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'The mysterious disease of Senegalese fishermen': the culprit is a toxic marine microalga

Fishermen returning from fishing, barbed tongue. Saint-Louis / Sénégal – Crédits : IRD, Carole Filiu Mouhali

In 2020 and 2021, a mysterious skin disease affected more than a thousand Senegalese fishermen, raising concern and international attention. A study conducted by an international scientific consortium and published on February 13 in the journal *EMBO Molecular Medicine* reveals the origin of this disease: a toxin produced by the marine microalga *Vulcanodinium rugosum* triggers a severe inflammation of the skin cells. This study highlights the increased risks associated with environmental toxins, exacerbated by global change. It opens up prospects for better monitoring and prevention of the impact of these toxins on human health, while offering new therapeutic opportunities.

Scientists from the CNRS, Ifremer, IRD and the universities of Toulouse (France), Murcia (Spain) and Singapore, together with the Poison Control Center and Cheikh Anta Diop University in Dakar (Senegal), have identified the cause and analyzed the molecular and cellular mechanisms involved in this worrying skin disease which, for the first time, affected more than a thousand fishermen in the Petite-Côte geographical area, a part of the Senegalese coastline south of Dakar, between 2020 and 2021.

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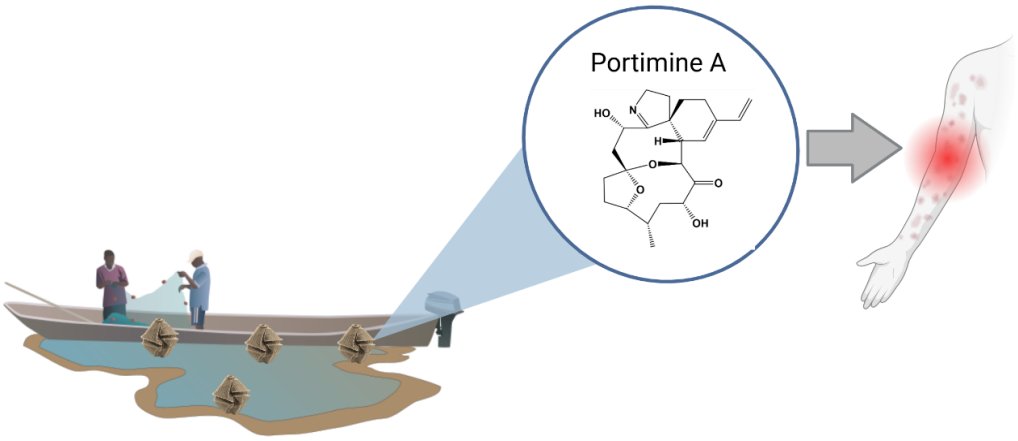
After handling driftnets, these fishermen developed severe acute dermatitis, characterized by inflammation and skin lesions. Due to its unknown origin and unusual symptoms, it was quickly dubbed the “mysterious fisherman's disease” by the media.

> “We were helpless facing this crisis that fishermen were experiencing in 2020. With our Senegalese colleagues, we didn't know what to look for during the first investigations at sea because this phenomenon had never been observed before. So we set up a scientific consortium to conduct an interdisciplinary investigation. In 2021, we were better prepared to respond to the second crisis. The prevention recommendations we gave to the fishermen proved justified, even if it took us 5 years of research to find the cause of this disease,” **explains Patrice Brehmer, an IRD researcher based in Dakar,** requisitioned on this occasion in 2020 by the environmental brigade of the Senegalese national gendarmerie.



The exposure of Senegalese fishermen in 2020 and 2021 to the microalgae *Vulcanodium rugosum*, which produces Portimine A, caused the skin damage known as “mysterious fishermen's disease”.
Crédits : Etienne Meunier/Léana Gorse (CNRS, Université de Toulouse, 2025)

THE MARINE MICROALGA VULCANODINIUM RUGOSUM AND ITS PORTIMINE A TOXIN ARE TO BLAME

To understand this epidemic, the authorities, clinicians and research organizations in Senegal, including the Poison Control Center in Dakar and the IRD, have conducted investigations to rule out several possible causes, such as viral or bacterial infections, or chemical pollution. The results of these analyses have pointed to another possible cause: marine microalgae.

