



## **Migratory Species and Climate Change Expert Workshop**

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### **DISCUSSION PAPER: DEVELOPMENT OF THE DECISION TREE**

*(Prepared by the UK)*

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# Discussion paper: Development of the Decision Tree

## Introduction

The 14th meeting of the CMS Conference of the Parties agreed Decision 14.214(e) ([CMS COP14 Decisions](#)), this decision was directed to the Scientific Council and reads as follows:

***The Scientific Council is requested, subject to the availability of external resources, to:***

**e) *propose measures to help facilitate migratory species' range changes;***

A Decision Tree was developed by Andrew Twelves while working as an intern at JNCC, and included as part of the discussion paper presented to the 5th Sessional Committee of the CMS Scientific Council ([UNEP/CMS/ScC-SC5/Doc.6.4.5](#)). This Decision Tree aims to assist Parties to identify the appropriate conservation action, including conservation, restoration, adaptation and translocation interventions they might wish to undertake. The decision tree uses yes/no questions to link detected scenarios to possible strategies for migratory species. For ease of reference, the decision tree is included in Annex 1 to this document and can also be found on page 13, figure 2 of the discussion paper.

At CMS COP14 the Decision Tree was incorporated into [Resolution 12.21 \(Rev. COP14\)](#) as Annex 2 with the intention that it help Parties to interpret and implement operative paragraph 10 of the Resolution:

10. Agrees that Article I (1) (c) (4) of the Convention, on the definition of “favourable conservation status” could be interpreted as follows in light of climate change, and invites the governing bodies of relevant CMS instruments to also approve this interpretation:  
*According to Article I (1) (c) (4) of the Convention, one of the conditions to be met for the conservation status of a species to be taken as “favourable” is that: “the distribution and abundance of the migratory species approach historic coverage and levels to the extent that potentially suitable ecosystems exist and to the extent consistent with wise wildlife management”. While there is a continued need to undertake conservation action within the historic range of migratory species, such action will increasingly also need to be taken beyond the historic range of species in order to ensure a favourable conservation status, particularly with a view to climate-induced range shifts. Such action beyond the historic range of species is compatible with, and may*

*be required in order to meet, the objectives and the obligations of Parties under the Convention.*

This paper aims to build on the work already undertaken on the Decision Tree by testing its usability, identify strengths and weaknesses in the process, and highlight any potential issues and areas for improvement. The aim of this paper is to aid the discussion of the working group, generating points for discussion and suggestions for the working group to consider.

## **Method**

Six CMS listed species were selected from a range of taxonomic groups (mammals, birds, reptiles, insects). These six species were chosen from Part 1 and 2 of the 2023 report on Climate change and migratory species: a review of impacts, conservation actions, indicators and ecosystem services (Martay, Macphie, *et al.* 2023 and Barton, *et al.* 2023). Both reports include species that will be impacted by climate change and therefore require conservation actions to support range shifts.

The following species were tested against the Decision Tree.

- *Gazella subgutturosa* (Goitered Gazelle)
- *Oryx dammah* (Scimitar oryx)
- *Geronticus eremita* (Northern Bald Ibis)
- *Grus japonensis* (Red-crowned Crane)
- *Caretta caretta* (Loggerhead Turtle)
- *Danaus plexippus* (Monarch butterfly)

Using a standardised table, the outcome to each of the specified conservation scenario questions in the Decision Tree was documented. The final conservation strategy: Conservation, Restoration, Adaptation, or Translocation was recorded together with any observations (Annex 2).

## **Observations**

The conservation scenarios included in the Decision Tree have simple yes/no answers and result in a conservation outcome. During the testing process, there were several examples where it was not straightforward to decide on a conclusive answer, due to the complexity of the species and interpretation of the conservation scenario. There is therefore a risk that the end conservation action for a species may differ depending on the individual's interpretation of the conservation scenario, their knowledge and expertise, and available data.

Examples interpretation issues encountered during the testing process.

