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# Red Tide

Marine Meteorological Course for Royal Oman Navy

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# OUTLINE

What is Red Tide?

Distribution of Red Tide

Red Tide Causes

Red Tide Effects

Research / Red Tide

Red Tide In Oman

How Scientists are Tracking Florida's Red Tide

How to Prevent Red Tide





# WHAT IS RED TIDE ?



# DEFINITION

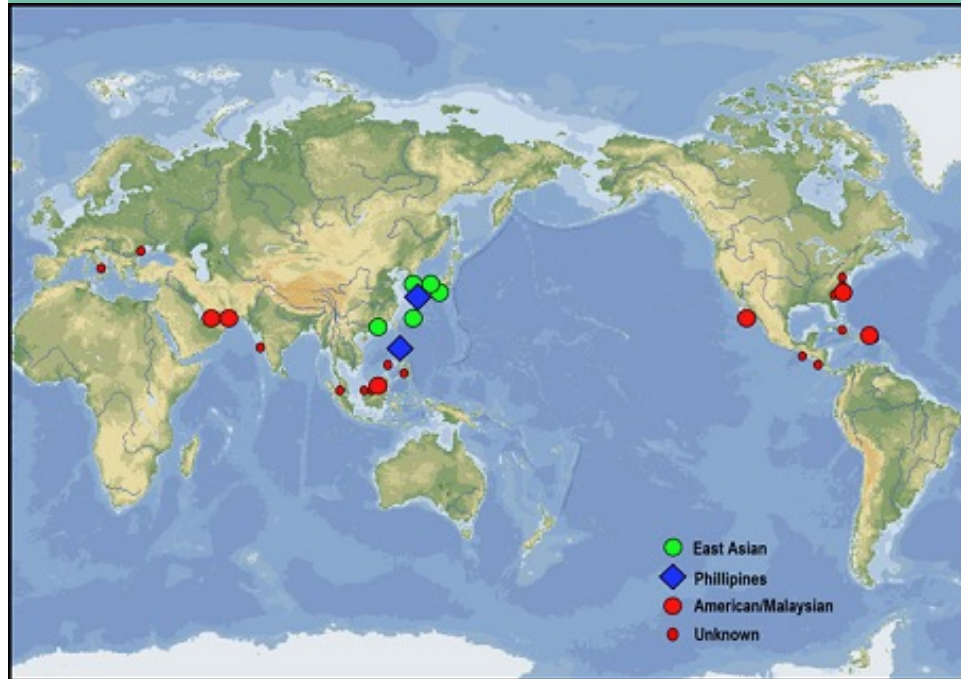
Red tide is a common name for a phenomenon known as algal bloom (large concentrations of aquatic microorganisms), that occurs when toxic, microscopic algae in sea water proliferate to higher-than-normal concentration often discoloring the water red, brown, green, or yellow. These microscopic forms of algae produce toxins that can sicken humans and be fatal for marine animals.





# RED TIDE DISTRIBUTION

- Mexico
- USA: Texas, Florida, California
- Japan
- Caribbean
- South Pacific Area

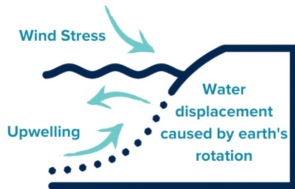


The causes of red tide are unclear but experienced scientists have arrived at the conclusion that some specific factors might have caused the phenomenon

## Causes of Red Tide

### Natural

#### Coastal upwelling



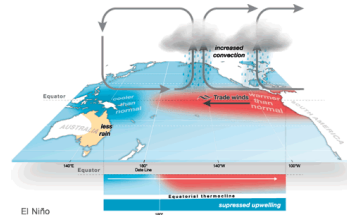
#### Systematic increase in sea water temperature



