BIODIVERSITY AND ECOLOGY

Urchins in peril

RUDOLF RAFF

Proc. R. Soc. B doi:10.1098/rspb.2008.1935 (2009)
Ocean warming, but not acidification, could significantly hinder reproduction in purple sea urchins. Previous studies have shown that a decrease in ocean pH could impair shell formation in adult urchins, but few urchin larvae may survive to the adult stage under plausible climate change scenarios, according to a new study.

Maria Byrne of the University of Sydney and colleagues designed a series of experiments to assess the effects of concurrently rising ocean temperatures and acidity on the reproduction of the sea urchin *Heliocidaris erythrogramma*. For each series of temperature increases, changes in acidity had no apparent effect on the fertilization and development of sea urchin larvae. Temperature, however, affected both processes. At 26 °C, complete developmental failure occurred in many of the larvae, with fewer than four per cent developing normally, compared with about 65 per cent normal development in a control population kept at 2 °C.

H. erythrogramma is an ecologically important species in the shallow coastal waters of eastern Australia. The region is expected to become a climate change hot spot over the coming century: climate models predict that its sea surface temperature will rise 2–3 °C by 2070, which could routinely push temperatures above 26 °C.

Alicia Newton

BIOLOGY

Evolutionary escape

JASON HARMON / ANTHONY IVES

Science **323,** 1347–1350 (2009)
A study of an aphid pest and its predators shows that when climate change hits, consequent shifts in food webs can combine with rapid evolution to buffer the adverse effects of warming.

Jason Harmon of the University of Wisconsin, Madison, and colleagues conducted field experiments with pea aphids feeding on alfalfa crops to determine how the herbivorous pest would respond to high temperatures in the presence of different predator ladybird species. When aphid population growth was dampened by heat shock — induced by plastic-wrapping the insects' cages to raise mid-day temperatures 5 °C — one ladybird species left the sparser populations alone, whereas the other stayed on the hunt, further culling the pests. But warming also gave an advantage to a strain of aphids carrying heat-tolerant microbial symbionts, enabling rapid evolution, the researchers found. Using a mathematical model, the team shows that ladybird predators will act alongside evolution to set the size of future aphid populations, but will not influence how quickly heat tolerance evolves.

Though ecological and evolutionary responses to change are complex, this study shows it is possible to account for such factors in predicting how species are likely to fare in a warmer world.

Anna Barnett

ANTHROPOGENIC CHANGE

Methane map

PHOTOMORPHIC / ISTOCKPHOTO.COM

Glob. Biogeochem. Cycles
doi:10.1029/2008GB003299 (in the press)
Methane emissions from rice paddies may have been previously overestimated, according to a new study. The concentration of atmospheric methane — a major greenhouse gas — has nearly tripled since the industrial revolution, but the contribution from individual sources has remained unclear.

Now Xiaoyuan Yan of the Chinese Academy of Sciences and his colleagues have generated a global map of methane emissions from rice paddies for the year 2000, using country-specific estimates of rice harvest area and data on agricultural practices. They calculate that methane emissions totalled 25.6 million tonnes over the entire year and mostly came from monsoon Asian countries. The authors say that the reason their calculation is at the lower end of earlier estimates, which range from 25 to 170 million tonnes per year, is probably because it takes account of farming practices.

The study found that the release of methane was highly dependent on management techniques: emissions were reduced by 4.1 million tonnes per year if fields were drained at least once during the growing season, and a further 4.1 million tonnes if rice straw was applied off season. They estimate that if both practices were implemented, emissions could be reduced by 30 per cent annually.

Anna Armstrong

EXTREME EVENTS

Expert tips

JOEYGIL / ISTOCKPHOTO.COM

Proc. Natl Acad. Sci. USA
doi:10.1073/pnas.0809117106 (2009)
Climatologists believe that continued warming brings a sizeable risk of crossing climate tipping points in the next two centuries, a new poll finds. Because of unknowns in the climate system, scientific reports have expressed uncertainty

about whether and when such dramatic changes — for instance, dieback of the Amazon rainforest or loss of the Greenland ice sheet — could be triggered.

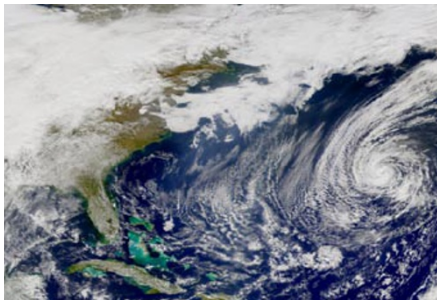
Elmar Kriegler of the Potsdam Institute for Climate Impact Research, Germany, and colleagues elicited responses from 43 climatologists on the likelihood of five potential tipping points being reached under three warming scenarios through the year 2200. For each of the five components of the climate system, answers from self-described experts on that topic were pooled and weighted to give a conservative lower estimate of the likely risk of a reaching a threshold that would lead to dramatic change. The responses indicated a 16-per-cent chance of reaching a tipping point in at least one of the five components by 2200 if global temperatures rise 2–4 °C above 2000. This increased to at least 56 per cent at higher temperatures.

The authors caution that voluntary participation may have skewed the group toward pessimists, but note that the answers represent a broad range of views.

Anna Barnett

OCEAN SCIENCE

Carbon calm



NASA

Geophys. Res. Lett. doi:10.1029/2009GL037553 (in the press)

It has previously been proposed that an increase in hurricane activity could cause more carbon dioxide to enter the atmosphere from the sea. Hurricane-force winds can drive a rapid local release of the greenhouse gas from surface waters, but new research shows that in the North Atlantic Ocean, at least, such short-term events have no effect on the total amount of CO_2 released each year.

Galen McKinley and colleagues at the University of Wisconsin-Madison used an ocean general circulation model to simulate the chemical response of seawater to hurricane activity in the subtropical North Atlantic from 1992 to 2006. Though the model indicated that there was a local surge of CO_2 release along the hurricane tracks, the amount of CO_2 released from the entire subtropical North Atlantic Ocean during any year was not related to the total number of storms over that hurricane season.

They conclude that the CO_2 stirred up by hurricanes would otherwise have been released, albeit more slowly, through ordinary emissions in the summer and fall.

Alicia Newton

MITIGATION

Road to recovery

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Environ. Res. Lett. **4,** 014012 (2009)

Recovering from dangerous levels of global warming may be even harder than anticipated, finds new research. Although there is no consensus on what constitutes a 'dangerous' level of climate change, the European Union has adopted a target of limiting warming to less than 2 °C above pre-industrial levels.

Now, Jason Lowe of the UK Met Office and colleagues estimate how long it would take to return to acceptable levels of warming if this threshold is exceeded. Using a simple climate model, Lowe and colleagues find that if greenhouse gas emissions peak in 2015 and subsequently decline at a compound rate of three per cent per year, there is a 55-per-cent chance of exceeding the 2 °C target. Moreover, there is a 30-per-cent chance global temperatures will remain above 2 °C for 100 years and a 10-per-cent chance they will still be above 2 °C 300 years from now.

The study is the first to use a state-of-the-art general-circulation model with an integrated carbon cycle to test the skill of simple models in analysing 'overshooting' scenarios for climate policy. It suggests that once a safe level of warming is exceeded, even very large and rapid reductions in emissions will result in only a gradual decline in global temperatures.

Olive Heffernan