had high vulnerability to climate change (green and hawksbill turtle top the list)
  - combined impacts of sea level rise, increased temperatures, ocean acidification alongside negative impacts of current anthropogenic threats



## Pilot study results



- Example of reptile assessments and rankings

	Habitat Vulnerability	Ecological Flexibility	Species Interactions	Interactions with other Processes	Total
Reptiles					
Gharial, Indian Gaviel	Medium	Medium / High	Medium	High	High (15)
Green Turtle	High	High	Medium	High	High (18)
Hawksbill Turtle	High	Medium / High	Medium / High	High	High (18)
Kemp's Ridley Turtle, Atlantic Ridley Turtle	Medium / High	Medium / High	Medium	High	High (16)
Leatherback Turtle	Medium / High	Medium	Low / Medium	High	High (14)
Loggerhead Turtle	Medium / High	Medium	Medium	High	High (15)
Olive Ridley	Medium / High	Medium / High	Low / Medium	Medium / High	High (14)

## Pilot study results



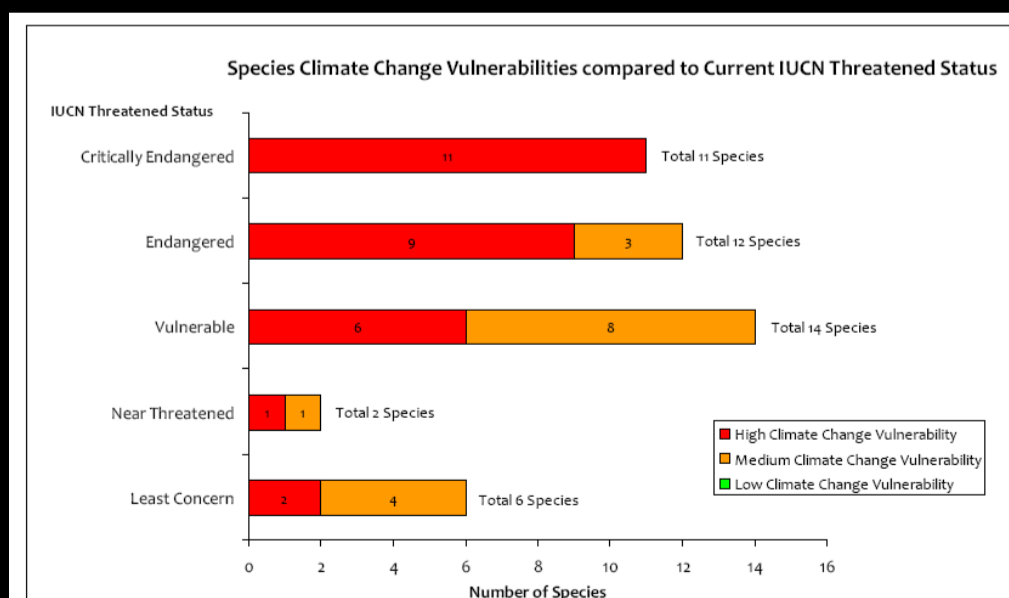
- Which species are most strongly affected?
  - over half of assessed mammals had high vulnerability to climate change (North Pacific and Northern Atlantic Right Whale top the list)
  - krill feeding whales particularly affected, due to combined impacts of ocean acidification, changes in ocean circulations and polar ice melt



## Pilot study results



- Which species are most strongly affected?
  - all **Critically Endangered** (IUCN) species also predicted to be highly vulnerable to climate change
  - BUT: not only threatened species affected



## Pilot study results



- Common factors likely to increase climate change vulnerability
  - key habitat (marine/coastal, drylands/deserts, wetlands)
  - prey distribution and abundance shifts
  - exposure to other threats
  - pre-determined migration routes (e.g. rivers), fixed breeding sites
  - sea-ice dependence
  - low reproductive rate



## Conservation action Targeting the weakest link



- Vulnerability of habitats upon which they depend?
  - protection of habitat, resilience in habitat network by recognising habitat shifts
- Vulnerability of species upon which they depend?
  - protection of related species, may integrate with habitat vulnerability
- Pressure of other threats reducing resilience to climate change?
  - targeted action to reduce other current threats
- *Direct limitations to species ecological flexibility and adaptation?*
  - *counteract limitations by targeted conservation actions, translocations may work in some cases, but not all; important to remove other vulnerabilities to give maximum chance of survival; **climate change mitigation essential***



## Where to from here?



### Assessment process and methodology improvement

- Address research gaps on species vulnerability to climate change
- Expand the set of species assessed
  - *all CMS listed species and other migratory species*
  - *new species may become listed as result of emerging climate change threat*
- Integrate methodologies and lessons learned from similar assessment processes (e.g. IUCN Red Flag)
  - streamline assessment process
- Move from qualitative to quantitative assessments as more information becomes available



## Where to from here?



### Conservation action

- Identify key vulnerabilities and feed appropriate action into species-specific conservation action plans
  - Work with CMS parties to identify most effective strategies to combat vulnerability across the species' range
- Acknowledge that climate change mitigation is essential key action if certain species are to survive
  - Work with CMS parties to identify most effective strategies for climate change mitigation – draw on other relevant conventions



