

# Algal Bloom – Seafood Safety and more...

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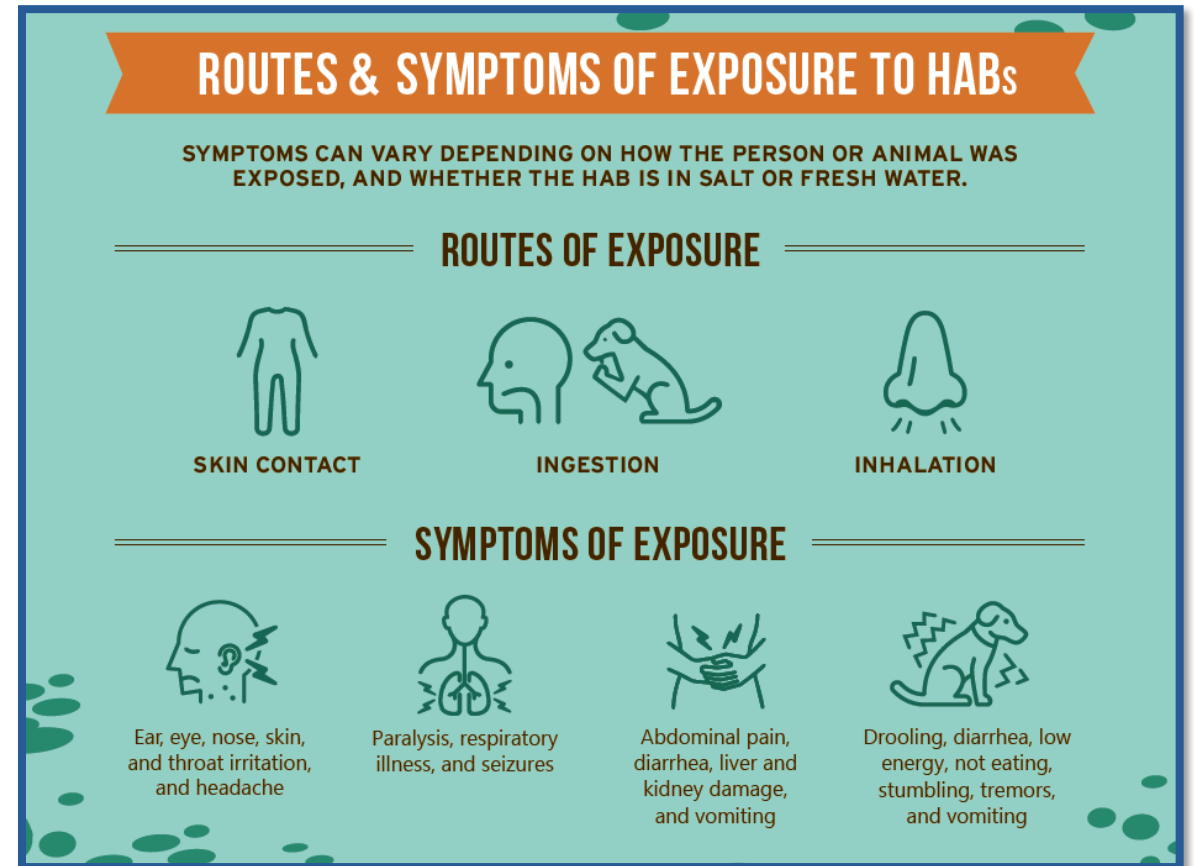
September 12, 2022

# Harmful Algal Blooms & Seafood Natural Toxins

- Main forms of harmful algal blooms (HAB)
- Seafood Natural Toxins
  - Shellfish Natural Toxins
  - Fish Natural Toxins
- Scombrototoxin (Histamine) Formation
- Keeping seafood safe

# Main forms of harmful algal bloom (HAB)

- Skin exposures
- Ingestion of contaminated water
- Inhalation exposures
- **Foodborne exposure**



