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## CLIMATE CHANGE IMPACTS ON CETACEAN POPULATIONS

Cetaceans are exposed to the multiple impacts of climate change throughout their ranges. Observed and predicted impacts worldwide include:

- range shifts
- altered community compositions and species interactions
- shifts in biological events, including access to adequate prey, with possible phenological, health, energetic, and reproductive consequences
- increased exposure to extreme events, with consequences ranging from exhaustion and malnutrition to displacement, reduced reproductive success and increased vulnerability to regime shifts
- habitat loss (especially among species affected by multiple anthropogenic stressors and those inhabiting e.g., coastal areas)
- exposure to more frequent toxic algal blooms
- amplified propagation of pathogens and diseases
- heightened exposure to pollutants, including via climate change-induced mobilisations of legacy pollutants from the environment and lipid mobilisation from blubber during times of nutritional stress

## PHYSIOLOGICAL IMPACTS

Cetaceans are intelligent, self-aware and highly social creatures capable of learning, knowledge transfer, and developing cultural traditions, and have been shown to experience a variety of mental states including pain. Their welfare is inextricably linked to the conditions that surround them, and changing (eco)physiological conditions due to climate change can cause them considerable hardship. The apparent increased incidence of emaciated cetaceans around the world, for example, may be an indicator of the growing climate stresses on the animals, their habitat and prey<sup>[1]</sup>.