- Conservation scenario - ***Is the species currently present throughout its naturally suitable range?***
  - It might be useful to provide guidance on 'naturally suitable' and how this should be determined. For *Grus japonensis*, the species is not present in parts of the species range in China that otherwise appear suitable. This is due to human disturbance from fishing or plant gathering, or people walking close to the marsh. Although this habitat could be deemed as potentially suitable, due to disturbance, and argument could be made for it being unsuitable?
  - It might be useful to clarify if the scenario applies to any level, for example the national/local level or if the assessment is intended to be more general. Comprehensive data may not be available for the entirety of the species range, making answering yes/no to this scenario difficult. In the case of *Gazella subgutturosa* despite being present in Iraq, Kaky *et al.* found the species is not found within Protected Areas despite the habitat being suitable. 'No' was therefore answered to this scenario.
- Conservation scenario - ***Is the suitable but uninhabited range likely to remain suitable under climate change?***
  - This is a very broad question with no timescales. For example, the predicted range shifts for a species in the next 10 years may greatly differ compared to the next 50+ years. This may result in differing interpretations of this scenario.
  - Assessments will depend on the availability of data, which for some species may be difficult to ascertain. Level of confidence could also be considered, is the predicted impact from climate change based on data with a low, medium or high level of confidence. In the case of *Oryx dammah* it is difficult to predict with a high level of certainty if uninhabited parts of the species range will continue to remain suitable under climate change.
- Conservation scenario - ***Is there a natural barrier to range expansion?***
  - There is ongoing work relating to agreeing a definition for the term 'barrier'. Once agreed this should assist with the interpretation of this conservation scenario.
- Conservation scenario - ***Is there an anthropogenic barrier to range expansion?***
  - As mentioned in the point above, an agreed definition of the term "barrier" will assist with this scenario. Greater guidance could be considered for this scenario, potentially a scale or rating according to the severity of the human activity and its associated barrier to range expansion. As this

scenario is left open, and could include any anthropogenic barrier, it may result in most Parties answering 'yes' to this question and therefore arrive at the outcome 'Restoration'.

- Conservation scenario- ***Is colonisation of suitable range necessary for the species survival?***
  - Guidance could be considered to assist with interpretation of this scenario, for example using a timeframe (short/medium/long term) and scoring matrix. A species predicted survival in the short, medium and long-term may differ, and predictions may have varying degrees of certainty. Guidance may assist Parties when dealing with complex scenarios, if for example colonisation in the short or medium term is not required but may be necessary in the long-term. Weighting in the scoring could also be considered based on the level of certainty.
  - It is also possible Parties may arrive at a different outcome for species with multiple populations. For example, the non-migratory island population *Grus japonensis* in Japan has grown rapidly in recent decades into a large and stable proportion of the global population, but the continental population remains at high risk of extinction.
  
- Conservation scenario- ***Would colonisation occur naturally if anthropogenic barriers were removed?***
  - An agreed definition of the term "barrier" should assist Parties and aid interpretation. Depending on the species, Parties may need to consider a wide range of anthropogenic barriers which could differ across the species range. For complex scenarios a template could assist with a scale or rating depending on the level of impact. Guidance could also include advice on how to approach any uncertainties in sources of information and/or lack of data.
  
- Conservation scenario- ***Is there a risk of an anthropogenic barrier in the future?***
  - None of the six species tested led to this scenario in the Decision Tree. For future planning, should the Decision Tree link to this scenario question in order to consider the risk of future anthropogenic barriers? Depending on the answer, Parties could consider 'Conservation' as a secondary conservation strategy. For example, barriers in the form of linear infrastructure and fences are an emerging threat in Central Asia which may impact *Gazella subgutturosa*. If a secondary action is included as part of the Decision Tree process, then 'Conservation' could be a secondary conservation action.

## Recommendations

The Decision Tree has the potential to be a useful tool for Parties and conservationists, to help identify the conservation action a species requires. Although easy-to-use, the Decision Tree could be further developed to improve its effectiveness. The working group may wish to consider the following.

- Development of supplementary guidance to assist with the interpretation of each of the conservation scenario questions.
  - o This should include clear definitions, e.g. 'natural barrier', 'anthropogenic barrier' and 'suitable range'.
  - o Guidance for Parties for dealing with species where the available data is lacking or there are uncertainties.
  - o Whether Parties should assess the conservation scenarios at the global or regional, local level.
- If development of scoring criteria or a matrix is required if this could be of value.
  - o For complex scenarios this could assist Parties reach a definitive yes or no answer. This could be in the form of a template with a scoring rating depending on the level of risk and level of confidence.
  - o The breadth of scoring criteria should be considered. Should the criteria be taxon specific. Should it apply to the regional, global, local level? Should timescales be included (short, medium, long-term)?
- If the inclusion of a secondary strategy outcome is appropriate. Currently the Decision Tree arrives at only one outcome. For Adaption, Restoration and Translocation, the decision tree does not lead on to the question '*Is there a risk of an anthropogenic barrier in the future?*'. It might be useful to still consider this question for future planning.

