



Incorporating climate change into endangered species conservation: Introduction

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The threat of rapid anthropogenic climate change is now widely accepted as a major threat to biodiversity (Thomas et al. 2004, Millenium Ecosystem Assessment 2005) and has, as a result, become an urgent and rapidly growing area of conservation biology research. The papers included in this Theme Section of *Endangered Species Research* (ESR) focus on a number of aspects of climate change and how they may impact species of conservation concern around the world. Climate change has been an area of focus for ESR for a number of years (Godley 2006) but to date has been featured relatively little (but see Baker et al. 2006, Zbinden et al. 2007).

In a multitaxon review resulting from an international panel meeting, Robinson et al. (2009, this Theme Section) review the potential impacts of climate change on migratory species. The authors highlight the characteristics of species that undertake large-scale migrations that might make them particularly vulnerable to detrimental impacts of climate change. These include habitat use at high latitudes where climate changes are predicted to be most severe, reliance on highly productive seasonal habitats that may become impoverished and less predictable, the decoupling of climatic variables between non-breeding and breeding areas, the constraints imposed by human land-use, and the potential for adaption within migratory populations. The authors discuss potential policy and management changes but highlight that for marine ecosystems, efforts may be limited to climate change mitigation. In a sister paper, Newson et al. (2009, this theme Section) seek a suite of indicators that might act as proxies for wider species assemblages, habitats and ecosystems. They identify a suite of 17 indicators whose attributes could show negative impacts of climate change in birds, marine mammals, sea turtles, fish, terrestrial mammals and bats.

Isaac (2009, this Theme Section) highlights that many models have failed to take into account how life

history and ecological parameters that determine extinction risks will be affected by climate change. She reviews the evidence regarding the effects of climate change on key life history traits in mammals and shows that changes have been both negative and positive for reproductive success and survival. Research to clarify how changes have influenced population dynamics is among future lines of study suggested.

For cetaceans, MacLeod (2009, this Theme Section) offers a framework for assessing likely impacts of oceanic temperature changes on the species' ranges. It is predicted that the ranges of 88% of cetaceans may be affected by changes in water temperature resulting from global climate change and for many, these implications are unfavourable. This framework suggests that certain characteristics such as restriction to non-tropical and shelf waters put some species at greater risk.

As a group, sea turtles may be good indicators of climate change effects on coastal and marine habitats because of various life history traits they exhibit. Hawkes et al. (2009, this Theme Section) highlight how we still lack data to predict the impacts of climate change in this group, although possible impacts of sea level rise, extreme weather events and climate driven changes to ocean current systems are considered. The authors highlight future research directions including (1) conservation strategies, (2) enhancement of longitudinal data and (3) examining the adaptive capacity of marine turtles. In a related paper Reina et al. (2009, this Theme Section) review a long-term dataset of nesting leatherback turtles *Dermodochelys coriacea* and their individual responses to climatic variation. This study highlights how extant environmental variability can feed into population feasibility. There is much utility in such studies to inform us as to the likely effects of climate change.

The field is moving fast, although many questions remain unanswered or unaddressed. As a journal we

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welcome future submissions on climate change as it pertains to conservation, whether they be theoretical, empirical or philosophical. Particularly welcomed are synthetic reviews that pull together many disparate sources of information allowing strategic overviews to be made.

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