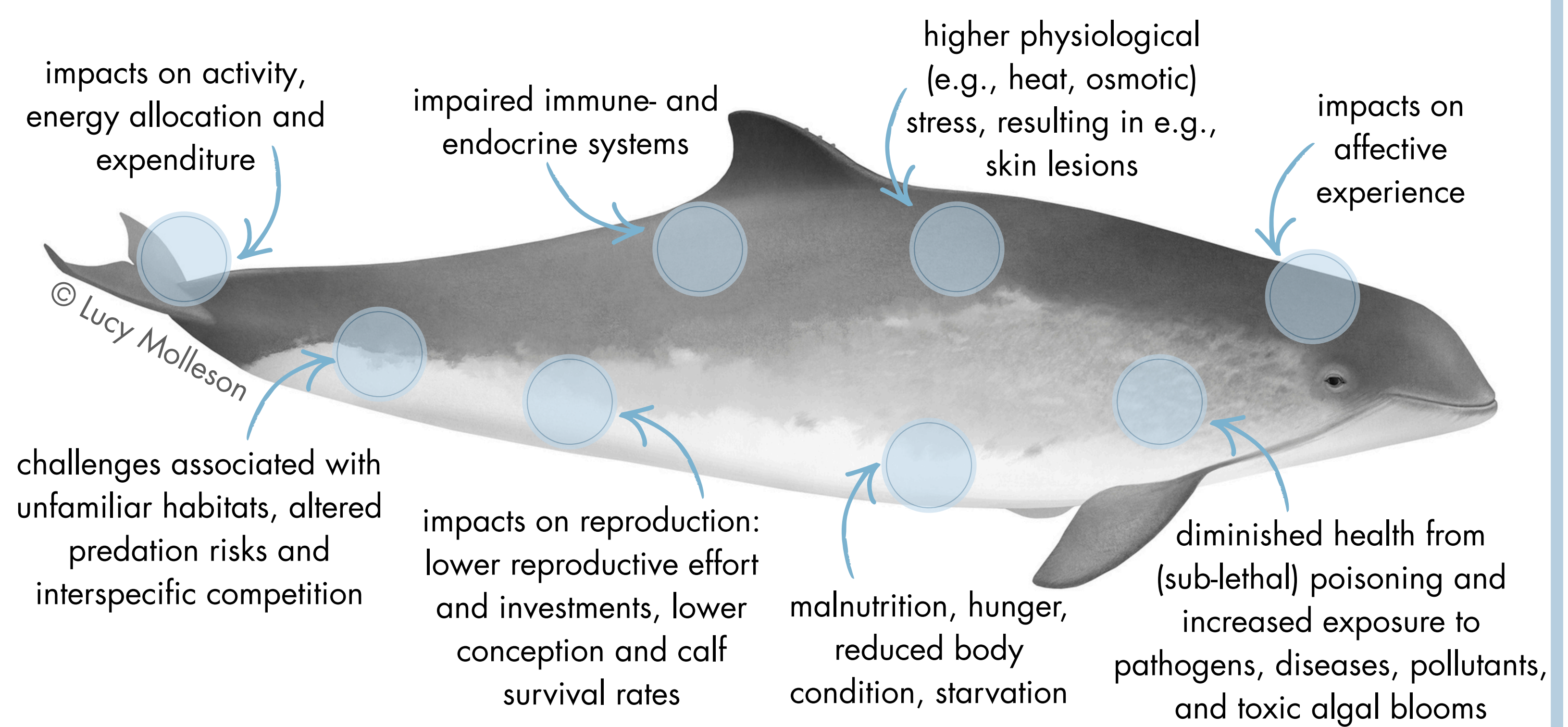


Figure 1 Observed and predicted impacts of climate change capable of reducing individual cetaceans' welfare.