Source: <https://clark.wa.gov>

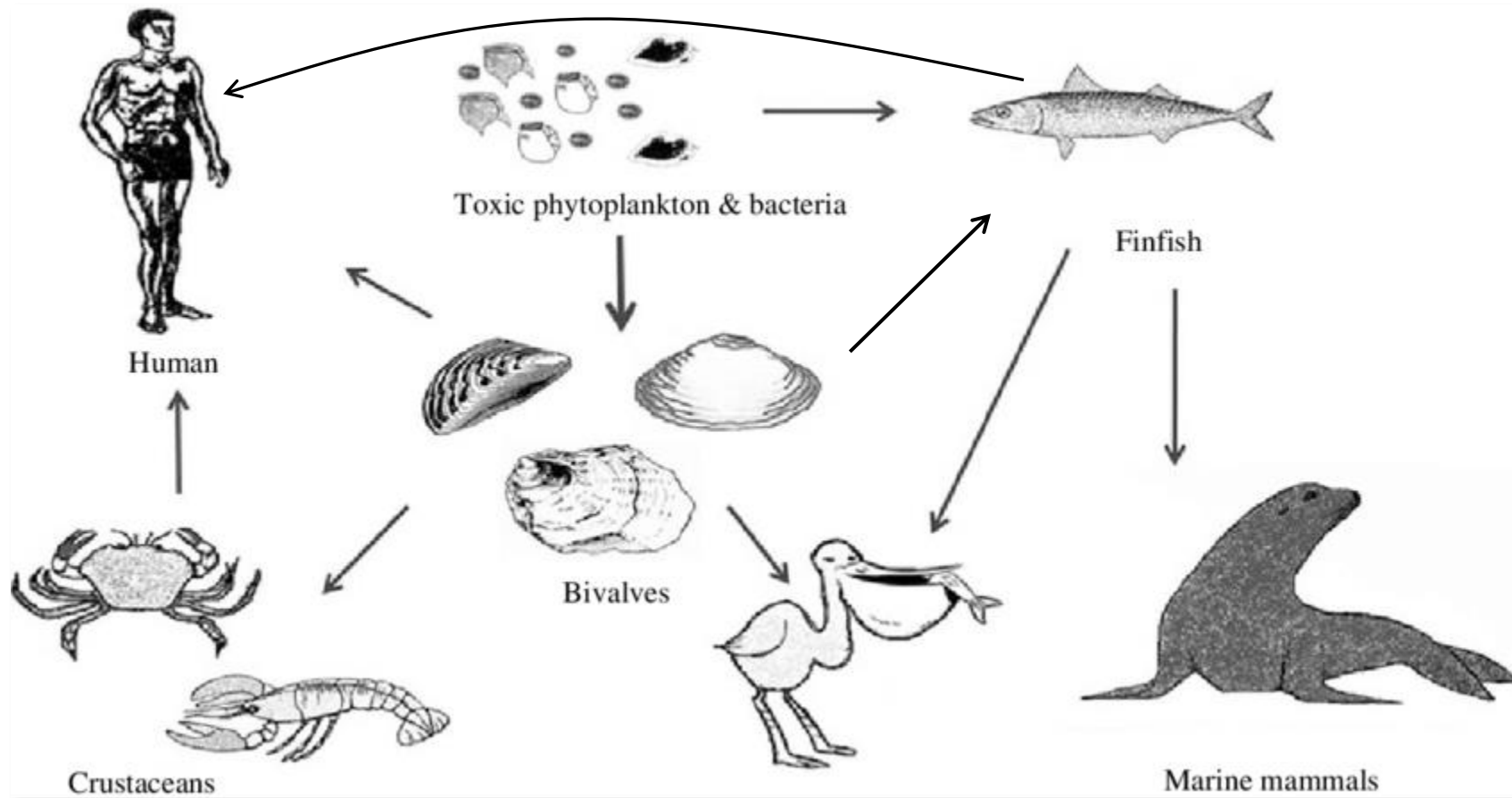
# Seafood Natural Toxins

- Fish and shellfish contaminated with natural toxins from the waters they lived can cause consumer illness
- These toxins are produced by naturally occurring algae
- Natural toxins are more common in warm months
- However, natural toxins are sporadic and not all fish/shellfish from a given species or location are toxic

# Seafood Natural Toxins (cont.)

- Most are heat stable and resistant to freezing
- Onset of symptoms is quick and with neurological effects
- 30 to 70 cases per year in U.S. (CDC 2015,2016 & 2017)