#### Iron-rich dust influx from large desert areas

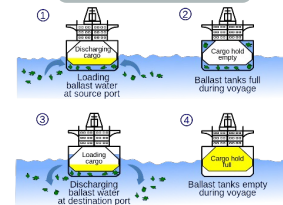


#### El Niño events



### Human Activities

#### Ballast Water

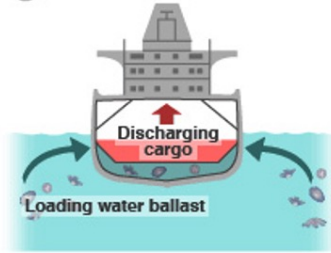


#### Sewage



### BALLAST WATER CYCLE

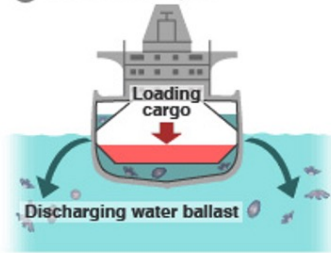
① At source port



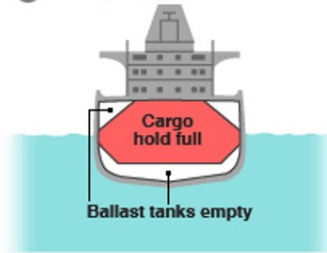
② During voyage



③ At destination port



④ During voyage



SOURCE: GloBallast

# DISCHARGE OF BALLAST WATER





SEWAGE



## RED TIDE EFFECTS

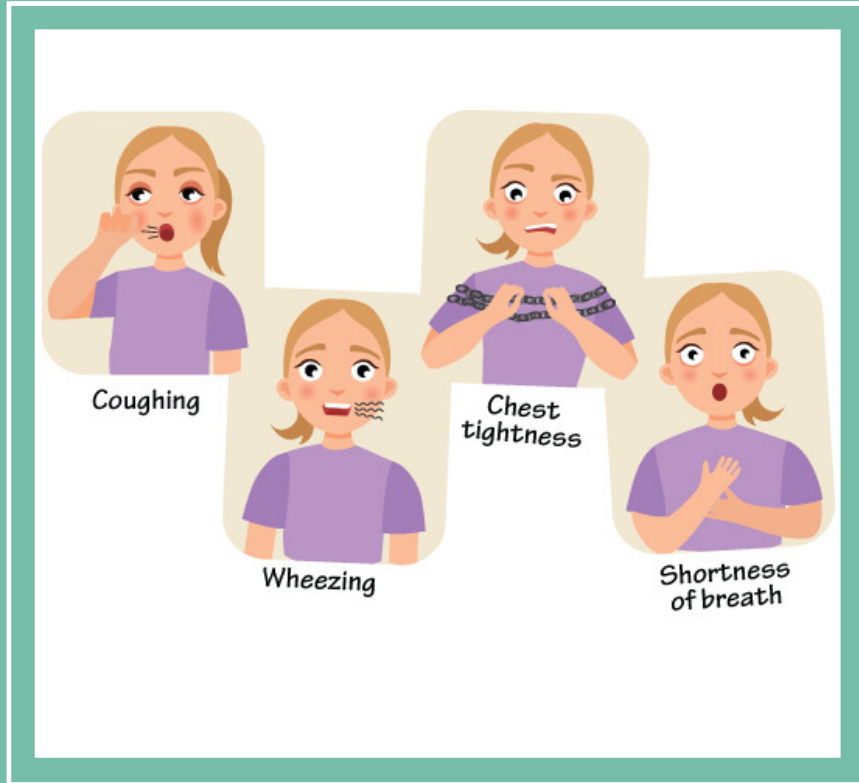






## DAMAGE TO THE MARINE LIFE

- Marine animals do perish
- Marine animals are not necessarily going to die off, but they might transport these toxins to humans when they eat them.



## HUMAN HEALTH PROBLEMS

- Asthmatics symptoms
- Diarrhea and vomiting
- Temperature reversal
- Tingling in lips, tongue, and throat

# IMPACTS TO THE ECONOMY

## FISHERIES PRODUCTION



## TOURISM





# RESEARCH

## Red Tide: A threat to water resources in the Arabian Gulf Region by Dr. Muthanna A. Al-Omar

Arabian Gulf is an enclosed area of water with a relatively high evaporation rate.

Sources of pollution:

- Sewage outfalls
  - Industrial outfalls
  - Oil pollution
  - Discharge of ballast water
-

## RESEARCH

- Arabian Gulf is surrounded by rapidly developing countries.
- Many sewage outfalls, industrial and desalination outfalls were identified, beside oil pollution incidents, dredging and ballistic water discharge
- Nutrients are believed to be discharged from many sources such as animal farms, slaughterhouses, fertilizer factories, intensive marine culture operations and other sources in addition to oil pollution.
- Some studies have found that around 337 species of phytoplankton are living in the Gulf's waters.





