Fish 'an ally' against climate change

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An unlikely ally may have been found in the fight against the effects of climate change. Fish excretions seem to play a key role in maintaining the ocean's delicate pH balance, says a study that also reveals that there are 2 billion tonnes of fish in the world's oceans.

Bony fish excrete lumps of calcium carbonate, known as "gut rocks" which are thought to dissolve in the upper layers of the ocean. A team led by Rod Wilson of the University of Exeter in the UK has now shown that the sheer amount of gut rocks produced plays a key role in buffering the carbon dioxide that acidifies seawater.

"This study really is the first glimpse of the huge impact fish have on our carbon cycle - and why we need them in the ocean," says Wilson's colleague Villy Christensen of the University of British Columbia in Canada.

Protective role

While marine biologists have known for some time that fish produce gut rocks, until now no-one had estimated just how much calcium carbonate is spewed out into the ocean in this way.

It was widely believed that most marine carbonate is provided by the external skeletons of marine plankton. These microscopic organisms are likely to be hard hit as climate change increases the acidity of the oceans and their skeletons literally dissolve away.

The new study reveals that fish play an important role in stopping this from happening.

The researchers used two different models to estimate the amount of fish biomass that is in the global oceans, and its distribution.

By drinking salt water, fish ingest a lot of calcium, and they excrete more or less calcium carbonate depending on their size and the temperature of the water. "For a given total mass of fish, smaller fish produce more than bigger fish, and fish at higher temperatures produce more than fish at lower temperatures," explains Wilson.

Surprise finding

The team then used data on how much carbonate fish produce on average to calculate how much the fish biomass represented in their computer models are likely to excrete.

This revealed that between 3% and 15% of all the calcium carbonate produced in the oceans comes from fish. Wilson says this is a conservative estimate - he and his team think the real figure could be three times higher.

"I expect it will be a big surprise to most of the ocean scientists who study the ocean carbon cycle," says Wilson. "Apart from a handful of fish biologists around the world, the scientific community were previously unaware that fish produce of any of this chalky mineral, let alone enough to be significant on a global scale."

Eric Achterberg of the National Oceanography Centre in Southampton, UK, says the study offers an insight into an underrepresented marine process. "Whether the fish carbonate is really an important contribution to the mid-water alkalinity is not certain yet and forms an excellent topic of research," he says.

'Unrecognised allies'

Wilson agrees that it is not yet certain whether the gut rocks do indeed dissolve in the upper layers of the ocean. Their chemical structure suggests that they are very soluble in seawater and should readily dissolve. But if future studies show this does not happen, this will mean the gut rocks sink to the bottom of the ocean without dissolving and buffering the oceans.

Because fish carbonate production goes up with temperature, fish are likely to produce more carbonate - and be more effective buffers of ocean acidity - as temperatures increase through global warming. That's the good news. The bad news is that overfishing may have an additional downside: in addition to depleting food stocks, it could also deplete the precious carbonate buffer.

Because of the complexity of ocean chemistry, "we cannot really say much with any confidence about how overfishing might affect ocean acidification says Wilson. "But we definitely need to study this more to help make better predictions about these future changes."

"We must buck the current trend of clear-cutting of the oceans and foster these unrecognised allies against climate change," says Christensen.

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