



## Fish 'gut rocks' vital to oceans, climate

Scientists discover 'unrecognized allies' in countering warming seas

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WASHINGTON - Researchers on Thursday said they have discovered an important factor that helps marine life, especially coral reefs, and which could mitigate against warming seas: "gut rocks" from the world's bony fish population.

Computer models and lab research show that bony fish — which include about 90 percent of marine species but not sharks or rays — produce a good part of the calcium carbonate that helps maintain the oceans' acidity balance, they said in the peer-reviewed journal *Science*.

"This study is really the first glimpse of the huge impact fish have on our carbon cycle — and why we need them in the ocean," said co-author Villy Christensen, a University of British Columbia researcher. "We must buck the current trend of clearcutting of the oceans and foster these unrecognized allies against climate change."

Lead author Rod Wilson of the University of Exeter in Britain said that "our most conservative estimates suggest three to 15 per cent of the oceans' carbonates come from fish, but this range could be up to three times higher."

Until now, scientists believed calcium carbonate came only from microscopic marine plankton.

Bony fish produce carbonate to dispose of the excess calcium they ingest in seawater. This forms into calcium carbonate crystals in the gut and the fish then simply excrete these "gut rocks."

The process is separate from digestion and production of feces.

### The warming angle

The researchers estimated the bony fish population at between 812 million and 2 billion tons, and predicted that future increases in sea temperature and rising CO<sub>2</sub> would cause fish to produce even more calcium carbonate, thus helping to mitigate the warming.

That's because higher temperatures stimulate overall metabolism in fish, which drives biological processes to run faster. Also, blood levels with more CO<sub>2</sub> directly stimulates the gut to produce more carbonate.

The increase in carbon dioxide in the atmosphere not only drives global warming, but also raises the amount of CO<sub>2</sub> dissolved in ocean water, tending to make it more acid, potentially a threat to sea life.

Alkaline chemicals like calcium carbonate can help balance this acid. Scientists had thought the main source for this balancing chemical was the shells of marine plankton, but they were puzzled by the higher-than-expected amounts of carbonate in the top levels of the water.

The carbonate produced by bony fish is soluble and dissolves in the upper sea water, while that from the plankton sinks to the bottom, the team noted.

"Because of the impact of global climate change, fish are likely to have an even bigger influence on the chemistry of our oceans in the future," Wilson said in a statement.

The research was funded by the U.K. Biotechnology and Biological Sciences Research Council, The Royal Society, the U.S. National Science Foundation, the Natural Sciences and Engineering Research Council of Canada, United Nations Environmental Program, the Pew Charitable Trust and the U.K. Department of Environment, Food and Rural Affairs.

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