CLIMATE CHANGE IMPACTS ON CETACEANS

AN URGENT CALL FOR ACTION

Marine ecosystems are severely impacted by climate change.[1,2] Cetaceans have unique ecologies with complex life cycles that make predicting their response to climate change difficult and, for some species and populations, make them especially vulnerable to climate change impacts.[3,4] Broadly, climate change affects the phenology (the timing of recurring biological events, such as migration), demography (aspects such as survival rates and calving rates) and distribution of marine vertebrates,[5] which can influence marine ecosystem structure and functioning. Shifting geographic ranges have been observed for marine species across all ocean regions.[2] Changes in human activities resulting from climate change may also affect cetaceans - including location of fisheries and vessel traffic.[6,7]

KEY MESSAGES

- Cetaceans are impacted by climate change in various ways including on timing of important life events, on critical habitats and on abundance of prey.
- Multiple human stressors will act in concert and magnify the impact of climate change long-term.
- An urgent response by the International Whaling Commission (IWC) is required across all work areas to develop and implement a climate change response programme for cetaceans.

Changes in the distribution and abundance of prey are a central way in which climate change impacts cetaceans. However, how it impacts their individual physiology is still poorly understood.[3] Cetaceans may also be affected by physical changes to their habitats and increasing susceptibility to disease and contaminants.[8] Impacts may be species or population-specific, with some able to expand their habitat while others are forced to constrain their range. [9] Reduced habitat range and shifts in prey availability may cause population declines.[9]

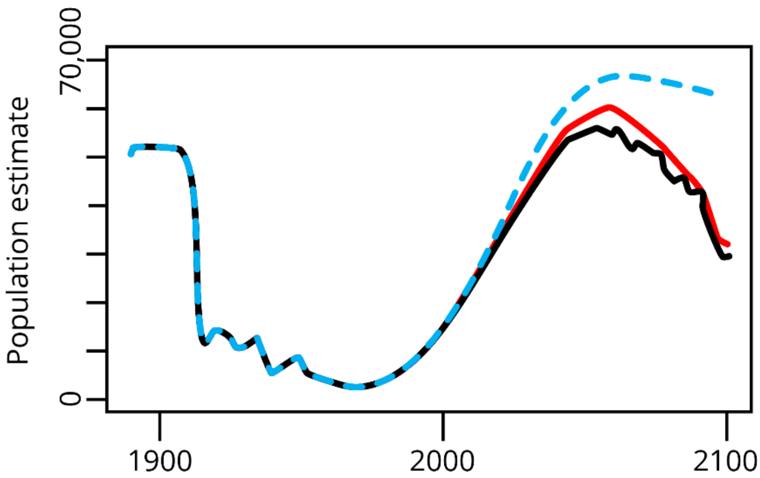

Fig 1 – Blue line indicates Atlantic/Indian humpback population trajectory without climate drivers. Red line represents trajectory with climate drivers and black line represents links to sea-ice. Adapted from Tulloch et al (2019)[17]

Arctic and Antarctic cetaceans are thought to be especially sensitive to climate change because many of them rely on sea ice and sea ice ecosystems.[10,11] The rapid decline of sea ice in the Arctic is altering habitat availability, shelter from predators and timing of important life events for endemic species. This includes their seasonal migrations, which for narwhal (*Monodon monoceros*), bowhead (*Balaena mysticetus*) and beluga (*Delphinapterus leucas*) whales, follow sea ice retreat in spring/summer and advance in autumn/winter.[12–14] Increasing frequency of marine heatwaves in the Pacific Arctic as a result of climate change may also be responsible for bowhead whales in this region foregoing their seasonal migration south and remaining in their summer feeding grounds over winter for the first time in 2018–19.[15,16] This possibly represents a major shift in migration behaviour for these whales as a result of climate change. Additionally, recent modelling has indicated that while some populations in Antarctica have been recovering since large-scale commercial whaling was prohibited, climate change will reverse this recovery, as can be seen from Figure 1.[17]

In the Southern Ocean, climate change is likely to drive rearrangements in phytoplankton community composition with ramifications for the whole ecosystem.[18] There are regional, southward shifts in Antarctic krill distribution due to ocean warming.[19] For whales feeding almost exclusively on krill – such as Antarctic blue (*Balaenoptera musculus intermedia*), humpback (*Megaptera novaeangliae*) and Antarctic minke whales (*Balaenoptera bonaerensis*) – this is likely to impose high energetic costs on migration, with effects on body condition, reproductive fitness and population abundance.[19] In particular, the distribution and ecology of Antarctic minke whales are directly tied to sea ice[20] where any changes that affecting the quantity and quality of their habitat and food availability could have significant consequences.[21]

Climate change will impact cetaceans in other regions too[22] and what is particularly concerning is the certainty, that without immediate, concerted action, multiple stressors such as entanglement in fishing gear and ghost nets, growing ship traffic, pollution from chemical, plastic and underwater noise sources, will act in concert and magnify the impact of climate change long-term.[23,24]

An urgent response is required from the IWC

Since 1996, the IWC has sought to address the effects of climate change on cetaceans primarily through a series of dedicated workshops. Urgency is growing to understand and address this multifaceted threat with a clear, dedicated workstream on this issue across the entire breadth of the work of the IWC.

In addition, growing evidence shows that whales are 'climate positive,' providing benefits that range from capturing carbon to enhancing marine productivity.[25,26] The IWC needs to engage robustly with this issue and properly define its role and how it will engage not only to better understand impacts on cetacean populations but also to address them.

Recommendations

We strongly recommend that the IWC, led by the Conservation Committee, develops an integrated **climate change response programme for cetaceans** aimed at fully understanding the threat of climate change, providing clear advice on tools to mitigate its negative impacts and build resilience, and developing appropriate conservation measures. We advise that this includes recommendations from the most recent IWC climate change workshop in 2021, which included a call for a further evaluation to complete its work.[6] In this new focused effort, the IWC should also seek to work in partnership with other international organisations with complementary interests.

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