# Seafood Natural Toxins Cycle

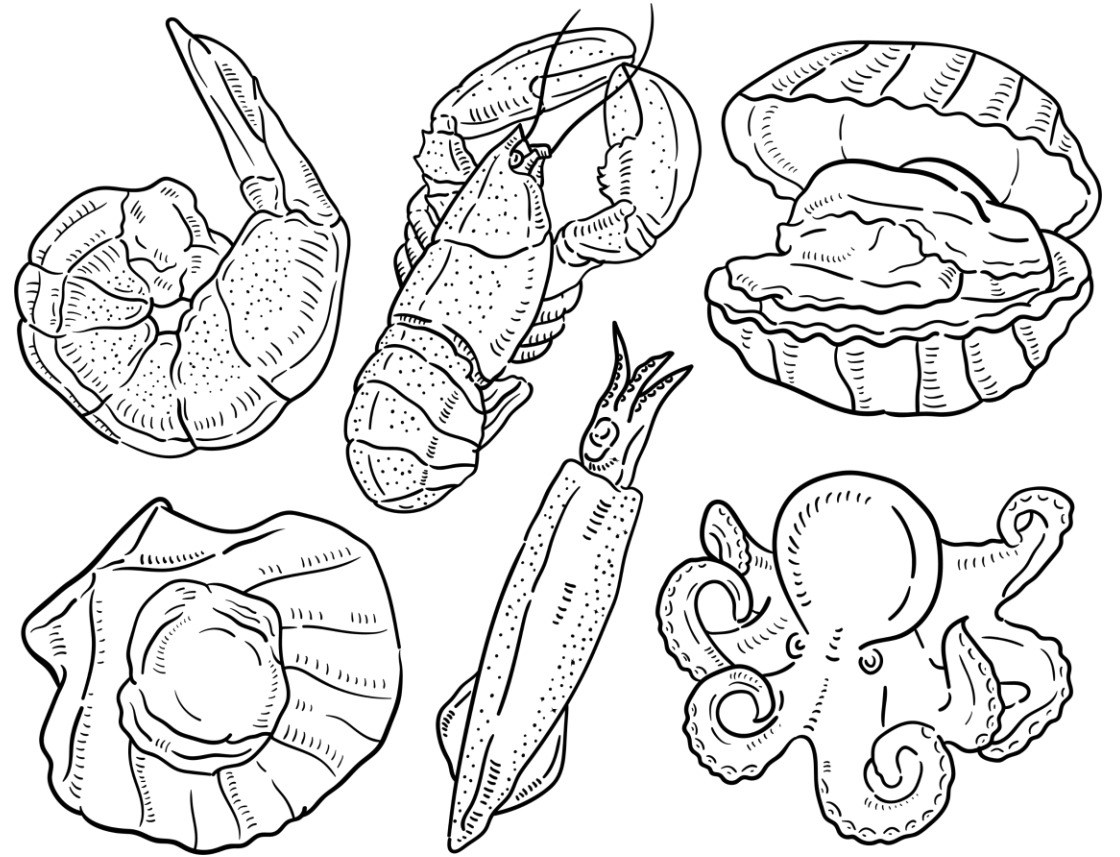


The toxin cycle : diagram illustrating the interrelationships between harmful algae and shellfish, finfish, birds and mammals.

(Modified from O'Halloran, 2010).

# Shellfish Natural Toxins

- Amnesic shellfish poisoning (ASP)
- Azaspiracid shellfish poisoning (AZP)
- Diarrhetic shellfish poisoning (DSP)
- Paralytic shellfish poisoning (PSP)
- **Neurotoxic shellfish poisoning (NSP)**



# Amnesic shellfish poisoning (ASP)

- Domoic acid
- Molluscan shellfish, crabs, and finfish species
- Related to Northeast and Northwest coasts of North America, and the Gulf of Mexico
- Gastrointestinal (GI) symptoms (onset within 24 hours)
- Severe cases neurological symptoms (onset within 48 hours)
- No confirmed cases in U.S. since 1987 (seafood toxin-monitoring programs)



# Azaspiracid shellfish poisoning (AZP)

- Azaspiracids
- Bivalve molluscan shellfish
- Outbreaks in Europe and U.S. associated to mussels from Ireland
- Reported in Washington State waters, but not in excess of guidance levels in commercially harvested shellfish (August 2019)
- Severe GI disorders (onset within few hours)
- Self-limiting and non-fatal

# Diarrhetic shellfish poisoning (DSP)

- Okadaic acid and dinophysistoxins
- Bivalve molluscan shellfish
- Worldwide distribution
  - 2008 excess levels for the first time along Texas Gulf Coast.
  - Pacific North America
- GI symptoms, headaches, fever, and **dehydration** (within 3 hours)
- Self-limiting and non-life threatening

# Paralytic shellfish poisoning (PSP)

- Saxitoxins
- Bivalve molluscan shellfish
- Northeast and northwest coastal regions
- Some bivalves eliminate toxin within weeks, some months or years.
- Gastropods are predators of bivalves
- GI and neurological symptoms, in severe cases respiratory paralysis (onset within 2 hours)
- Extremely potent toxin with high mortality

# Neurotoxic shellfish poisoning (NSP)

- Brevetoxins
- Bivalve molluscan shellfish
- Gulf of Mexico, Southern Atlantic Coast, New Zealand
- GI and neurological symptoms (onset within few hours)
- Treatment consists mainly of supportive care

# Fish Natural Toxins

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Ciguatera fish poisoning (CFP)

