
TEXAS
PARKS &
WILDLIFE

Harmful Algal Blooms (HABs) in North Texas

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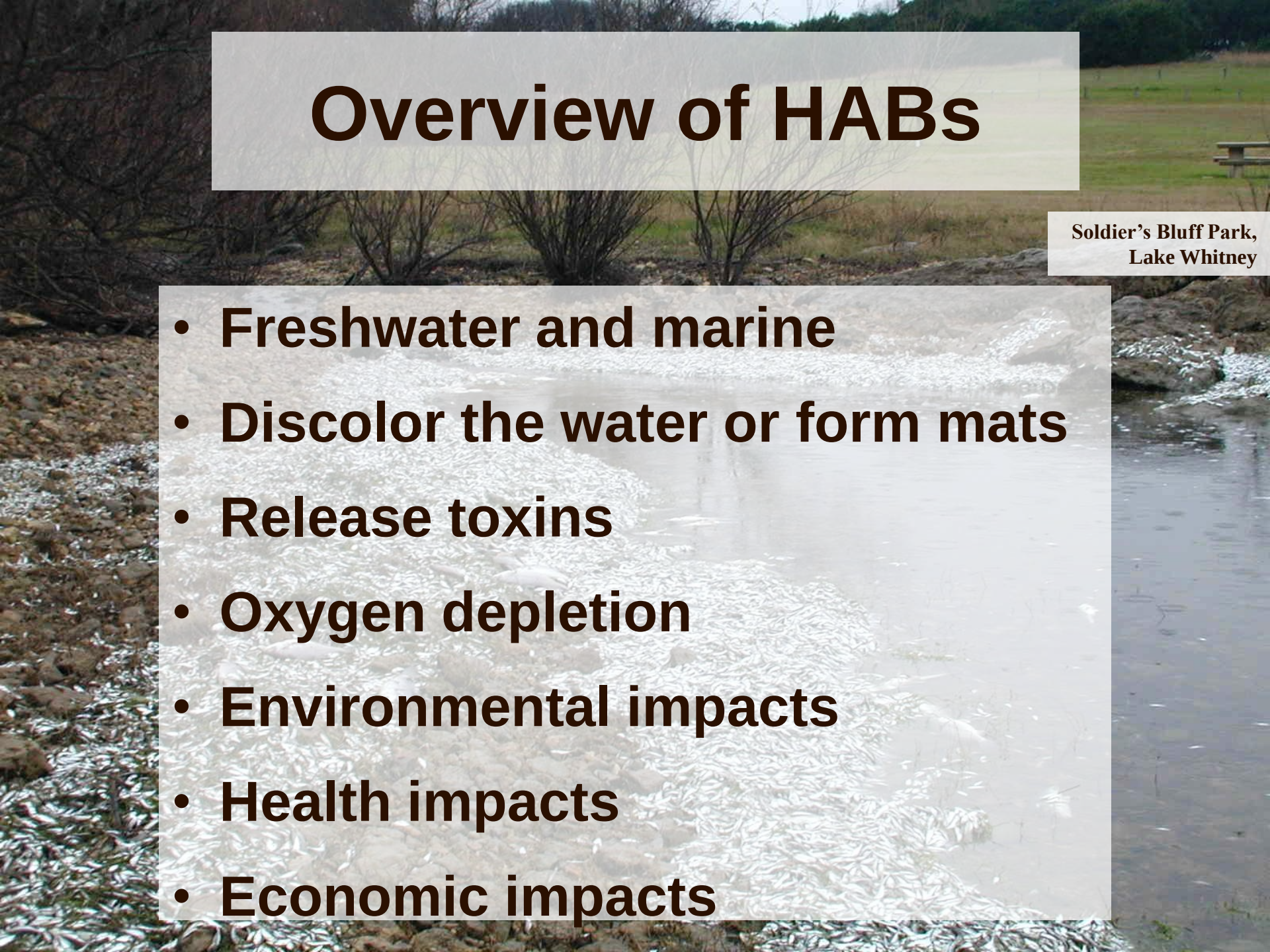
TPWD Inland Fisheries