## References

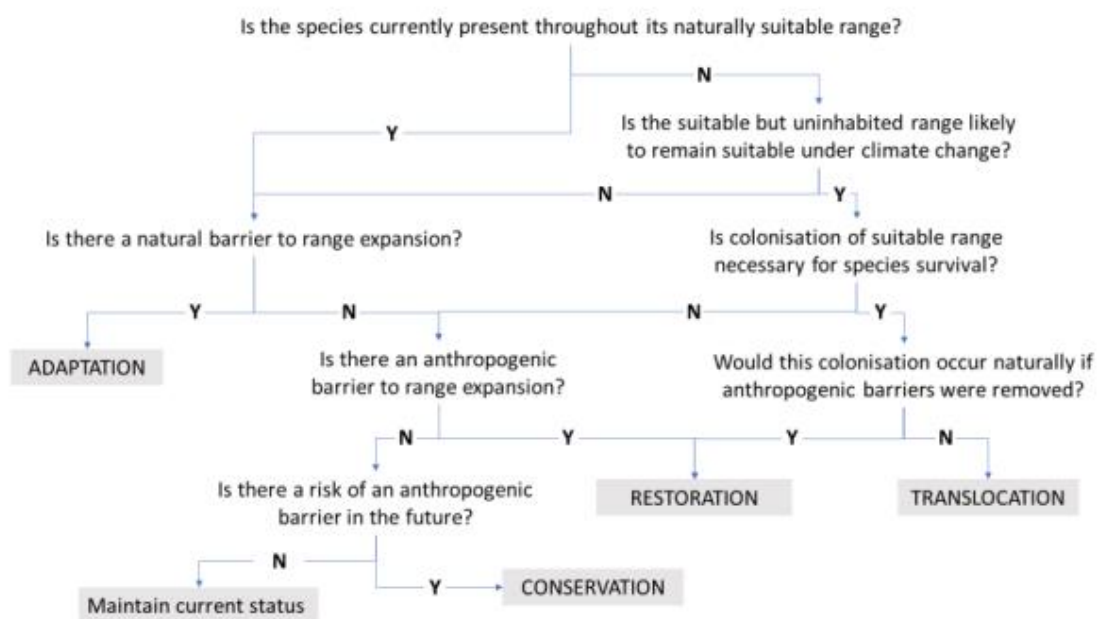
Barton, M.G., Martay, B., Hereward, H.F.R., Pearce-Higgins, J.W., Robinson, R.A., Scott, S.E. & Williams, J.M. 2023. Climate change and migratory species: a review of impacts, conservation actions, indicators and ecosystem services. Part 2 – Conserving migratory species in the face of climate change. JNCC, Peterborough, ISBN 978-0-86139-002-1.

CMS. 2024. Decisions of the Conference of the Parties to CMS in effect after its 14th meeting. <https://www.cms.int/en/document/decisions-conference-parties-cms-effect-after-its-14th-meeting>

CMS. 2021. Discussion Paper for the Scientific Council on Decision 13.128: Climate Change and Migratory Species. <https://www.cms.int/en/document/discussion-paper-scientific-council-decision-13128-climate-change-and-migratory-species>

Martay, B., Macphie, K.H., Bowgen, K.M., Pearce-Higgins, J.W., Robinson, R.A., Scott, S.E. & Williams, J.M. 2023. Climate change and migratory species: a review of impacts, conservation actions, indicators and ecosystem services. Part 1 – Impacts of climate change on migratory species. JNCC, Peterborough, ISBN 978-0-86139-001-4.

**Annex 1: Decision Tree from discussion paper [Annex 2 of Resolution 12.21 \(Rev.COP14\)](#)**



**Annex 2: Testing of the Decision Tree for species *Gazella subgutturosa*, *Oryx dammah*, *Geronticus eremita*, *Grus japonensis*, *Caretta caretta* and *Danaus plexippus***