> “The absence of suspected pollutants in the water samples collected led us to question the potential role of microalgae in the event. The water and biomass samples taken from the nets and the bottom of one of the fishing canoes allowed us to implicate the microalgae *Vulcanodinium rugosum*, which had already been suspected in 2015 of being responsible for similar skin irritations in 60 bathers in Cienfuegos Bay, Cuba, mainly children,” **explains Philipp Hess, head of the Physiology and Toxins of Toxic and Harmful**

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Microalgae research unit at IFREMER.

The similarity of the reported symptoms between the mysterious illness of the fishermen in Senegal and the incident in Cuba alerted the scientists at IFREMER. Analysis of environmental samples collected during the epidemic in Senegal confirmed the presence of *Vulcanodinium rugosum* and its toxins. High levels of the toxins produced by this organism, particularly Portimine A, were found in the affected fishing areas in Senegal.

> "Based on our analyses and with the assistance of our French partners, we quickly opted for the biotoxin hypothesis and informed the competent authorities back in November 2021, on the strong presumption of the role of Portimine A produced by *Vulcanodinium rugosum*, as high concentrations of Portimine A had been collected by a team composed of the IRD, the Anti-Poison Center, the Environment Police, and UCAD in a boat operating in the contaminated zone," **explains Prof. Mamadou Fall, head of the Poison Control Center in Dakar, Senegal, and Director of the Toxicology and Hydrology Laboratory at Cheikh Anta Diop University in Dakar**.

THE PORTIMINE A TOXIN FROM VULCANODINIUM RUGOSUM, RESPONSIBLE FOR SKIN NECROSIS

In order to understand the link between the microalgae and the skin inflammation observed in fishermen, the researchers tested all the toxins identified in the samples taken from the contaminated fishing areas on human skin cells.

> "We have shown that Portimine A blocks protein production in cells, resulting in the activation of a powerful immune sensor, the NLRP1 receptor, which normally protects us against many infections. Thus activated, this receptor triggers intense uncontrolled inflammation and causes the severe dermatoses seen in fishermen," **explain Léana Gorse and Etienne Meunier, respectively doctoral student and head of the 'Immune Detection and Elimination of Pathogens' team at the Institute of Pharmacology and Structural Biology (CNRS - University of Toulouse).**

The scientists also discovered that some people with a genetic mutation in the NLRP1 gene are protected against the effects of Portimine A. These results open up research prospects, particularly in the fight against cancer and other diseases, in order to understand why not everyone is affected in the same way and to identify new potential therapeutic targets, such as NLRP1, to mitigate the effects of toxins such as Portimine A.

TOXIC MICROALGAE FAVORED BY ENVIRONMENTAL CHANGES?

This study highlights a broader issue: the growing impact of environmental toxins on human health, in a context of global change, particularly climate change and the increase in maritime transport. Changes in temperature, acidity, oxygenation and ocean currents are encouraging the proliferation and redistribution of marine microorganisms such as toxic dinoflagellates. Maritime traffic also encourages the spread of marine species from one ecosystem to another, particularly

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through ballast water.

The Portimine A dermatitis epidemic illustrates the unpredictable risks that changes to marine ecosystems can cause. It also highlights the urgent need to monitor toxin-producing marine species, understand their mechanisms of action and adaptation, and develop solutions to prevent and treat threats to human health.

Read the article: Léana Gorse, Loïc Plessis, Stephen Wearne, Margaux Paradis, Miriam Pinilla, Rae Chua, Seong Soo Lim, Elena Pelluz, Gee-Ann TOH, Raoul Mazars, Caio Bomfim, Fabienne Hervé, Korian Lhaute, Damien Réveillon, Bastien Suire, Léa Ravon-Katossky, Thomas Benoist, Léa Fromont, David Péricat, Kenneth Mertens, Amélie Derrien, Aouregan Terre-Terrillon, Nicolas Chomérat, Gwenaël Bilien, Véronique Séchet, Liliane Carpentier, Mamadou Fall, Amidou Sonko, Hadi Hakim, Nfally Sadio, Jessie Bourdeaux, Céline Cougoule, Anthony K. Henras, Ana Belen Perez-Oliva, Patrice Brehmer, Francisco J. Roca, Franklin L. Zhong, John Common, Etienne Meunier, Philipp Hess. EMBO Molecular Medicine (2025). DOI 10.1038/s44321-025-00197-4

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