# OMAN

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- Oman has been maintaining a record of red tide outbreaks since 1988
- The highest massive fish kills were reported in 2001 to 2002 when 27 tones of dead fish came ashore along Batinah, Sur and south of Oman
- The Director of the Marine Conservation Department at the Ministry of Fisheries reported that the red tide is occurring usually between July and September due to monsoon winds and currents
- During 2008 the red tides were first reported sometime in July, with a second outbreak recorded in August
- Incidents over the region previously; Kuwait and Iran





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## DHOFAR - 2020

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- Occurred in October 2020 near the coasts and spread widely
- Ministry of Agriculture, Fisheries and Water Recourses had issued alerts and warnings regarding the matter
- Ministry of Health had recorded tens of poisoning cases
- The effect have reached the marine life and affected the citizens afterwards

# EXAMPLE



## Tweet



وزارة الثروة الزراعية والسمكية وموارد المياه  
@MAFWR\_OM



تنبيه  
نظراً إلى وجود مؤشرات بيئية لحدوث ظاهرة المد  
الأحمر في مياه بحر العرب بمحافظة ظفار، فإنه  
وجب التنبيه لما يلي:  
١- عدم صيد الأسماك في مناطق وجود هذه  
الظاهرة.  
٢- عدم استهلاك الأسماك النافقة والمحاريات خلال  
تلك الفترة.  
ويقوم المختصون بالوزارة بمتابعة هذه الظاهرة  
وتقييم تأثيرها.

[Translate Tweet](#)

8:26 PM · 10/21/20 · [Twitter for Android](#)

# Tracking Red Tide in Oman

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## Monitoring red tide using satellite imageries:

- Identifying the locations where red tide is present. In addition, monitoring the ocean currents flow and the concentrations of the chlorophyll to predict the possibility for red tide to occur.

## Field Observations:

- During the event of red tide, a specialized team makes protocol guided visits to take samples and test it biologically, chemically, and physically. All to the purpose of identifying the exact type of microorganism that is present.



# FLORIDA RED TIDE PRESENT

May cause eye, throat or skin irritation

May cause coughing or sneezing

Avoid the beach if you have asthma or a respiratory condition

Onshore winds and rough surf worsen its effects

**Red Tide is caused by naturally occurring algae.**

Can kill fish and other sea animals

Do not swim near dead fish or touch them

Wear shoes to prevent injuries from stepping on bones of dead fish

Keep pets away from water, sea foam and dead fish



Florida Red Tide may not be present  
at all Sarasota County Beaches

Scan for the most  
recent test results:



Conditions at select beaches:

[OurGulfEnvironment.scgov.net](http://OurGulfEnvironment.scgov.net)

(Click on Water Quality / Red Tide)

More information: [www.mote.org/beaches](http://www.mote.org/beaches) or (941) BEACHES

Statewide Red Tide Status Update: [myfwc.com/redtidestatus](http://myfwc.com/redtidestatus)

Questions/health concerns: (941) 861-5000 (Weekdays only)

To report a fish kill: (800) 636-0511

# FLORIDA RED TIDE



# HIGHLIGHTS

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- Growth rates may be affected by sunlight, and shade may play an important role in the development of blooms. In addition, water temperature is also a major player in the increase of these blooms' density in the water
- Scientists who study the life cycle of red tide in Florida divide red tide blooms into four stages: initiation, growth, maintenance, and termination.
- Even though red tide blooms have long been a fixture of the West Florida Shelf marine ecosystem, many people believe that they are getting worse in terms of frequency, intensity, and duration.



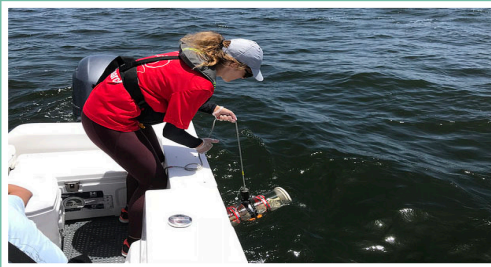
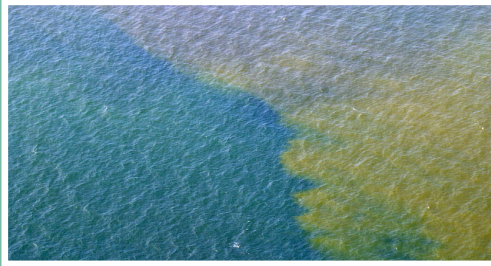
## TRACKING FLORIDA'S RED TIDE

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<b>Initial Factors</b>	
<b>Upwellings</b>	Upwellings of deep, nutrient enriched water along the continental shelf are viewed as playing a potential role in the initiation of offshore blooms.
<b>Saharan Dust</b>	Dust clouds from the Sahara Desert contain iron. When deposited in the Gulf of Mexico the iron can boost <i>trichodesmium</i> blooms and their production of nutrients.
<b>Rainfall</b>	Rainfall may enhance a number of nutrient delivery mechanisms including those that involve atmospheric deposition (see <i>trichodesmium</i> discussion) and terrestrial fluxes.