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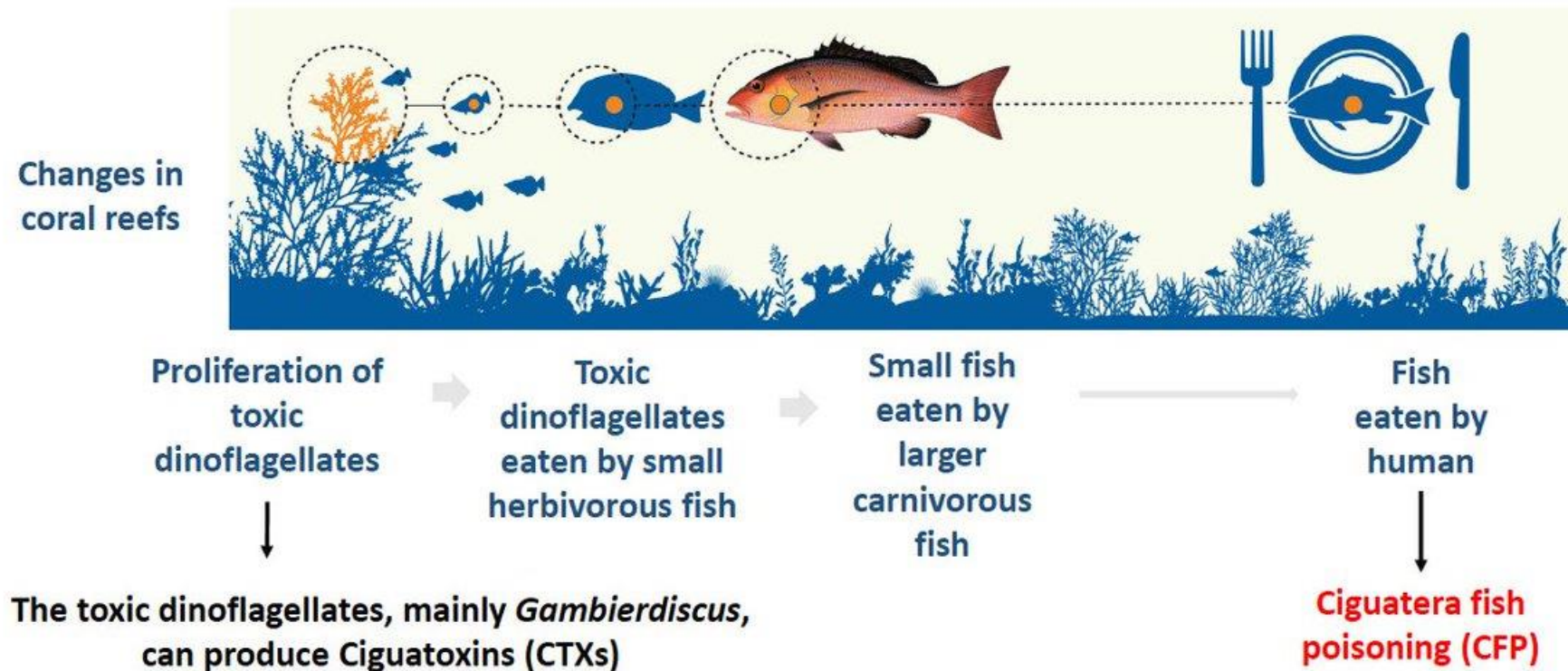
Cyanobacteria

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Tetrodotoxin (Pufferfish poisoning)



# Ciguatera Fish Poisoning (CFP)



Source: FAO Fisheries Aquaculture

# Ciguatera Fish Poisoning Symptoms

- Neurological (onset within 6h)
  - Numbness and tingling
  - Joint and muscle pain,
  - Headache
  - Reversal sensation of hot and cold
  - Vertigo
  - Muscular weakness
- Gastrointestinal (onset within 2h)
  - Nausea
  - Vomiting
  - Diarrhea
- Cardiovascular (onset within 6h)
  - Irregular heartbeat
  - Reduced blood pressure

# Harmful Cyanobacteria



- Most prevalent HAB in freshwater environment
- Discoloration of water bodies
- Worldwide distribution
- Direct skin contact, inhalation or ingestion of water
- Consumption of fish or shellfish from contaminated waters
- Rashes, allergies, and GI symptoms.



# Puffer fish poisoning (Tetrodotoxin)

Usually associated with puffer fish from Indo-Pacific Ocean regions.

Some reports involving puffer fish from Atlantic Ocean, Gulf of Mexico, and Gulf of California.

No confirmed cases from northern puffer fish ("Sea squab"; *Sphoeroides maculatus*) (August 2019).

AKA fugu, swellfish, bok, blowfish, globefish, blaasop, or balloonfish.

<https://www.youtube.com/watch?v=sGWZFcsyMgA>



# Puffer fish poisoning (Cont.)

- 1,200x more deadly than cyanide
- No antidote
- Not deactivated by cooking or freezing
- Neurological symptoms develop within ½ to 2 h: Tingling, burning, numbness, drowsiness, incoherent speech, and respiratory paralysis.



# Scombrototoxin (Histamine) poisoning

- It is not a natural toxin!
- Is produced by bacterial spoilage due to time and temperature abuse of certain species of fish

# Scombrotoxin (cont.)

- The Scombridae family fish-100 species
- Mahi-mahi
- Mackerel
- Marlin
- Swordfish
- Tuna
  - Yellowfin
  - Albacore
  - Bigeye
  - Bonito or Skipjack



# Top Five Pathogens-Food Pairs Causing Outbreaks in the U.S. in 2017

## Top 5 pathogen-food category pairs resulting in outbreaks

Etiology	Food Category*	No. Outbreaks	No. Illnesses	No. Hospitalizations	No. Deaths
<i>Scombroid toxin/Histamine</i>	Fish	17	58	1	0
<i>Ciguatoxin</i>	Fish	13	43	3	0
<i>Salmonella</i>	Chicken	11	299	16	0
<i>Salmonella</i>	Fruits	10	421	124	2
<i>Vibrio parahaemolyticus</i>	Mollusks	7	26	3	0

