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Heatwave alters marine hotspot ecosystem

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Warmer waters A record-breaking Indian Ocean heatwave off the Western Australian caost has shown how global warming might trigger marine ecosystem change.

Marine ecologist Dr Timothy Langlois, of the University of Western Australia (http://www.uwa.edu.au/) , and colleagues, report their study online ahead of print publication today in the journal *Nature Climate Change* (http://dx.doi.org/10.1038/NCLIMATE1627) .

"Using these sorts of data sets we can predict the sorts of things that are going to happen with climate change," says Langlois.

Extreme climatic events, such as heatwaves, are predicted to increase as the globe warms but little is known about their impact on marine ecosystems.

Previous studies have found that heatwaves can have extensive effects on specific species, for example on giant kelps in North America.

But a heatwave off southwest Australia last year has given an insight into how such events can trigger ecosystem-wide changes.

The heatwave occurred in a 2000-kilometre stretch of water that is regarded as a global biodiversity hotspot.

After the heatwave, there was an influx of warm-water fish such as the lined dottyback *(Source: Timothy Langlois)*

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"We've got some of the greatest diversity of seaweeds and seagrasses in the world there and a lot of endemic species of fish that aren't found anywhere else in the world," says Langlois.

Above-average temperatures

In early 2011 the seawater along this coastline experienced the highest temperatures on record - 2 to 4°C above average - for more than 10 weeks.

The warming was due to an influx of tropical warm water southwards, that accompanied an increase in the flow of the region's main Leeuwin ocean current due to an unusually strong La Niña.

When the heatwave hit, Langlois and colleagues had been monitoring the natural variability in species in the hotspot waters, off both Jurien Bay and Hamelin Bay, 500 kilometres to the south.

"The water was murky green in some places we went to. It looked like it was turning into a bit of a soup," says Langlois.

After the heatwave peaked the researchers returned and found changes in Jurien Bay, where temperatures had been highest.

"We were really blown away that the algal assemblages had really changed a lot," says Langlois.

He says a drop in seaweed cover freed up "real estate" for a host of new seabed species and there was a "tropicalisation" of fish communities.

There was a 10 to 15 per cent increase in warm water fish including the lined dottyback (*Labricinus lineatus*), says Langlois.

Thresholds

Extreme events can result in the breaching of temperature thresholds when it becomes no longer possible for organisms to adapt.

When this happens, the ecosystem can change suddenly and this leads to serious consequences - including the possible decimation of commercially important species.

Previous studies have found some marine communities recover from heat waves rapidly but others don't.

Langlois and colleagues plan to check their study area later this year to see what changes have persisted after temperatures have cooled again.

Commercial fisheries

Interestingly, the researchers did not measure a decline in temperate fish species but, says Langlois, there was evidence that commercial species, not monitored by the researchers, were affected by the heatwave.

He says the fisheries department reported decimation of a commercial abalone population and numerous fish and lobsters being washed up dead along the coast.

Langlois says long term monitoring of marine communities, of the kind he and colleagues have been involved in, is essential in understanding risks faced by commercial species.

"It's possible that such studies can disentangle the effects of climate change or fishing on marine ecosystems," he says.

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