Overview of HABs

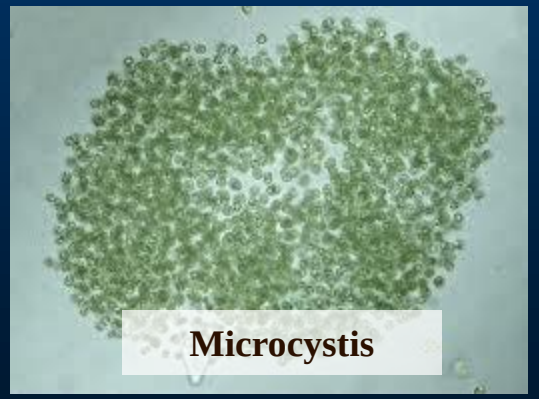


Soldier's Bluff Park,
Lake Whitney

- Freshwater and marine
- Discolor the water or form mats
- Release toxins
- Oxygen depletion
- Environmental impacts
- Health impacts
- Economic impacts

North Texas HABs

P. parvum and blue-green algae



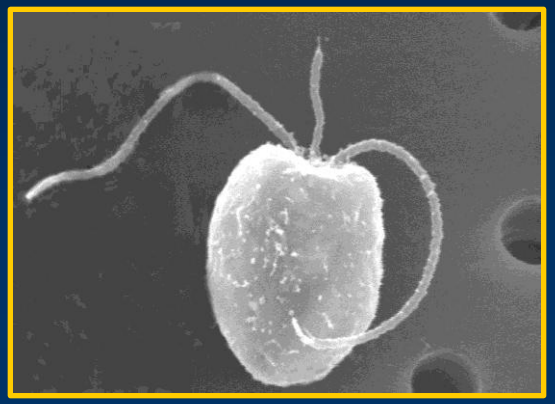
Comparative Lethality of Selected Toxins & Chemical Agents in Laboratory Mice

	AGENT	LD_{50} (µg/kg)	MOLECULAR WEIGHT	SOURCE
	Botulinum toxin	0.001	150,000	Bacterium
	Shiga toxin	0.002	55,000	Bacterium
	Tetanus toxin	0.002	150,000	Bacterium
	Abrin	0.04	65,000	Plant (Rosary Pea)
	Diphtheria toxin	0.10	62,000	Bacterium
#5	**Maitotoxin**	**0.10**	**3,400**	***Gambierdiscus***
#7	**Palytoxin**	**0.15**	**2,700**	***Ostreopsis***
#8	**Ciguatoxin**	**0.40**	**1,000**	***Gambierdiscus***
	Textilotoxin	0.60	80,000	Elapid Snake
	C. perfringens toxins	0.1 - 5.0	35-40,000	Bacterium
	Batrachotoxin	2.0	539	Arrow-Poison Frog
	Ricin	3.0	64,000	Plant (Castor Bean)
	alpha-Conotoxin	5.0	1,500	Cone Snail
	Taipoxin	5.0	46,000	Elapid Snake
	Tetrodotoxin	8.0	319	Puffer Fish
	alpha-Tityustoxin	9.0	8,000	Scorpion
#17	**Saxitoxin**	**10.0 (Inhal 2.0)**	**299**	***Alexandrium* & *Gymnodinium***
	VX	15.0	267	Chemical Agent
	SEB (Rhesus/Aerosol)	27.0 (ED_{50}~pg)	28,494	Bacterium
	Anatoxin-A(s)	50.0	500	Blue-Green Algae
	Microcystin	50.0	994	Blue-Green Algae
	Soman (GD)	64.0	182	Chemical Agent
	Sarin (GB)	100.0	140	Chemical Agent
	Aconitine	100.0	647	Plant (Monkshood)
	Brevetoxin	**180.0**	**1,000**	***Karenia brevis***

Adapted from: Defense Against Toxin Weapons, David Franz DVM, PhD, Colonel (ret), U.S. Army
www.usamriid.army.mil/education/defensetox/toxdefbook.doc

Prymnesium parvum
the "golden alga"