## Decision Tree Testing

Species name: <i>Gazella subgutturosa</i> (Goitered Gazelle)			
CMS: Appendix II		Reference: Kaky et.al. 2023. Conservation of the Goitered gazelle ( <i>Gazella subgutturosa</i> ) under climate changes in Iraq <a href="https://www.cell.com/heliyon/pdf/S2405-8440(22)03789-6.pdf">https://www.cell.com/heliyon/pdf/S2405-8440(22)03789-6.pdf</a>	
	Yes/No	Decision tree outcome	Comments
Is the species currently throughout its naturally suitable range?	No		<p><b>Answered No</b></p> <ul style="list-style-type: none"> <li>Kaky et.al found the species is not found within Protected Areas (PAs) in Iraq despite the habitat being suitable. '<i>all 43 occurrence records in Iraq were found outside PAs, and the <b>mean habitat suitability for the gazelle was no higher inside compared to outside PAs</b></i>'.</li> <li>The paper found that the most suitable habitat in both the current and future scenarios is located in north-eastern Iraq close to the Iranian border near the Zagros</li> </ul>
Is the suitable but uninhabited range likely to remain suitable under climate change?	Yes		<p><b>Answered Yes (for the uninhabited range in Iraq).</b></p> <ul style="list-style-type: none"> <li>Modelling suggests '<i>habitat suitability for the gazelle is <b>relatively stable or will become even more suitable than current scenarios</b></i>' '<i>This offers a potential glimmer of hope for the conservation of the gazelle, as climate change is unlikely to cause severe population reductions: <b>Gazella subgutturosa is able to survive in extreme heat and drought conditions</b> because it has a number of physiological adaptations that will allow it to cope with climate change</i>'</li> </ul>
Is colonisation of suitable range necessary for the species survival?	No		<b>Answered No</b>
Would colonisation occur naturally if anthropogenic barriers were removed?			
Is there a natural barrier to range expansion?	No		<b>Answered No</b>
Is there an anthropogenic barrier to range expansion?	Yes	<b>RESTORATION</b>	Habitat loss due to expanding infrastructure development, agricultural conversion, and increasing livestock numbers across the species' range.
Is there a risk of an anthropogenic barrier in the future?	Yes	<b>CONSERVATION</b>	The decision tree does not lead on to this question, but could future anthropogenic barriers this be included/considered? Barriers in the form of linear infrastructure and fences are an emerging threat in Central Asia

## Decision Tree Testing

Species name: *Oryx dammah* (Scimitar oryx)

CMS: Appendix I

	Yes/No	Decision tree outcome	Comments
Is the species currently throughout its naturally suitable range?	No		<p><b>Answered No</b></p> <ul style="list-style-type: none"> <li>Historically present throughout most of the sub-desert zones north and south of the Sahara. Indiscriminate hunting, habitat loss and degradation through overgrazing, and competition with domestic livestock resulted in wild populations becoming extinct. Reintroduced population in Chad</li> </ul>
Is the suitable but uninhabited range likely to remain suitable under climate change?	Yes		<p><b>Answered Yes? (although difficult to predict)</b></p> <ul style="list-style-type: none"> <li>The IUCN SSC Antelope Specialist Group notes that 'the possible effects of climate change at local site level are difficult to predict'.</li> <li>Observed changes at the reintroduction site in Chad over the period 1982–2008, with increasing plant cover in the wetter Sahelian habitats in the south of the reserve, but a reduction in the more Saharan northern part (Fremantle et al. 2013).</li> <li>A recent study predicted a continued expansion of the Sahara desert between 2015–2050 (Liu and Xue 2020). Other studies suggest an increase in rainfall in parts of the Sahara and Sahel (Intergovernmental Panel on Climate Change (IPCC) Assessment Report 6, and the IPCC Atlas (<a href="https://interactive-atlas.ipcc.ch/regional-information">https://interactive-atlas.ipcc.ch/regional-information</a>)). Even with increased rainfall predications, it is likely the region will remain arid.</li> </ul>
Is colonisation of suitable range necessary for the species survival?	Yes		<p><b>Answered Yes</b></p> <ul style="list-style-type: none"> <li>Species is extinct across most of the species range</li> </ul>
Would colonisation occur naturally if anthropogenic barriers were removed?	No	<b>TRANSLOCATION</b>	<p><b>Answered No</b></p> <ul style="list-style-type: none"> <li>Semi-managed population in Morocco and fenced Katane enclosure inside Ferlo Nord Faunal Reserve in Senegal. No evidence to demonstrate the removal the fenced enclosures will result in successful colonisation.</li> </ul>
Is there a natural barrier to range expansion?			
Is there an anthropogenic barrier to range expansion?			
Is there a risk of an anthropogenic barrier in the future?			