## WELFARE IMPACTS

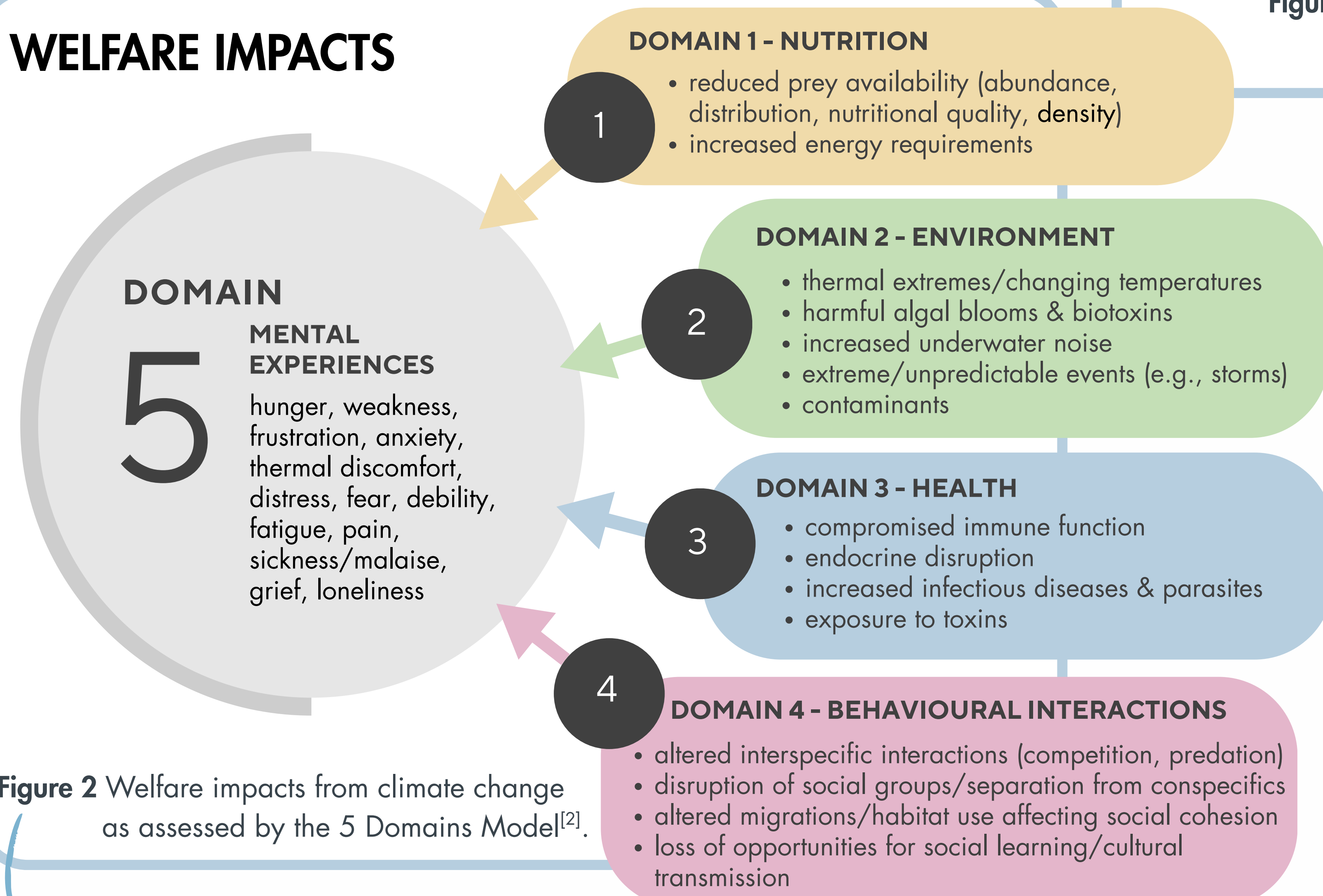


Figure 2 Welfare impacts from climate change as assessed by the 5 Domains Model<sup>[2]</sup>.

Climate change can be expected to **negatively impact cetacean welfare** within **each** of the Five Domains.

## FUTURE-PROOF STEWARDSHIP OF NE ATLANTIC CETACEANS

Our ocean is increasingly and deeply impacted by global warming and a growing body of research indicates that integrating welfare science, including health studies, into more traditional conservation approaches could help to render protection strategies for NE Atlantic cetaceans more future-proof and effective.

Our hope is that regional conservation bodies such as ASCOBANS and ACCOBAMS can serve as platforms for close collaboration between the often still separate disciplines of welfare, climate and conservation science to guarantee better, ethical, and climate-smart ocean stewardship in the NE Atlantic and inspire action beyond.

## SOCIAL LEARNING AND CULTURE

Recent research increasingly reveals the importance of individuals' roles within social networks, groups and populations. Older individuals may fulfil leadership roles, and key individuals can be essential in maintaining social coherence and organisation<sup>[3,4,5]</sup>. Different groups, such as matrilineal orcas (*Orcinus orca*), can hold different ecologically adaptive knowledge<sup>[3]</sup>.

Culture and social learning can be of crucial conservation importance as learning from others can help animals develop skills that improve their chances of survival, reproduction, and responses to changing conditions<sup>[6,7]</sup>. Social learning has also been shown to help individuals to communicate, secure mates, avoid predators, improve foraging effectiveness, and navigate ecological and social environments<sup>[6]</sup>.

In a rapidly changing environment, adaptive knowledge may become increasingly valuable. If climate change particularly affects key individuals or bearers of advantageous knowledge, or alters the value, spreading, stability, and availability of learned information and traditions within social groups, the climate crisis might have impacts that so far have been largely overlooked – those that “cascade” from individuals to populations and, perhaps, even reach species level.

Some cetacean populations appear to show reduced, or even absent, recovery due to a lack of inclusion of this type of knowledge in conservation strategies<sup>[4]</sup>.

## References

[1] Simmonds et al. (2026) SC/70/E/15 submitted to the Scientific Committee of the IWC; [2] Nicol et al. (2020) *Front Vet Sci* 7:57; [3] Lusseau & Newman (2004) *Proc Biol Sci* 271:477–481; [4] Wade et al. (2012) *J Mar Biol* 1:567276; [5] Williams & Lusseau (2006) *Biol Lett* 2(4):497–500; [6] Arbon et al. (2015) *Phil Trans R Soc B* 380:20240136; [7] Brakes et al. (2021) *Proc Biol Sci* 288:20202718