- Brackish water alga (salinity above 2 ppt)
- 1 haptonema, 2 flagella
- "corkscrew" swimming pattern
- Toxic to gill-breathing organisms: fish, clams, mussels, crawfish, tadpoles
- No known human health effects



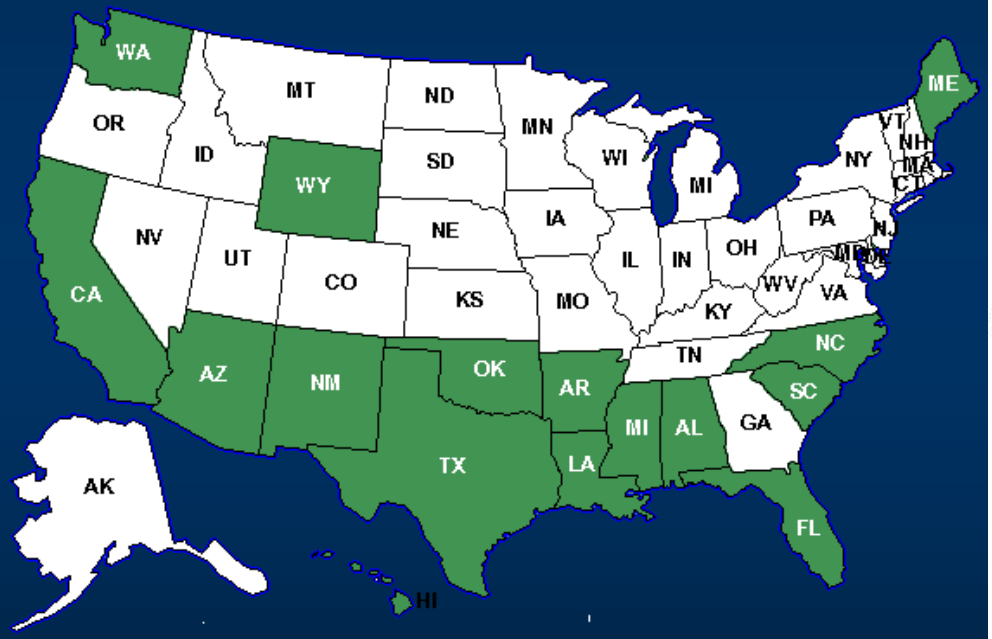
Prymnesium parvum
the "golden alga"

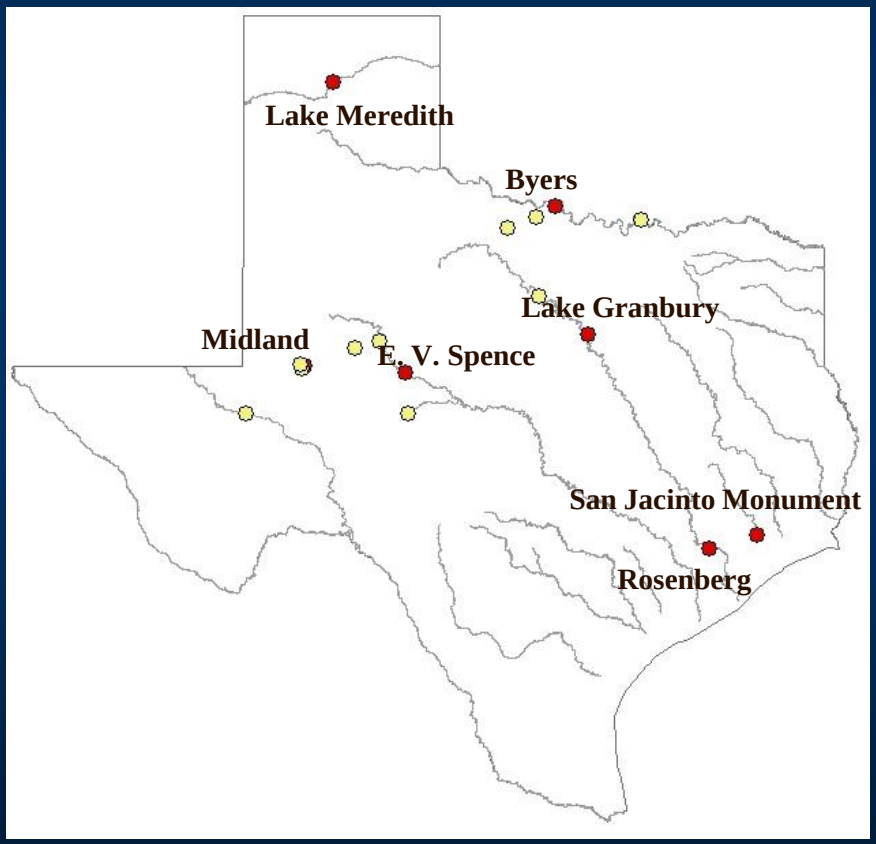
- 1985: fish kill on Pecos River
- Suspected in "low DO" fish kills dating back to the 1960s on Brazos, Pecos and Wichita Rivers
- Wide temperature tolerance: 5°C to 30°C
- Blooms in winter usually
- Dormant cyst stage

