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Intelligence

Researchers uncover giant enzymes in marine algae responsible for deadly fish-killing toxins

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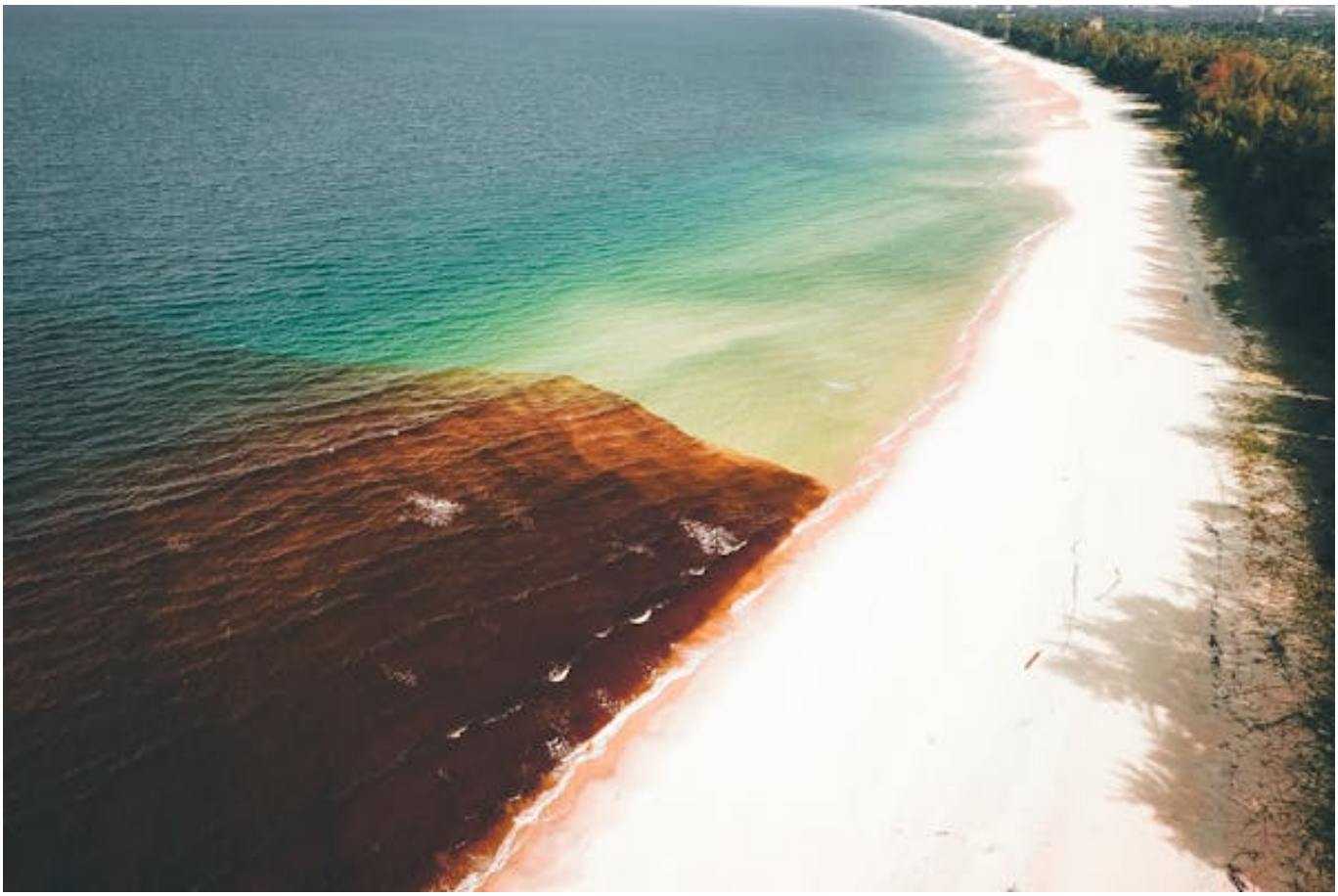
By Responsible Seafood Advocate

Massive enzymes in marine algae produce neurotoxins responsible for fish deaths during harmful algal blooms

Researchers have discovered that marine algae called *Prymnesium parvum* use massive enzymes, known as PKZILLAs, to produce complex neurotoxins called prymnesins. These neurotoxins cause mass fish deaths during harmful algal blooms around the world.

“The discovery and initial characterization of the prymnesin PKZILLA gigasynthases now elucidates the long-standing question about how microalgae biosynthesize their giant polyketide polyether molecules,” wrote the authors.

It also expands expectations of genetic and enzymatic size limits in biology. Many marine microbes produce exotic organic molecules with varied biological functions. Some microalgae, like *P. parvum*, are known for producing some of the largest nonpolymeric carbon chain molecules in nature, including polyketide polyether biotoxins. During harmful algal blooms, neurotoxic prymnesins compounds are notorious for causing environmental damage, including massive environmental fish kills.



A new study shows that massive enzymes in marine algae that produce neurotoxins are responsible for mass fish deaths during harmful algal blooms. Photo by Pok Rie (https://www.pexels.com/photo/coastline-with-algal-bloom-water-5006877/).

However, despite decades of extensive research, how these microalgae produce such large and complex compounds is poorly understood. Using a customized gene annotation strategy, the researchers discovered genes in *P. parvum*, which they named PKZILLAs (PKZILLA-1 and PKZILLA-2), that are involved in the production of polyketide synthase (PKS) enzymes. Notably, the scientists found that these enzymes were massive, with PKZILLA-1 being one of the largest proteins ever identified at 4.7 megadaltons and containing 140 enzyme domains.

Although slightly smaller, PKZILLA-2 is 3.2 megadaltons with 99 enzyme domains. According to the findings, these massive PKS gigasynthases are responsible for the biosynthesis of the 90-carbon backbone of prymnesin toxins. The authors also characterized a variant, PKZILLA-B1, which produces a

shorter version of these toxins.

Read the full article here (http://www.science.org/doi/10.1126/science.ado3290).

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