



## DinoSHIELD: A Natural Approach to Control Red Tides

### WHY DINO SHIELD?

Marine harmful algal blooms (HABs), sometimes referred to as red tides, are caused by microscopic algae that can produce toxins which are harmful to both humans and animals. Toxins produced by HABs can accumulate in shellfish tissue potentially leading to shellfish poisoning when consumed. The majority of available marine HAB control strategies often negatively impact the entire aquatic community, including phytoplankton, fish, and shellfish. Control strategies that specifically target HABs can provide improved ecosystem functions and reduce the socioeconomic impacts of HABs.

### WHAT IS DINO SHIELD?

DinoSHIELD is an emerging technology which aims to prevent and control HABs 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 the Delaware Inland Bays. The bacteria are immobilized in a hydrogel system that can release the algicide while retaining the bacteria so that the algicide can be continuously delivered.

### IS DINO SHIELD SAFE?

DinoSHIELD is a naturally derived, environmentally safe approach to managing marine HABs. The algicide-containing hydrogels have been extensively tested in the lab to ensure effectiveness against marine HAB species without impacting natural aquatic communities. The algicide is highly specific to red tide algae and has been shown to have no effect on non-harmful phytoplankton, invertebrate and vertebrate species at doses needed to disrupt HABs. Additionally, DinoSHIELD is made from food-safe materials and the algicidal bacterium is common to coastal waters of the Mid-Atlantic.

### HOW IS DINO SHIELD USED?

Following production of DinoSHIELD in the lab, the algicide-containing hydrogel beads are put into a mesh bag and suspended at various depths off of docks and other existing marine structures to ensure a consistent application rate across the target area. These mesh bags can be deployed for the prevention and control of marine HABs in ecosystems with chronic blooms. Following regulatory approval, DinoSHIELD can be used by state managers, shellfish growers, and other end-users to safely manage HABs in their coastal waterbodies.



# An Environmentally Safe Strategy to Manage HABs



DinoSHIELD is produced in the lab by immobilizing algicidal bacteria common to the Delaware Inland Bays in non-toxic hydrogel beads. This creates a slow, continuous release of the algicide over time that prolongs its effectiveness in controlling and preventing marine HABs without the need for frequent high-dose applications. Laboratory studies have shown that the bacterium does not require direct contact to combat HABs. The effects of the algicide were greatest when blooms were actively growing, suggesting this technology would be effective during the early stages of blooms or as a prevention strategy.



Further research in laboratory and confined field trials with natural populations of phytoplankton showed a decrease in HAB species and an increase in “healthy” phytoplankton after DinoSHIELD treatment. Additionally, in laboratory testing, no toxicity has been observed on the various marine life tested, including copepods, crab and oyster larvae, adult crabs and juvenile finfish when exposed to the algicide at levels required to inhibit red tide growth. This year, additional confined field trials will be conducted in the Delaware Inland Bays to test the effectiveness of DinoSHIELD on natural phytoplankton and HAB species in a controlled environment.



With appropriate permits in place, DinoSHIELD can be deployed in mesh bags in areas that are experiencing, or at risk for, marine HABs, and then removed when no longer needed and/or replaced when depleted. DinoSHIELD is proving to be a safe and effective approach for controlling red tides that can be used by water resource managers and the aquaculture community to reduce the environmental, social and economic impacts of HABs in their regions.

## RESOURCES

- For more information about the projects leading to the DinoSHIELD technology, please see the project summaries from [2010](#), [2015](#), and [2020](#) funded through NOAA's [Prevention, Control, and Mitigation of HABs Program](#).
- Results from peer-reviewed publications leading to DinoSHIELD can be found in: [Simons et al. 2021](#); [Wang and Coyne, 2020](#); [Ternon et al. 2018](#); [Grasso 2018](#); [Pokrzywinski et al. 2017a, 2017b, 2012](#); [Pokrzywinski 2014](#), [Tilney et al. 2014a, 2014b](#); and [Hare et al. 2005](#)
- For additional information about HABs see the [University of Delaware](#) and [NOAA NCCOS](#) webpages