Foodborne Disease Outbreak Surveillance System, U.S. 2017 (<https://www.cdc.gov>)

# Outbreak Investigation of Scombrototoxin Fish Poisoning: Yellowfin/Ahi Tuna (November 2019)

*Outbreak appears to be over; yellowfin tuna imported from Truong Phu Xanh Co., LTD with production dates in 2019 should still be discarded, if found*

- **Case Counts:**
  - Total illnesses: 50
  - Hospitalizations: 1
  - Deaths: 0
  - Cases occurrence: August 8 to November 24, 2019
  - States with Cases: DE (6), MA (2), MD (4), MN (2), NJ (2), NY (6), OH (11), PA (6), RI (3), VT (7), WV (1)

[https://www.fda.gov/food/outbreaks-foodborne-illness/outbreak-investigation-scombrototoxin-fish-poisoning-yellowfinahi-tuna-november-2019?utm\\_campaign=Outbreak\\_Tuna\\_12262019&utm\\_medium=email&utm\\_source=Eloqua](https://www.fda.gov/food/outbreaks-foodborne-illness/outbreak-investigation-scombrototoxin-fish-poisoning-yellowfinahi-tuna-november-2019?utm_campaign=Outbreak_Tuna_12262019&utm_medium=email&utm_source=Eloqua)

# Shellfish Poisoning Regulation (FDA action levels)

Toxin	Concentration
ASP (Domoic acid)	20 ppm* (30 ppm Dungeness crab viscera)
AZP (Asaspiracid)	0.16 ppm
DSP (Okadaic acid)	0.16 ppm
NSP (Brevetoxin)	0.8 ppm
PSP (Saxitoxin)	0.8 ppm
Ciguateratoxin	0.1 ppm (Caribbean), 0.01 ppm (Pacific)
Scombrototoxin	50 ppm

