



SCIENTIFIC MEETING

THE CLIMATE CHANGE THREAT TO CORALS

Tuesday, 14 April 2009

The Meeting Rooms, The Zoological Society of London, Regent's Park, London NW1 4RY

Chair: Paul Pearce-Kelly, Senior Curator, ZSL

The coral reef squeeze: severity and synergisms of three increasing threats to coral reefs

Professor Charles Sheppard, University of Warwick

The corals that form reefs have begun to suffer from rising temperature and a slightly falling pH, with some effects first becoming visible perhaps 25 years ago. Both factors are impairing their ability to deposit their skeletons and build reefs. The third factor, and one which the above two superimpose upon, is that of unwise resource use practices which change their ecological state, specifically by adding too much additional nutrient and by over-fishing.

Temperature appears to have started rising in about the 1970s, leading to episodes of mass bleaching, sometimes (but not always) followed by mass mortality. Its geographical pattern is not at all straightforward. pH has fallen too, with probably synergistic results, whose effects are only just being measured and reported. The third factor, over-use and abuse of the reef system, has doubtless continued for centuries. This 'human needs' part of the equation is at least as intractable, and is increasing too. Pressures arising from resources use are increasing, and the smaller the country, the faster is the likely rate of increase of such pressures. Comment is made about current solutions that are being tried, including the misdirections of aid and development funding with regard to 'sustainable development' of coral reefs.

Response of the coral symbiosis to climate change: the 'Achilles heel' of photosynthesising animals

John Turner, School of Ocean Sciences, Bangor University

The association between corals and their algal symbionts is key to the high productivity and biodiversity evident on tropical reefs, enhancing calcification and underpinning the provision of living resources and services such as coastal protection.

However, ocean overheating and high solar irradiation cause the association to break down, resulting in the reduction of light harvesting pigments or the loss of algal symbionts, which if sustained, lead to the death of corals and degradation of the reef, with consequent loss of productivity, habitat, and service value to man. The important question is: Can the coral symbiosis respond to rapid climate change? Long-term responses require time as evolution

follows its course but Adaptive Bleaching and symbiont Shuffling hypotheses have been proposed to explain observed responses, although these ultimately are limited by the ability of coral symbiosis to re-establish functionally. In the short term, coral symbioses are genetically constrained in their ability to physiologically acclimatise. Coral algal (*Symbiodinium*) symbiosis has been successful for 200 million years but the great efficiency in light capture that underpins this success would appear to be the 'Achilles Heel' under conditions of rapid climate change. Recent research indicates the importance of time to repair the photosystems between stress events, without which cell death and bleaching induced mortality of coral colonies result. A model is presented showing that reproduction and calcification subsequently fail when repeatedly stressed, highlighting the importance for any management measures which can increase reef resilience to buy time.

Short and longer term impacts of coral bleaching on coral reef fish

Nicholas Polunin, School of Marine Science & Technology, Newcastle University

Coral reefs are among the most vulnerable ecosystems to climate change but until recently the work on this has been largely confined to the corals themselves. I will review findings from our work on the impacts of climate-driven coral bleaching both on coral cover and reef-associated fishes. I will give an overview of (1) our 2005 and 2008 resurveys of 21 sites around Mahé and Praslin in the granitic Seychelles where coral cover and some coral-dependent fish species were greatly reduced in 1998, (2) our comparison of 66 sites across seven West Indian Ocean countries and (3) our analysis of the effects of coral loss versus fishing pressure on reef fish communities in the Lau Islands of Fiji. Coral recovery has been particularly slow in the Seychelles, but many other West Indian Ocean locations have been more resilient as have the exposed reef situations studied in Fiji. There may be longer term impacts on reef fisheries in the Seychelles where marine protected areas have been especially damaged by bleaching, while in Fiji there is evidence that coral loss effects on fish have been greater than those of fishing.