nzherald.co.nz

The immediate threat to our oceans

1:06 PM Monday Jun 21, 2010

The issue

"We are about to fundamentally change the chemistry of our ocean. The greatest risk to our marine environment is the accelerating enrichment of seawater with anthropogenic CO_2. This CO_2 pollution results from our ignorance of the fundamental processes that link the marine environment with the atmosphere and the land. The overall human CO_2 emissions over the industrial era amount to close to 560 billion tons.

A little less than half of this CO_2 remains in the atmosphere acting as greenhouse gas leading to climate change. The remainder is, at present, removed in roughly equal parts into the ocean and by land vegetation. We are emitting roughly 10 billion tons of carbon annually, a rate that exceeds the natural emissions by a factor of nearly 100. About 87% of this release originates from fossil fuel combustion and cement production and another 12% from deforestation. The ocean is a complex system well designed for maintaining a balance between inputs and outputs of carbon but the current rapid rise in atmospheric CO_2 exceeds its capacity to maintain this balance.

The effects on our world

This has caused a wholesale shift in the chemistry of the upper water column worldwide. This shift will fundamentally change open-ocean and coastal ecosystems in the near future. The most significant changes to seawater chemistry are decreases in a number of key seawater properties in a process called ocean acidification: pH, carbonate ion concentrations, and the saturation state of calcium carbonate minerals. In some regions, ocean acidification has already decreased mean surface water pH to a level that was not expected to happen for several decades.

The observed shift in seawater chemistry has dramatic impacts on the physiology of many marine organisms, most importantly those that build their shells or skeletons out of calcium carbonate.

For example, ocean acidification decreases the rate at which reef building corals produce their skeleton, reduces the ability of marine algae and zooplankton to maintain their protective shells, declines marine plankton as a food source in the food web of marine species, and reduces the survival of larval marine species, including commercial fish and shellfish.

The most efficient means of protecting our marine environment is probably education; we must educate our future generations, so they understand the natural feedbacks that will fundamentally change their environment.

The way forward

Our children must overcome the false feeling of security afforded by living in New Zealand and understand that protecting New Zealand's marine environment does not end with fighting invasive species, collecting trash from our beaches, establishing reserves, and caring for sea mammals; a significant threat comes from what you cannot see and calls for immediate action: a rapid reduction of our CO_2 emissions.

My research group is currently working on two fronts - we are investigating how the climate of a high- CO_2 world will affect coastal ecosystem functioning and we are developing novel tools to assess the sustainability of marine aquaculture. A particular focus for the research into the impact on the coastal ecosystem is how rapid sedimentation of fine grained land-derived (terrigenous) clay affects the seafloor. This research is timely considering that climate change models predict an increase in the frequency of extreme rainfall events and consequently an increase in the supply of suspended particles via waterways to coastal habitats.

Suspended particles eventually settle at some distance to the shore smothering the seafloor and its organisms. Effects of such deposition on the functioning of coastal ecosystems are well documented and of global concern; the underlying mechanisms, however, are poorly understood. The assessment tools we are working on aim to simplify and reduce the costs involved in assessing the ecological impact of marine farms - a condition of resource consent."