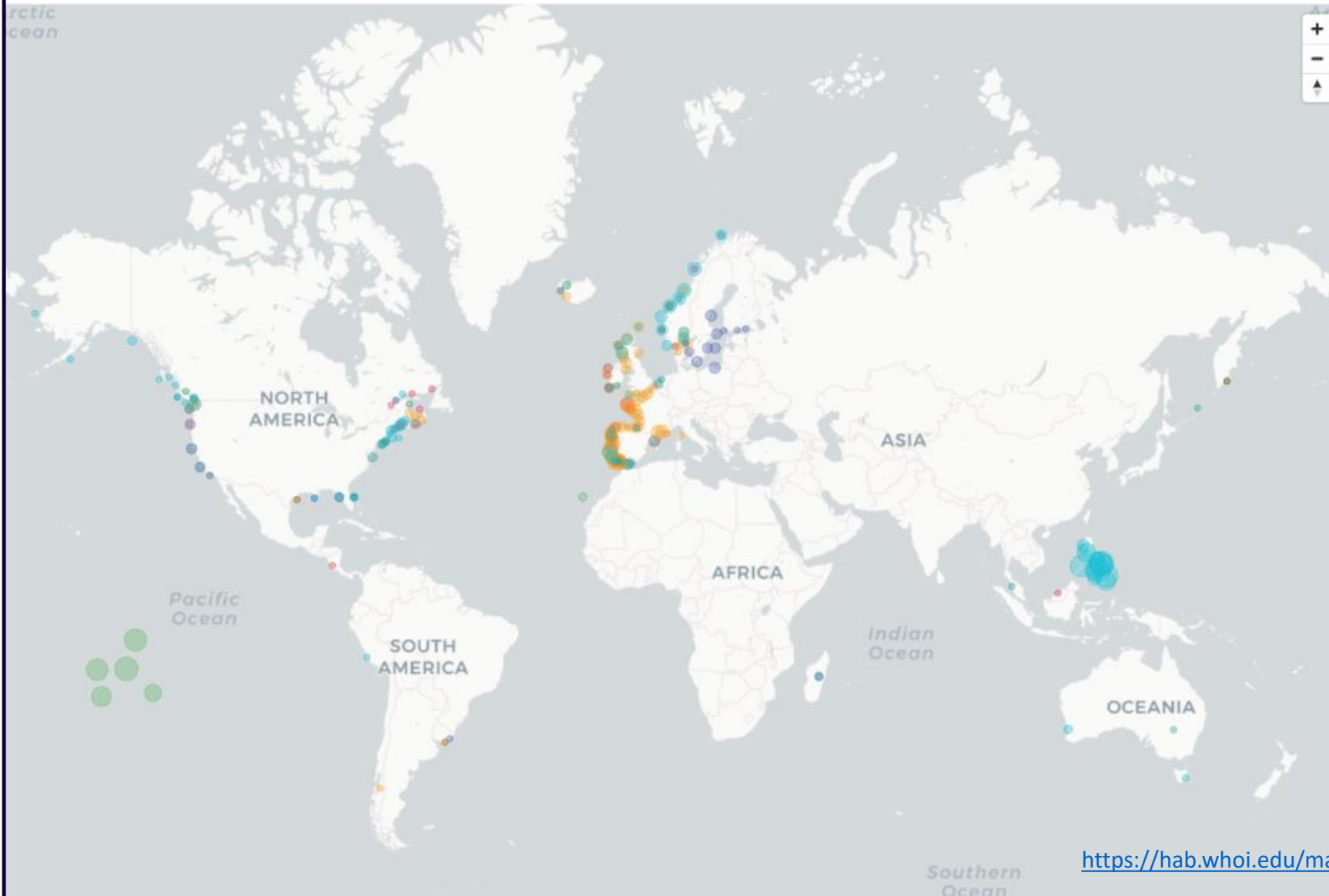
\*ppm =  $\mu\text{g}/100\text{g}$

# HARMFUL ALGAE

ABOUT SPECIES MAPS IMPACTS RESEARCH RESOURCES RESPONSE NHC

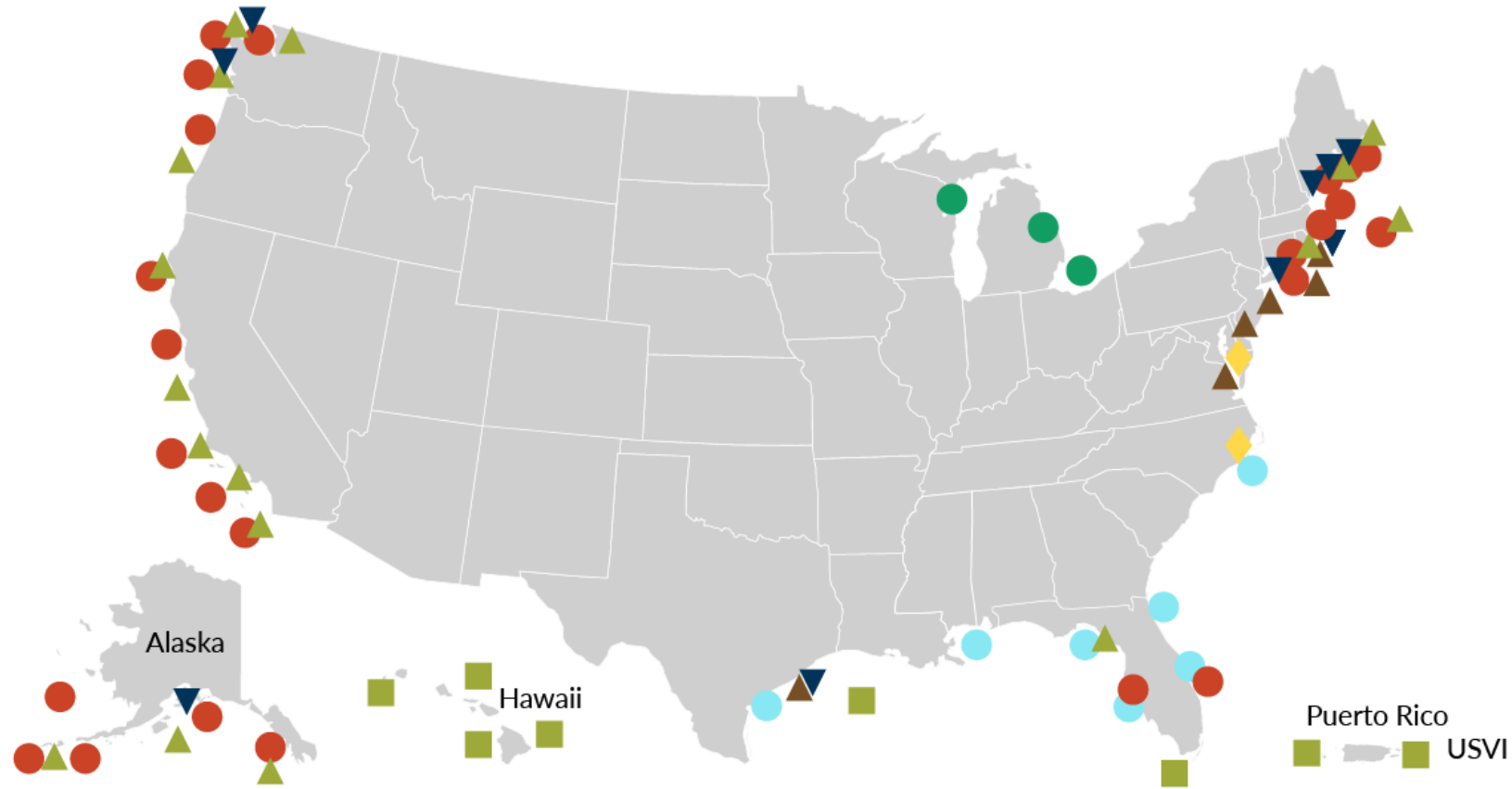


## IOC-UNESCO Harmful Algae Information System





# Present



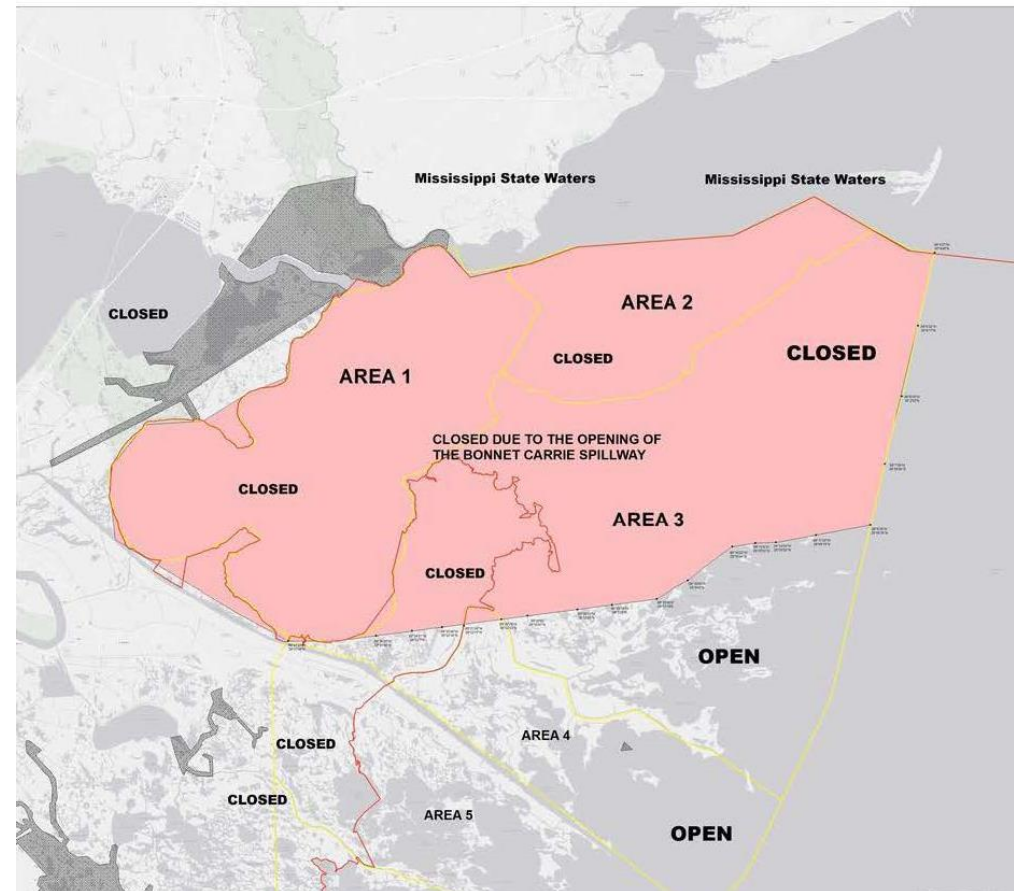
◆ *Karlodinium*    ● NSP    ● PSP    ▼ DSP    ■ Ciguatera    ▲ Brown tide    ▲ ASP    ● CyanoHABs

⚠ Occasional anoxia, marine mammal mortalities (whales, manatees, sea lions, dolphins), noxious blooms (aesthetics), macroalgal blooms

All 50 states are impacted by cyanobacteria HABs (CyanoHABs), typically in multiple water bodies. The same is true for at least 23 states impacted by golden algal blooms caused by *Prymnesium parvum*. It is not practical to indicate the location of each CyanoHAB, so widespread problems are denoted for the Great Lakes only. Source: <https://hab.whoi.edu>.

# Shellfish poisoning control

- Shellfish Control Authorities
- Authorize waters for harvesting shellfish