Jackson Bend, Lake Granbury

Possum Kingdom Reservoir

Prymnesium parvum
the "golden alga"





Signs of a toxic event

- water may have a yellow or copper tint
- heavy white foam along shoreline
- may appear to be low D.O. problem
  - fish hovering, not gasping for air
  - pale gills
  - redness around fins and gills
- clams and mussels may die, detach from shells, float
- large numbers of piscivorous birds
- fish will seek refuge areas

Treatments for golden alga

- Physical methods
- Chemical methods
- Cause lysis and/or detoxify
- Often too costly to be practical on large water bodies

Physical Treatments

- X Sonication (Ultrasound)
- X Biological control (Liquid Live Microorganisms)
- X Barley straw/extract
- ✓ UV sterilization
- ✓ Ozonation

Chemical Treatments

X Acids (HCl and H_2SO_4)

? Nitrogen : Phosphorous (5:1)

(Kills Cells But Reduces Striped Bass Production)

? Oxidative compounds

($KMnO_4$, H_2O_2; Reduces Toxicity But Concentration Undefined)

✓ Ammonium sulfate

✓ Copper algaecides

Chemical Treatments
Pros and Cons

Ammonium sulfate

- Most commonly used method by TPWD hatcheries
- Cheap
- Not an approved algaecide

Copper algaecides

Copper sulfate – $CuSO_4$

- some organisms very sensitive to copper ion in water
- not a preferred method (harmful to primary and secondary production)

Cutrine® Plus – chelated $CuCO_3$

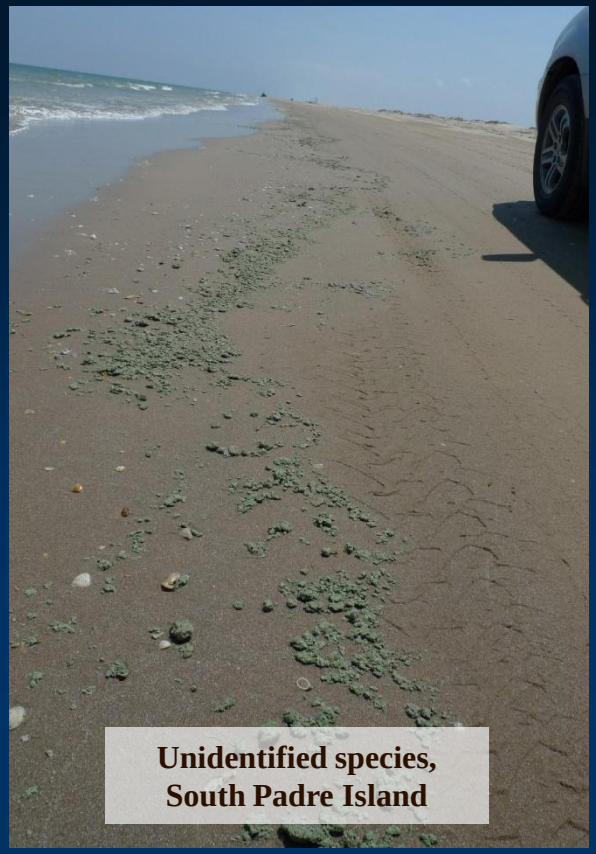
- effective treatment = 0.2 mg/L total copper
- treatments over 0.4 mg/L = rainbow trout mortality

