NEWS FROM THE UNIVERSITY OF TASMANIA, AUSTRALIA

Media Release

Chiefs of Staff, News Directors

Monday 1 December 2014

Coherent patterns in collapse of marine ecosystems

New Tasmanian-led research is shining a light on identifying how marine ecosystems collapse and when to step in before it's too late.

In a paper just published by the Royal Society of London, Dr Scott Ling led a global study assessing the dynamics of kelp bed collapse caused by sea urchin overgrazing.

The international analysis has revealed a globally coherent pattern of marine ecosystem collapse and demonstrated the difficulty of regaining lost ecosystems once tipping points have passed.

Overgrazing by sea urchins strips the seafloor of productive and diverse kelp beds in the transition to impoverished urchin barrens. The global analysis involved the efforts of 19 co-authors who contributed key data from 11 temperate reef systems spanning both hemispheres where collapse has occurred.

Dr Ling, from the University of Tasmania's Institute for Marine and Antarctic Studies (IMAS), said in addition to collapses on rocky reefs around the world, in Australia these included reefs where collapse has occurred – off the NSW coast, Port Phillip Bay, and now northeast Tasmania. While local rocky reefs have collapsed in these areas, scientific research has shown that management measures can be effective in offering protection of those kelp beds that are threatened, but that currently remain intact.

"The clear message is that natural ecosystems collapse beyond critical tipping points, and if they are pushed too far, then it can be extremely difficult to get them back," he said.

"Understanding how and why marine ecosystems collapse is essential if collapses are to be prevented and if important ecosystem services such as commercial and recreational fishing and nursery grounds are to be sustained."

A suite of milestone research papers has been published this week by the prestigious *Philosophical Transactions of the Royal Society of London B* in a Theme Issue examining the dynamics and drivers of marine regime shifts around the globe.

The papers examine collapse from the perspectives of theory, ecosystem observations, and management to ask whether these major ecological shifts have general patterns that apply

from coastal reef systems to the open ocean. More than 80 authors from different disciplines, across six continents, highlight the advances in the field, as well as provide clear direction for future research needs in this area.

Dr Ling said the global patterns in sea urchin overgrazing confirm what has been observed in Tasmania, and his clear message is that “an ounce of prevention is worth a ton of cure.”

“That is, kelp beds can tolerate some increase in urchin abundance, but the system reaches a tipping point where grazing overwhelms the kelp and the reef collapses to urchin barrens.”

“Recovering the kelp then requires almost all the sea urchins to be removed from the barrens.”

Professor Craig Johnson, also from IMAS and a co-author of the study, added that: “We have seen this pattern in eastern Tasmania, where it is relatively easy to control urchins in kelp beds, but once urchins build up and create extensive barrens it is virtually impossible to rehabilitate the kelp on large spatial scales.”

He said new management arrangements designed to rebuild rock lobster populations on inshore reefs in eastern Tasmania will vastly reduce the risk of ongoing destruction of kelp beds to form extensive urchin barrens.

The Theme Issue was released on November 24 and can be found here - http://rstb.royalsocietypublishing.org/content/370/1659.toc The global synthesis conducted by Scott Ling was supported by an Academic Career Development Scholarship, University of Tasmania.

Background

Marine ecosystem collapses have been reported worldwide and can cause major socio-economic impacts; for example, when they involve fisheries collapse, coral reef degradation, or the overgrazing of kelp beds. Safeguarding productive marine ecosystems and the important services they provide humans is imperative; however knowing when they are approaching dangerous tipping points can be difficult and often it can be too late to halt collapse once it starts to occur.

Because of this, Dr Ling said that degradation of marine ecosystems is of concern to resource managers who are left with few practical options to eliminate sufficient urchins to allow the kelp beds to recover, “we can effectively build resilience of intact kelp beds by re-building the number of sea urchin predators, but attempting to do the same thing once the kelp has disappeared is a much greater challenge, thus we need to be proactive not reactive.”

A general feature emerging from across all marine ecosystems examined in the Theme Issue is that single culprits are rarely to blame, but rather a combination of impacts leads to collapse. Dr Ling said, “It’s a bit like the straw that broke the camel’s back; everybody blames the straw but they don’t see the huge burden the ecosystem was carrying in the first place.”

Dr Ling goes on to explain: “Importantly when the camel’s back is broken it simply doesn’t stand back up once you take the load off of its back; the camel needs a rest before it can get up and go on, or maybe it’ll never get back up - it’s the same with ecosystems, push them too hard and they may never stand back up to carry the sizeable loads that society expects them to shoulder.”

Dr Ling said that as human pressures on the marine environment increase the concern is that major shifts will become more frequent.

“Marine regime shifts present major challenges for ecosystem management, and in a world of increasing human pressures it is likely that collapses and the persistence of degraded ecosystems will increase with important flow-on impacts for economies.”

“While the scientific community has made great strides in understanding the drivers of regime shifts, strategies and practical tools for managers to anticipate and respond to are still scarce.”

“We must seek to define the tipping points of ecosystems and make sure we manage to avoid crossing them. This is crucial if we are to maintain sustainable living marine resources. Knowing when an ecosystem is approaching a tipping point can be hard to determine and so careful monitoring of ecosystem state and developing early warning systems are definitely a must for marine ecosystem science.”

Information released by:
Communications and Media Office, University of Tasmania
Phone: 61 3 6226 2124
Email: Media.Office@utas.edu.au