



FACT SHEET

Rust Tide (*Margalefidinium polykrikoides* blooms)

Rust tide is caused by the accumulation of a large population of a naturally occurring type of microscopic, single-celled phytoplankton called *Margalefidinium polykrikoides* (former name was *Cochlodinium polykrikoides*; Figure 1). *Margalefidinium* is a planktonic dinoflagellate typically present in RI coastal and estuarine waters in low numbers during the warm summer and early fall months. Occasionally, *Margalefidinium* abundance can increase to levels of 5-10 million cells per liter in parts of Narragansett Bay, coastal waters and the coastal salt ponds. *Margalefidinium* has red-brown photosynthetic pigments and when present at elevated abundance (millions of cells per liter) it causes rust-red colored patches visible on the water surface (Figure 2). This rust tide is not toxic to humans and should not be confused with “red tide” that has led to shellfish closures in other New England states.



Figure 1: Image of *Margalefidinium polykrikoides*, the organism causing rust tide. Each cell is ~45 micrometers in diameter. This 4-cell chain was isolated from Ninigret Pond, RI on 30 August 2016.
(Photo: David Borkman)



Figure 2: Red water patch caused by rust tide bloom of *Margalefidinium polykrikoides* on Ninigret Pond 30 August 2016. (Photo: David Borkman)

Is this organism new to RI waters?

Margalefidinium polykrikoides is not new or recently introduced to RI waters. It has been in RI waters for at least 40 years, and likely longer. A *Margalefidinium* bloom in Pettaquamscutt Cove (Narrow River) was documented in 1980 and a water discoloring *Margalefidinium* bloom was reported in Pt. Judith Pond in 1997. However, the abundance and spatial extent of *Margalefidinium* blooms appears to be increasing in RI waters in recent years.

Where and when is rust tide likely to occur?

Margalefidinium is a marine micro-organism; it may be found in the marine (saltwater) and estuarine waters of RI having a salinity of greater than ~15 ppt. It *cannot* survive in freshwater. It is a warm water marine species and requires water warmer than ~50°F (10°C) and grows best in very warm water of ~80°F (26°C). It is typically at maximum abundance in late summer and early autumn when the waters of Narragansett Bay are near their warmest water temperature.

What causes water-discoloring rust tides?

The complete set of physical, chemical and biological factors that contribute to *Margalefidinium* rust tide bloom formation are not fully known. *Margalefidinium* maximum growth rate occurs in warm water, so the warm water (nearly 80°F) temperatures observed during summer likely contribute to its abundance. It is a relatively slow growing phytoplankton species so factors that reduce the population mortality rate also may contribute to bloom formation. Predation on *Margalefidinium* cells by the usual marine predators (copepods, larval fish, and shellfish) appears to be reduced, perhaps by the hydrogen peroxide-like toxin on the cell surface. Larger rust tides sometimes occur during drought conditions when river flow in the Narragansett Bay watershed is reduced. This reduces the rate of estuarine circulation and increases the residence time, or length of time a parcel of water remains in the Bay. This may allow *Margalefidinium* cells to grow and accumulate in the same water mass until the population reaches water-discoloring abundance levels. The suite of environmental conditions that trigger rust tides appear to be regional as *Margalefidinium* rust tides are often observed synchronously in Long Island, NY (Peconic Bay), Buzzards Bay (MA) and in RI waters.

Are there potentially harmful effects of a rust tide?

While rust tide blooms are not toxic to humans, there is potential for harmful impacts of a severe *Margalefidinium* rust tide. *Margalefidinium* may harm fish and shellfish because it produces a hydrogen peroxide-like compound that can damage their gill tissue. Fish generally can avoid the bloom patches by swimming away from them. Aquaculturists should be aware of the potential harm (gill damage) that a *Margalefidinium* rust tide can cause when caged fish and shellfish are exposed to concentrated patches of the organism. Juvenile fish and shellfish seem especially susceptible to gill damage from rust tide blooms. A potentially harmful secondary effect of a rust tide is reduced dissolved oxygen levels in the water if the abundant *Margalefidinium* cells die suddenly, sink to the bottom and are consumed by bacteria which may take up available oxygen.

Are fish and shellfish safe to eat during a rust tide?

Yes, fish and shellfish are safe to eat during a rust tide. The rust tide organism does not produce a toxin that can harm humans, even if the organism was ingested. *Margalefidinium* is not toxic to humans, and fish and shellfish exposed to a *Margalefidinium* rust tide are safe for human consumption.

Where can I find more information or report a bloom?

More information can be found at:

<http://www.dem.ri.gov/> or <http://www.health.ri.gov/>

To report a suspicious algae bloom, contact RIDEM at (401)222-4700.