TPWD Golden Alga Response

- Treating rivers and reservoirs is not possible
- Regular monitoring
  - Collect water samples
  - Determine *P. parvum* concentrations
  - Test water for toxicity
- Investigate fish kills
- Keep public informed via TPWD website, TexHAB email distribution list, TPWD HAB Facebook page

Blue-Green Algae

- Also called cyanobacteria, cyanophytes, cyanoprokaryota
- Unicellular, colonial and filamentous forms
- Found in nearly all freshwater, marine and terrestrial habitats on Earth
- Many occur in extreme habitats such as hot springs, hypersaline lakes or deserts
- Can form massive surface blooms, cause low DO fish kills
- Can be mistaken for oil spills, paint spills, etc
- Some cyanobacteria have the ability to produce toxins and/or taste and odor compounds
- Known human health effects



Unidentified species,
South Padre Island

Spirulina, Supplejack Creek, Lavaca County

Trichodesmium, Corpus Christi

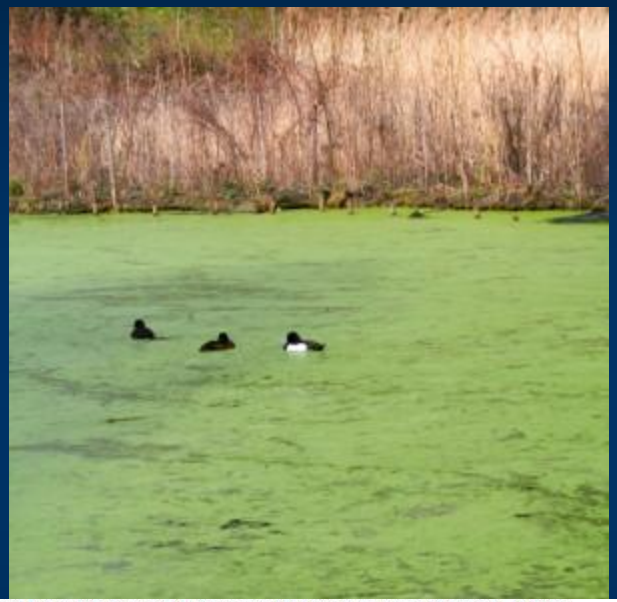
Aphanizomenon, Twin Buttes Reservoir near San Angelo

Blue-Green Algae Exposure

- Skin:
  - rash
  - hives
  - blisters
- Inhalation:
  - runny eyes
  - runny nose
  - sore throat
  - asthma-like symptoms
  - allergic reactions
- Ingestion:
  - stomach cramps
  - nausea
  - diarrhea
  - vomiting
  - paralysis
  - organ damage

Dangers to Animals

- Drinking the water
- Licking fur after swimming or wading



Vomiting	Diarrhea	Difficulty breathing
Coma	Shock	Disorientation
Seizures	Jaundice	Bloody, black stool

Pale mucous membranes

Excessive secretions (saliva, tears, etc.)

Neurologic signs (muscle tremors, muscle rigidity, paralysis, etc.)

