Sea life 'must swim faster to survive'

November 7 2011

Fish and other sea creatures will have to travel large distances to survive climate change, international marine scientists have warned. Sea life, particularly in the Indian Ocean, the Western and Eastern Pacific and the subarctic oceans will face growing pressures to adapt or relocate to escape extinction, according to a new study by an international team of scientists published in the journal *Science*.

"Our research shows that species which cannot adapt to the increasingly warm waters they will encounter under climate change will have to swim farther and faster to find a new home," says team member Professor John Pandolfi of the ARC Centre of Excellence for Coral Reef Studies and The University of Queensland.

Using 50 years' data of global temperature changes since the 1960s, the researchers analysed the shifting climates and seasonal patterns on land and in the oceans to understand how this will affect life in both over the coming century.

"We examined the velocity of climate change (the geographic shifts of temperature bands over time) and the shift in seasonal temperatures for both land and sea. We found both measures were higher for the ocean at certain latitudes than on land, despite the fact that the oceans tend to warm more slowly than air over the land."

The finding has serious implications especially for marine biodiversity hotspots – such as the famous Coral Triangle and reefs that flourish in equatorial seas, and for life in polar seas, which will come under rising

pressure from other species moving in, the team says.

"Unlike land-dwelling animals, which can just move up a mountain to find a cooler place to live, a sea creature may have to migrate several hundred kilometres to find a new home where the water temperature, seasonal conditions and food supply all suit it," Prof. Pandolfi says.

Under current global warming, land animals and plants are migrating polewards at a rate of about 6 kilometres a decade – but sea creatures may have to move several times faster to keep in touch with the water temperature and conditions that best suit them. Team member Associate Professor Anthony Richardson from the School of Mathematics and Physics at the University of Queensland became interested in how species might respond to climate change during his work on a global synthesis of marine climate impacts.

He says, "We have been underestimating the likely impact of climate change on the oceans." As a general rule, it seems sea life will have to move a lot faster and farther to keep up with temperature shifts in the oceans. This applies especially to fish and marine animals living in the equatorial and subarctic seas, and poses a particular issue both for conservation and fisheries management.

Assoc. Professor Richardson explains, "There is also a complex mosaic of responses globally, related to local warming and cooling. For example, our analysis suggests that life in many areas in the Southern Ocean could move northward." However, as a rule, they are likely to be as great or greater in the sea than on land, as a result of its more uniform temperature distribution.

The migration is likely to be particularly pronounced among marine species living at or near the sea surface, or subsisting on marine plants and plankton that require sunlight – and less so in the deep oceans.

"Also, as seas around the equator warm more quickly and sea life migrates away – north or south – in search of cooler water, it isn't clear what, if anything, will replace it," Prof Pandolfi adds. "No communities of organisms from even warmer regions currently exist to replace those moving out."

At the same time, sea life living close to the poles could find itself overwhelmed by marine migrants moving in from warmer regions, in search of cool water.

The team's future research will focus on how different ocean species respond to climate change and they are compiling a database on this for the Intergovernmental Panel on Climate Change (IPCC).

More information: The paper "The Pace of Shifting Climate in Marine and Terrestrial Ecosystems" by Michael T. Burrows, David S. Schoeman, Lauren B. Buckley, Pippa Moore, Elvira S.Poloczanska, Keith M. Brander, Chris Brown, John F. Bruno, Carlos M. Duarte, Benjamin S. Halpern, Johnna Holding, Carrie V. Kappel, Wolfgang Kiessling, Mary I.O'Connor, John M. Pandolfi, Camille Parmesan, Franklin B. Schwing, William J. Sydeman and Anthony J. Richardson, appears in today's issue of *Science*.

Provided by ARC Centre of Excellence in Coral Reef Studies