## Decision Tree Testing

Species name: <i>Geronticus eremita</i> (Northern Bald Ibis)			
CMS: Appendix II		Reference: Bowden, C.G.R. (Compiler) 2015. International Single Species Action Plan for the Conservation of the Northern Bald Ibis ( <i>Geronticus eremita</i> ). AEWA Technical Series No. 55. Bonn, Germany	
	Yes/No	Decision tree outcome	Comments
Is the species currently throughout its naturally suitable range?	No		<p><b>Answered No</b></p> <ul style="list-style-type: none"> <li>Data of historic colonies in the Alps (Switzerland, Germany, Austria), which disappeared during 17th century. Formerly almost certainly throughout North Africa and into the Middle East (Morocco to Algeria, Turkey Syria, Iraq?) until recently in Turkey and Syria; wintering in Saudi Arabia, Ethiopia and Northern Somalia. Since the beginning of the 20th century two disjunct wild populations: western population in Morocco and eastern population in Turkey</li> <li>Reintroduction projects in Austria, Germany and Spain</li> </ul>
Is the suitable but uninhabited range likely to remain suitable under climate change?	No		<p><b>Answered No (Although difficult to predict without assessing further)</b></p> <ul style="list-style-type: none"> <li>Droughts in North Africa predicted to impact availability of fresh water.</li> <li>Further studies/modelling required for northern Africa, Europe and Middle East. Smith et al. 2008 noted the that supplementary fresh water appears to help buffer productivity against the impacts of low rainfall in southern Morocco.</li> </ul>
Is colonisation of suitable range necessary for the species survival?			
Would colonisation occur naturally if anthropogenic barriers were removed?			
Is there a natural barrier to range expansion?	No		<b>Answered No</b>
Is there an anthropogenic barrier to range expansion?	Yes	RESTORATION	<b>Answered Yes</b> Loss/degradation of feeding habitat, tourism development, pesticides, hunting
Is there a risk of an anthropogenic barrier in the future?	Yes	CONSERVATION	The decision tree does not lead on to this question, but is it worth linking in the decision tree? To consider future anthropogenic barriers?

## Decision Tree Testing

Species name: *Grus japonensis* (Red-crowned Crane)

Reference: Liu et.al. 2020. Breeding range shift of the red-crowned crane (*Grus japonensis*) under climate change. Plos One, 15, e0229984 <https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0229984&type=printable>. IUCN SSC Crane Specialist Group – Crane Conservation Strategy [https://savingcranes.org/wp-content/uploads/2022/05/crane\\_conservation\\_strategy\\_red-crowned\\_crane.pdf](https://savingcranes.org/wp-content/uploads/2022/05/crane_conservation_strategy_red-crowned_crane.pdf)

CMS: Appendix I

	Yes/No	Decision tree outcome	Comments
Is the species currently throughout its naturally suitable range?	No		<p><b>Answered No (after some deliberation)</b></p> <ul style="list-style-type: none"> <li>The IUCN SSC Crane Specialist Group notes that <i>'In China, the cranes are highly wary and will not use habitat that otherwise appears suitable due to human disturbance from fishing or plant gathering, or people simply walking through or beside the marsh (Su 2008). Similarly, small to medium sized fragments of habitat will not be used. In Russia, experimental releases of hand-reared birds have aimed to introduce more tolerant birds into the population, so that habitats closer to human activity can be used (Andronova 2006)'</i> IUCN SSC Crane Specialist Group.</li> </ul>
Is the suitable but uninhabited range likely to remain suitable under climate change?	Yes		<p><b>Answered Yes (although difficult to predict without assessing further)</b></p> <ul style="list-style-type: none"> <li>Study by Liu et al. 2020 used bioclimatic niche modelling of the continental species breeding range. The study found the breeding range of the continental population of red-crowned crane will shift northward over this century. Resulting in a loss of almost all its current actual breeding range.</li> <li>The predicted shift of the breeding range suggests that China would lose a proportion of the breeding range, Russia would gain some breeding range area.</li> </ul>
Is colonisation of suitable range necessary for the species survival?	Yes		<p><b>Answered Yes</b></p> <ul style="list-style-type: none"> <li>Species remains at high risk of extinction due to multiple threats affecting the small and still declining continental population and to the dependence of the population in Japan on active conservation</li> <li>Coordinated action is needed to prevent the extinction of the continental population to increase the availability of extensive. Currently, the population wintering in China is very close to extinction, and that wintering in the Korean peninsula restricted to increasingly small patches of suitable habitat.</li> </ul>
Would colonisation occur naturally if anthropogenic barriers were removed?	Yes	RESTORATION	<p><b>Answered Yes (potentially)</b></p> <ul style="list-style-type: none"> <li>Shrinking of breeding and wintering ranges of red-crowned crane due to habitat modification resulting from anthropogenic environmental change. Species also susceptible to human disturbance. Removal of these anthropogenic barriers may result in the species expanding range.</li> <li>However, if as predicted, climate change will result in a poleward shift of breeding range, it is difficult to predict if the species will be able to colonise naturally</li> </ul>
Is there a natural barrier to range expansion?			
Is there an anthropogenic barrier to range expansion?			
Is there a risk of an anthropogenic barrier in the future?			