- Monitor harvest area
- Issue closure during algae bloom



## BONNET CARRIE OPENING EVENT



Louisiana Department of Health  
Office of Public Health  
Molluscan Shellfish Program

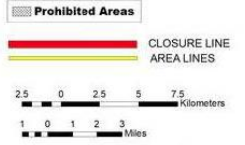
### Refrigeration Requirements for Shellstock Harvested for Raw Consumption

**Basic Description:**  
 Bayou Basin - Mississippi River west to Bayou Lafourche  
 Pontchartrain Basin - Mississippi state line to the Mississippi River  
 Terrebonne Basin - Bayou Lafourche to the Atchafalaya River  
 Vermilion Basin - growing waters south to the South West Pass and Marsh Island to inland inland waters from Pt. Chauvin to Freshwater Bayou Canal

Max. Hrs. From Harvest	20 Hrs	8 Hrs	1 Hr
Basin 02	Jan-Feb Dec	Mar-Apr Nov	May-Oct
Basin 03	Jan-Feb Dec	Mar-Apr Nov	May-Oct
Basin 04	Jan-Feb Dec	Mar-Apr Nov	May-Oct
Basin 06	Jan-Feb Dec	Mar-Apr Nov	May-Oct
Basin 12	Jan-Feb Dec	Mar-Apr Nov	May-Oct

THE CLOSURE WILL BE IN EFFECT AT 12 HOUR AFTER SUNSET ON JULY 6, 2019 UNTIL FURTHER NOTICE.

