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Editorial

Survival in a changing world

The Summary of the 2007 Intergovernmental Panel on Climate Change (IPCC) Report concludes that '*Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level*'. The attempt in Copenhagen to sign a contract in continuation of the Kyoto Protocol, which runs out in 2012, has not resulted in specific targets for carbon emission nor in an agreement on a legally binding treaty. Thus, it is considered merely to be the next step in a long march towards a global strategy for survival of the planet. In the meantime, the environmental changes that we observe have started to impact the habitats and living conditions of many species, including our own. Anthropogenic pollution and releases of a myriad of biologically active substances into the environment have further changed the world for living organisms. The aim of this special issue is to assess the impact of some of these changes on animal biodiversity and ecology, emphasizing adaptation and resilience in physiological systems.

It is indisputable that current climate change is unprecedented in its magnitude, in its rate of change and in its geographic pattern (MacDonald, 2010) (p. 855). Assessing the ensuing stresses on animal diversity and populations requires knowledge of the complex interactions between climate change and its major consequences, including associated changes in plant coverage, further anthropogenic factors, both local and regional and the physiological characteristics of the species concerned. Temperate species, both marine and terrestrial, have been observed to move to more temperate environments provided that suitable habitats are available (Helmuth et al., 2010) (p. 995). There are key physiological mechanisms that are involved in setting thermal tolerances in organisms; for example, the heat shock response. The data currently available suggest that the ability to acclimatize to changing thermal conditions is greatest among species exposed to moderately variable environments (Tomanek, 2010) (p. 971). Species with the widest thermal tolerances may live closest to their upper thermal limits and may therefore have a limited ability to acclimatize to still higher temperatures. Species that, in recent evolutionary time, have experienced only extremely narrow thermal shifts [e.g. Antarctic notothenioid fishes (Coppes Petricorena and Somero, 2007)] may have lost temperature-adaptive traits altogether and may therefore be extremely vulnerable. Anthropogenic CO_2 is seen as one of the main culprits in climate change but it is also involved in seawater acidification. Both increased water temperature and acidification directly affect coral reefs (Mydlarz et al., 2010) (p. 934), as well as coral reef fishes (Wilson et al., 2010) (p. 894). Combined with climate-change-induced storms, which often damage coral skeletons, these changes may have devastating long-term impacts on fish stocks. Climate changes also affect vector-borne pathogens that have significant morbidities and mortalities among humans and animals. Changes in climate influence arthropod disease vectors, their life cycles and the ways in which pathogens interact with vectors and hosts (Tabachnik, 2010; Sehgal, 2010) (p. 946; p. 955).

Climate change is thus seen as a major threat to biodiversity worldwide. Endangerment is currently defined using ecological traits (population size, habitat loss, etc.). It will be necessary in the future to also address species-specific physiological criteria such as stress tolerance, phenotypic plasticity and evolutionary potential to define climate change vulnerability of species (Bernardo et al., 2007).

This special issue only scratches the surface of the immensely complex, uncontrolled experiment entitled 'climate change' that humans unknowingly and unwillingly have set in motion. The extent, complexity and inescapability with which this experiment now proceeds are mind boggling. It must be hoped that not only physiologists will realize that the effects of climate change are beyond comprehension and beyond control but that political leaders will also recognize the awe and concern with which specialists view these changes and move promptly to take deliberate action.

Brian Barnes, Malcolm Gordon and Katsufumi Sato (Guest Editors)

Hans Hoppeler (Editor-in-Chief)

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