## Decision Tree Testing

Species name: <i>Danaus plexippus</i> (Monarch butterfly) CMS: Appendix II			
	Yes/No	Decision tree outcome	Comments
Is the species currently throughout its naturally suitable range?	Yes		<b>Answered Yes.</b> Majority of the North American populations show a multigenerational migration moving between between their breeding grounds in North America and wintering sites in Mexico. Historically, the EOO (Extent of Occurrence) and AOO (area of occupancy) were probably larger (but many overwintering habitats have been lost or degraded).
Is the suitable but uninhabited range likely to remain suitable under climate change?			
Is colonisation of suitable range necessary for the species survival?			
Would colonisation occur naturally if anthropogenic barriers were removed?			
Is there a natural barrier to range expansion?	No		<b>Answered No</b>
Is there an anthropogenic barrier to range expansion?	Yes	<b>RESTORATION</b>	<b>Answered Yes</b> <ul style="list-style-type: none"> <li>Degradation and loss of breeding and migratory habitat and degradation and loss of overwintering habitat.</li> <li>Pesticides including herbicides, insecticides, and fungicides, roadside mowing regimes, urban development, and logging.</li> <li>At overwintering grounds in Mexico, historical habitat loss and forest fragmentation probably contributed to early declines in Monarch numbers (Brower et al. 2002).</li> <li>From 1971 to 1999, 44% of 42,020 hectares of suitable overwintering habitat was degraded as a result of commercial logging (legal and illegal), conversion for agriculture and pastures, charcoal production, and controlled burns (Brower et al. 2002).</li> <li>More recently, deforestation due to logging has slowed and reserves have been established to protect this habitat</li> </ul>
Is there a risk of an anthropogenic barrier in the future?	Yes	<b>CONSERVATION</b>	The decision tree does not lead on to this question, but might be useful to consider future anthropogenic barriers? Climate change is predicted to result in a northward breeding range shift. Milkweed distribution which is an important driver is also predicted to expand northward.

## Decision Tree Testing

Species name: <i>Caretta caretta</i> (Loggerhead Turtle)			
CMS: Appendix I		Reference: Hochscheid et al (2022) Nesting range expansion of loggerhead turtles in the Mediterranean: Phenology, spatial distribution, and conservation implications. <i>Global Ecology and Conservation</i> 38 (2022) e02194	
	Yes/No	Decision tree outcome	Comments
Is the species currently throughout its naturally suitable range?	Yes		<p><b>Answered Yes</b></p> <ul style="list-style-type: none"> <li>• Circumglobal distribution.</li> <li>• Range is predicted to change with a shift polewards</li> <li>• There are 10 Loggerhead subpopulations: North West Atlantic Ocean, North East Atlantic Ocean, South West Atlantic Ocean, Mediterranean Sea, North East Indian Ocean, North West Indian Ocean, South East Indian Ocean, South West Indian Ocean, North Pacific Ocean, and South Pacific Ocean.</li> </ul>
Is the suitable but uninhabited range likely to remain suitable under climate change?			
Is colonisation of suitable range necessary for the species survival?			
Would colonisation occur naturally if anthropogenic barriers were removed?			
Is there a natural barrier to range expansion?	No		<b>Answered No.</b> Although this may change in the future if breeding or nesting grounds are required to stay geographically fixed, whilst foraging grounds shift due to climatic change
Is there an anthropogenic barrier to range expansion?	Yes	<b>RESTORATION</b>	<b>Answered Yes.</b> Anthropogenic barriers for example coastal development reducing availability for breeding and nesting sites. Additionally land based light pollution, acts to deter nesting females and disruption/disorientation for hatchlings. Paper by Hochscheid et al (2022), observes that loggerhead turtles have already started to expand their nesting range into the Western Mediterranean, which has until recently hosted only sporadic nests. Many of the sites were unsuitable due to development.
Is there a risk of an anthropogenic barrier in the future?	Yes	<b>CONSERVATION</b>	The decision tree does not lead on to this question. However an important point to consider for future planning/ availability of nesting and breeding sites due to sea levels rising and the species shifting polewards