Death

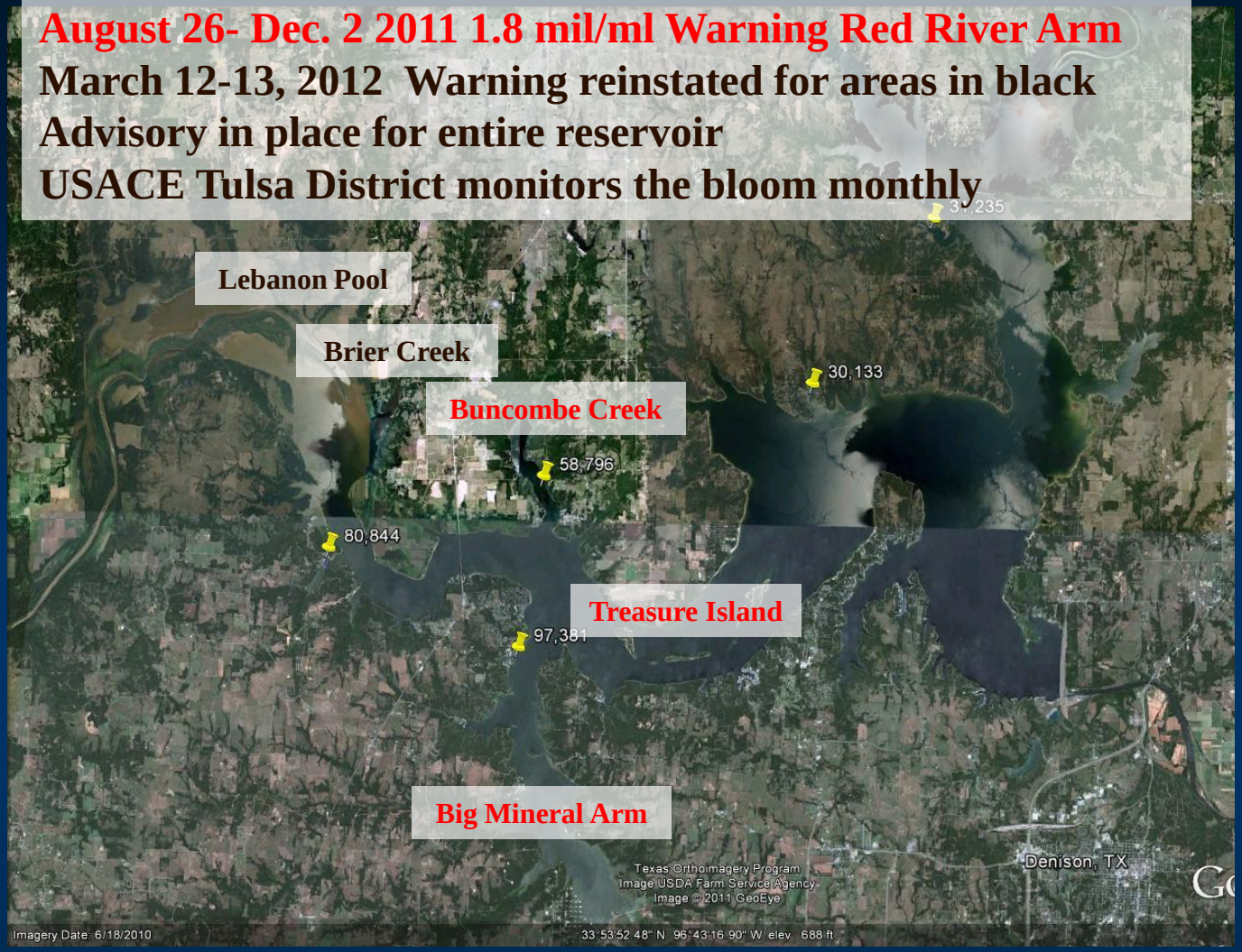
Livestock drinking from water with algal blooms are often found dead near the source of water.

A cow killed by Cyanobacteria (W. Carmichael)

Oklahoma 2011

- Reports 55 illnesses in 2011caused by blue-green algae
- Reports 6 illnesses at Texoma in 2011 caused by blue-green algae
- Reports 1 pet death

August 26- Dec. 2 2011 1.8 mil/ml Warning Red River Arm
March 12-13, 2012 Warning reinstated for areas in black
Advisory in place for entire reservoir
USACE Tulsa District monitors the bloom monthly



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World Health Organization:

- 20,000 cells/ml = advisory
- 100,000 cells/ml = warning

HAB Contacts

- Meridith Byrd, TPWD HAB Response Coordinator

  361-575-6306 meridith.byrd@tpwd.state.tx.us
- TPWD website: www.tpwd.state.tx.us/hab
- On Facebook: Texas Parks and Wildlife – Harmful Algal Blooms Research and Education
- USACE Tulsa District: www.swt.usace.army.mil


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