THE MAY 2019 OYSTER HARVESTING REGULATIONS ARE IN EFFECT FOR ALL OPENING CLOSURES OF MOLLUSCAN SHELLFISH HARVESTING AREAS. CONTACT THE MOLLUSCAN SHELLFISH PROGRAM AT LOUISIANA DEPARTMENT OF HEALTH FOR MORE INFORMATION.



Reference coordinates are in degree minute second format Datum NAD83  
 50 yard radius closure from point of waste discharge exists for all man-made habitable structures.

If you see someone taking oysters from a closed area please call Louisiana Department of Wildlife & Fisheries (LDWF) 1-800-442-2511. For questions concerning the closures call the Office of Public Health 1-800-256-2775.  
 Background Imagery provided by ESRI  
 Not for navigational purposes.

<https://www.fox8live.com/2019/07/03/la-health-dept-closes-some-oyster-beds-due-low-salinity-levels/>



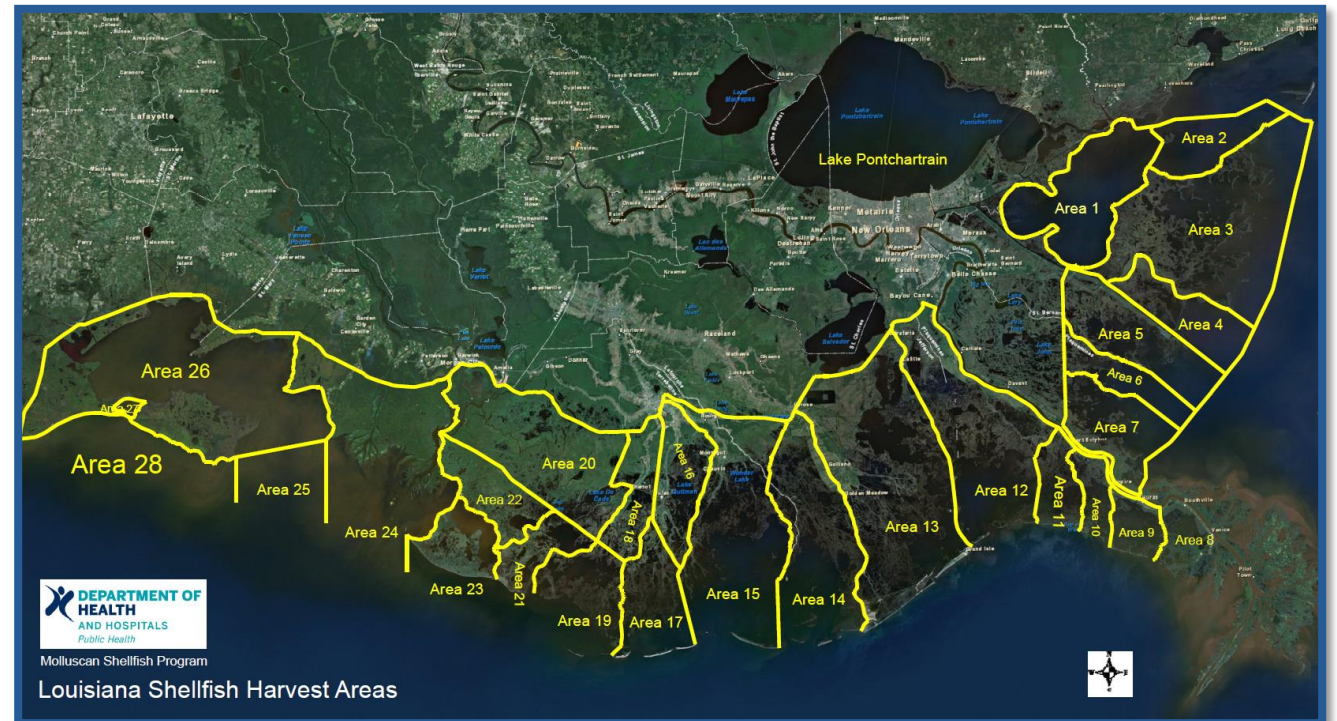
# e.g., Shellfish Surveillance in Louisiana

## Louisiana Department of Health (LDH)

- Shellfish Control Authorities
- Authorize waters for harvesting shellfish
- Monitor harvest area
- Issue closure

## Louisiana Department of Wildlife and Fisheries (LDWF)

- Manages shellfish licenses for commercial and recreational harvesters/dealers
- Notifies commercial and recreational licenses' holders about closure



# Scombrototoxin control

- Proper chilling and refrigeration of fish
- Seafood HACCP





# Thanks!!!

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