



DinoSHIELD: A Natural Approach to Control Red Tide

WHY DINO SHIELD?

Marine harmful algal blooms (HABs), including red tide, are caused by microscopic algae that can produce toxins which are harmful to both humans and animals. These toxins can become airborne, leading to respiratory irritation in humans and can accumulate in shellfish tissue leading to shellfish poisoning when consumed. The majority of HAB control strategies can have unintended impacts on the entire aquatic community, including fish and shellfish. Control strategies, such as DinoSHIELD, that target red tide can provide improved ecosystem function and reduce the socio-economic and human health impacts of HABs.

WHAT IS DINO SHIELD?

DinoSHIELD is an emerging technology which can control red tide in marine waters, reducing the impact of HABs on coastal communities and economically important industries such as shellfisheries and tourism. DinoSHIELD technology relies on the slow release of an algicide naturally produced by a bacterium commonly found in coastal waters, including along the Florida Gulf Coast. The bacteria or its algicide are immobilized in a hydrogel system that can release the algicide while retaining the bacteria so that the algicide can be continuously and consistently delivered.

IS DINO SHIELD SAFE?

The bacteria and its algicide used in DinoSHIELD have been extensively tested in lab and small-scale field studies to ensure effectiveness against red tide, without impacting natural aquatic communities. The algicide is highly specific to red tide and has been shown to have no effect on non-harmful phytoplankton, invertebrate and vertebrate species. Additionally, the bacteria is found throughout Florida's coastal waters. Finally, the hydrogel is commonly used in the food and drug industry as it's non-toxic and biodegradable. Overall, DinoSHIELD is proving to be an environmentally safe, effective, and sustainable mitigation tool for red tide.

HOW IS DINO SHIELD USED?

Following production of DinoSHIELD in the lab, the bacteria or algicide-containing hydrogel beads are put into mesh bags and suspended off of docks and other existing marine structures to ensure a consistent application rate across the treatment area. These mesh bags can be deployed for the control of red tide in ecosystems with chronic blooms, and removed when no longer needed. Following regulatory approval, DinoSHIELD can be deployed in strategic areas like canals, marinas, small coves, and aquaculture areas across southwest Florida to limit the impacts of red tide on these coastal communities.

An Environmentally Safe Strategy to Manage Red Tide



DinoSHIELD is produced in the lab by binding the naturally occurring bacteria, or its algicide, in non-toxic hydrogel beads. This creates a slow, continuous release of the algicide over time that prolongs its effectiveness in controlling red tide without the need for frequent high-dose re-applications. Lab studies have shown that the bacterium does not require direct contact to combat red tide. The effects of the bacteria and its algicide were greatest when blooms were actively growing, suggesting this technology would be effective during the early stages of blooms for red tide control.



Further research in lab and small-scale field trials with natural phytoplankton populations showed a decrease in HAB species with no impact to non-harmful phytoplankton after DinoSHIELD treatment. Additionally, through lab testing, no impacts have been observed on various marine organisms, including copepods, crab and oyster larvae, adult crabs and juvenile fish when exposed to the algicide at levels required to inhibit red tide growth. Additional, larger confined field demonstrations (up to 1 acre), scheduled for Winter 2024, will be conducted in southwest Florida to test the effectiveness of DinoSHIELD to strategically control red tide and identify any potential non-target ecosystem impacts during an active bloom.



A natural approach to control red tide

With appropriate permits in place, DinoSHIELD has the potential to be deployed in strategic areas that are experiencing, or at risk for, red tide, and removed when no longer needed. DinoSHIELD would be best deployed in sheltered areas like canals, marinas, small coves, and aquaculture areas for targeted red tide management. Overall, DinoSHIELD is proving to be a safe and effective approach to reduce the environmental, human-health, and economic impacts of red tide.

RESOURCES

- For more information about the projects leading to the DinoSHIELD technology, see the project summaries from [2010](#), [2015](#), and [2020](#) funded through NOAA NCCOS's [Prevention, Control, and Mitigation of HABs Program](#)
- Results from peer-reviewed publications leading to the DinoSHIELD technology can be found in:
 - *Algicidal Efficacy*: Hare et al. [2005](#); Pokrzywinski et al. [2012](#); and Wang & Coyne [2022](#)
 - *Cell Mechanism*: Tilney et al. [2014a](#); Pokrzywinski et al. [2017a](#), [2017b](#); and Wang & Coyne [2023](#)
 - *Toxicology*: Tilney et al. [2014b](#); Ternon et al. [2018](#); and Simons et al. [2021](#)
 - *Technology Development*: Wang & Coyne [2020](#) and Fernando et al. [2024](#)