Table I : Possible causes for Florida's red tide





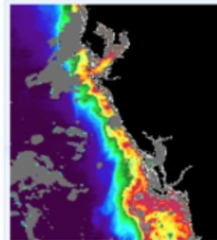
## TRACKING FLORIDA'S RED TIDE

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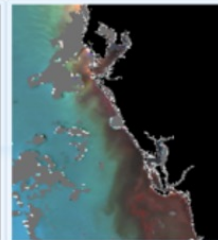
One of the best ways to test for the presence of *red tide* is to analyze water samples collected from boats or beaches.

State environmental agencies do this on a regular basis but understanding the full extent and evolution of fast-changing blooms or predicting where they will move with ground sampling alone is a challenge.

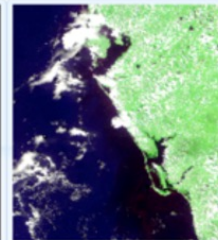
# TRACKING FLORIDA'S RED TIDE WITH SATELLITES AND SMARTPHONES



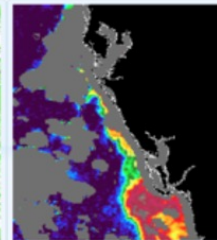
CHL L3D Information  
[Get Link Here](#) 



ERGB L3D Information  
[Get Link Here](#) 



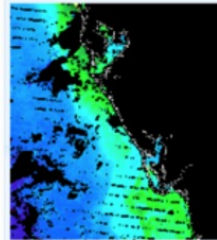
FRGB L3D Information  
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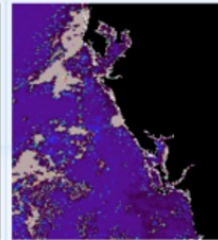
NFLH L3D Information  
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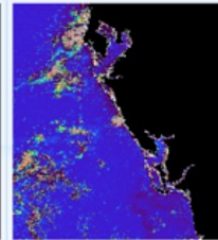
SST L3D Information  
[Get Link Here](#) 



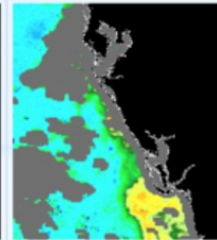
CI L3D\_RRC Information  
[Get Link Here](#) 



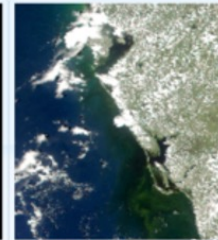
EFAI L3D\_RRC Information  
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FAI L3D\_RRC Information  
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FLH L3D\_RRC Information  
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RGB L3D\_RRC Information  
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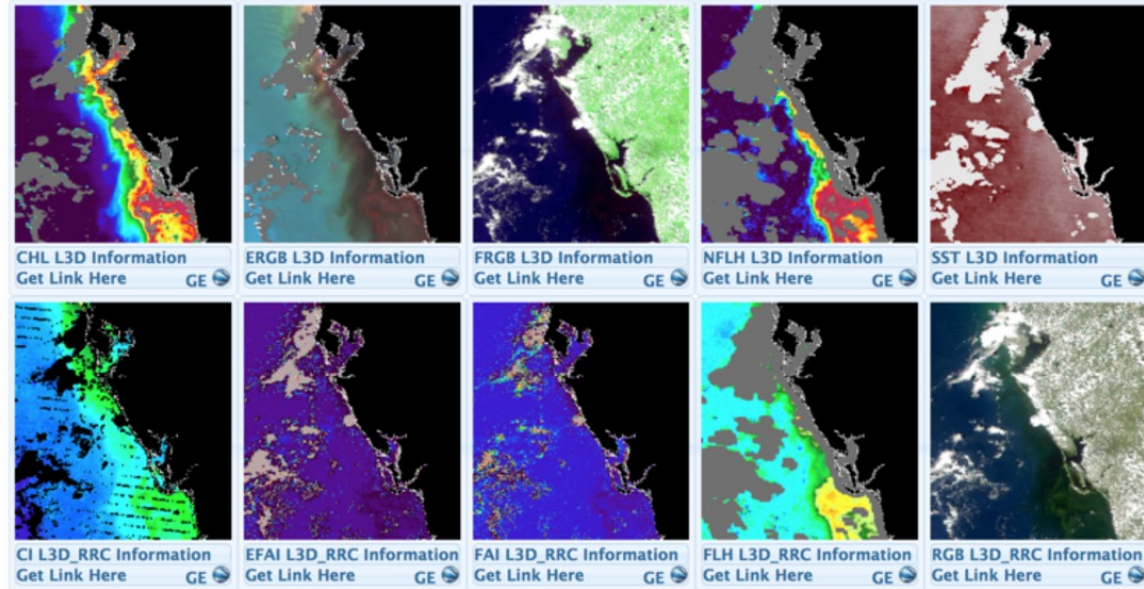
## Red tide monitoring systems:

- **Forecast:** National Oceanic and Atmospheric Administration's (NOAA's) Harmful Algal Bloom Forecast System
- **Near real time observations:** Integrated Red Tide Information System (IRIS) from the University of South Florida

## NASA's Aqua and Terra satellites

These sensors pass over Florida's Gulf Coast twice a day

Useful for identifying and mapping the spatial extent of algal blooms



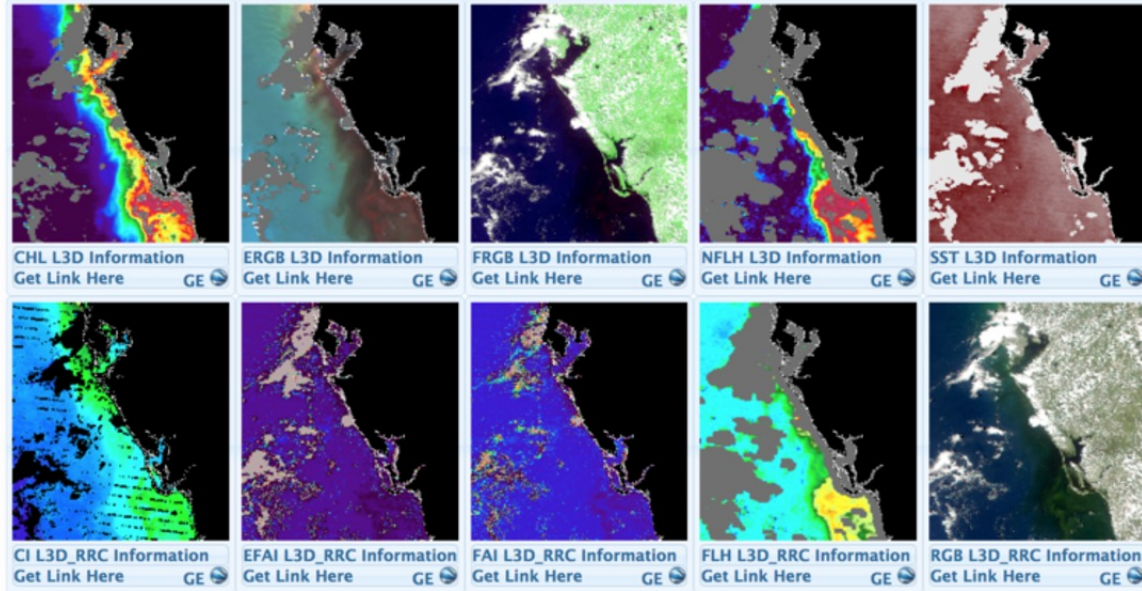


## Challenge example:

- It can be quite difficult to distinguish between algal blooms, suspended sediment, and colored dissolved organic matter (CDOM) that flows into coastal areas

## Overcoming it:

- Developing a red tide monitoring system that makes use of MODIS observations of fluorescence, which algal bloom emit in response to exposure to sunlight





## HOW TO PREVENT RED TIDE

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- THE SHORT ANSWER TO THIS QUESTION IS THAT THERE IS NO WAY TO PREVENT RED TIDE FROM HAPPENING!!!

### BUT WHAT WE CAN DO IS:

- PRIOR TO THE EVENT: LIMIT THE HUMAN CAUSES

# REFERENCES

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- <https://oceanservice.noaa.gov/hazards/hab/gulf-mexico.html>
- <http://www.inio.ac.ir/Default.aspx?tabid=1722>
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