California's Surface Water Ambient Monitoring Program
Cyanotoxins Discovered in Different Water body Types Throughout Southern California

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Water Boards

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Presentation Overview

- Intro
- Water Body Types & Data Sources
- Methods
- Results
- Take Home Messages
- Next Steps

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Why the Concern About Cyanotoxins?

- Negative health effects/mortality on humans, domestic animals, & wildlife
  - recreation, drinking water, shellfish consumption
- Implications for a broad range of agencies
  - public health
  - natural resource management
  - water supply
  - recreation

- Bloom distributions are expanding worldwide, lasting longer, & producing more toxins (Paerl *et al*.)
- SETAC deemed cyanotoxins “Contaminants of Emerging Concern” (2012 national conference)
- No cyanotoxin monitoring programs in region or statewide

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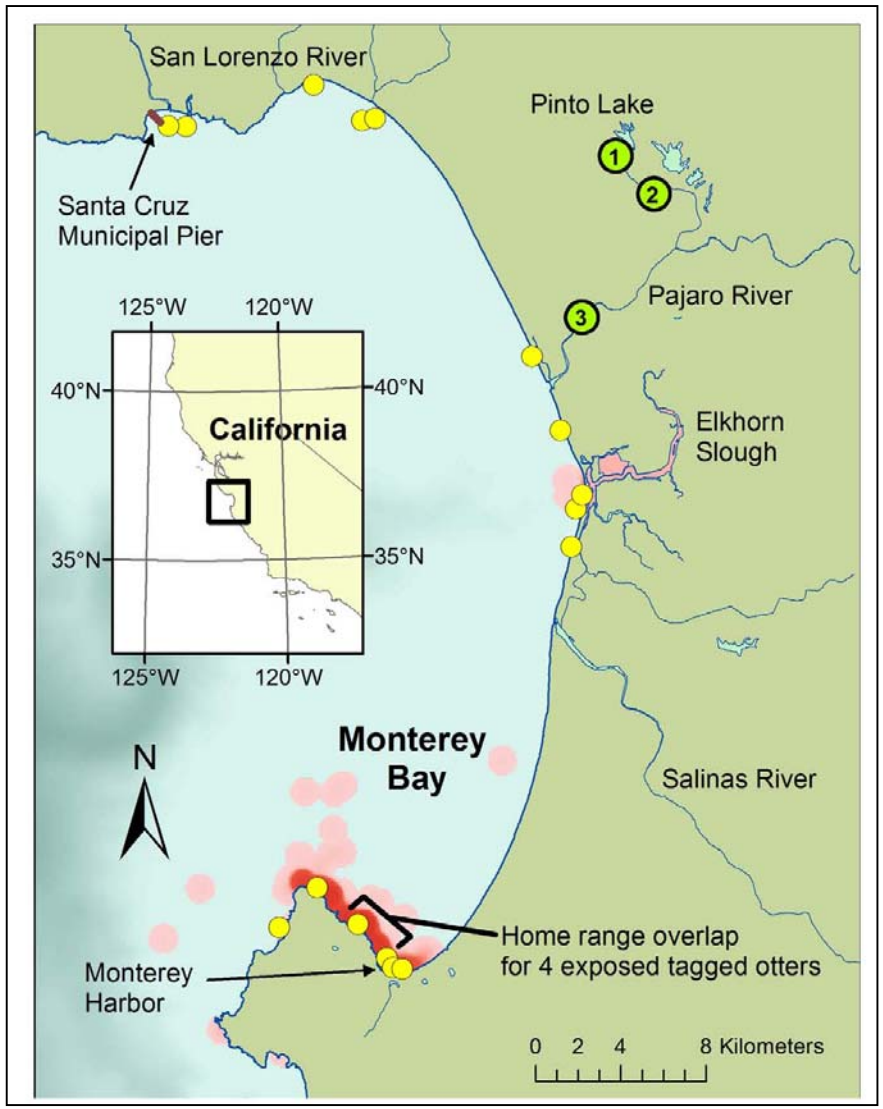
Cyanotoxins – Far Reaching Effects



Mortality of sea otters due to microcystin intoxication

- Distribution of otters dying due to microcystin intoxication
- Microcystin samples collected

Intense red shading corresponds to locations most frequently utilized by affected animals

Miller *et al*., 2010

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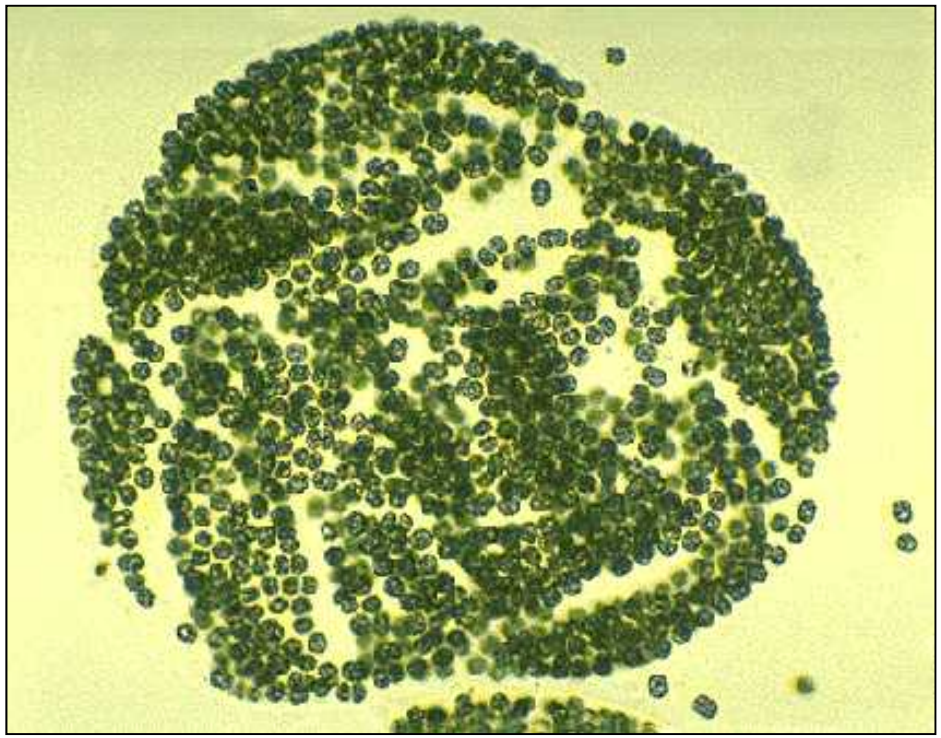
Data Opportunistically Collected Through Multiple Studies

Mainly microcystins
(most common cyanotoxins)



Some data on:

- Saxitoxin
- Lyngbyatoxin
- Anatoxin
- Cylindrospermopsin
- Nodularin

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Water Bodies Screened (Southern CA)

Probabilistic Studies

- Stormwater Monitoring Coalition (SMC)

Targeted Study

- San Diego Reference Streams Study (SCCWRP)

Probabilistic Study

- Depressional Wetlands (SWAMP/SCCWRP)

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Water Bodies Screened (San Diego Region)

Targeted Study

- Cyanotoxins in lakes and reservoirs

Targeted Study

- Cyanotoxins in coastal wetlands

Beneficial Uses

- Drinking water
- Fishing
- Recreational

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Methods of Cyanotoxin Collection

- Grab Samples (particulate)

  Toxins inside of the cells

- Continuous (dissolved) – Toxins released from the cells

Solid Phase Adsorption Toxin Tracking (SPATT) Samplers

Kudela, 2011

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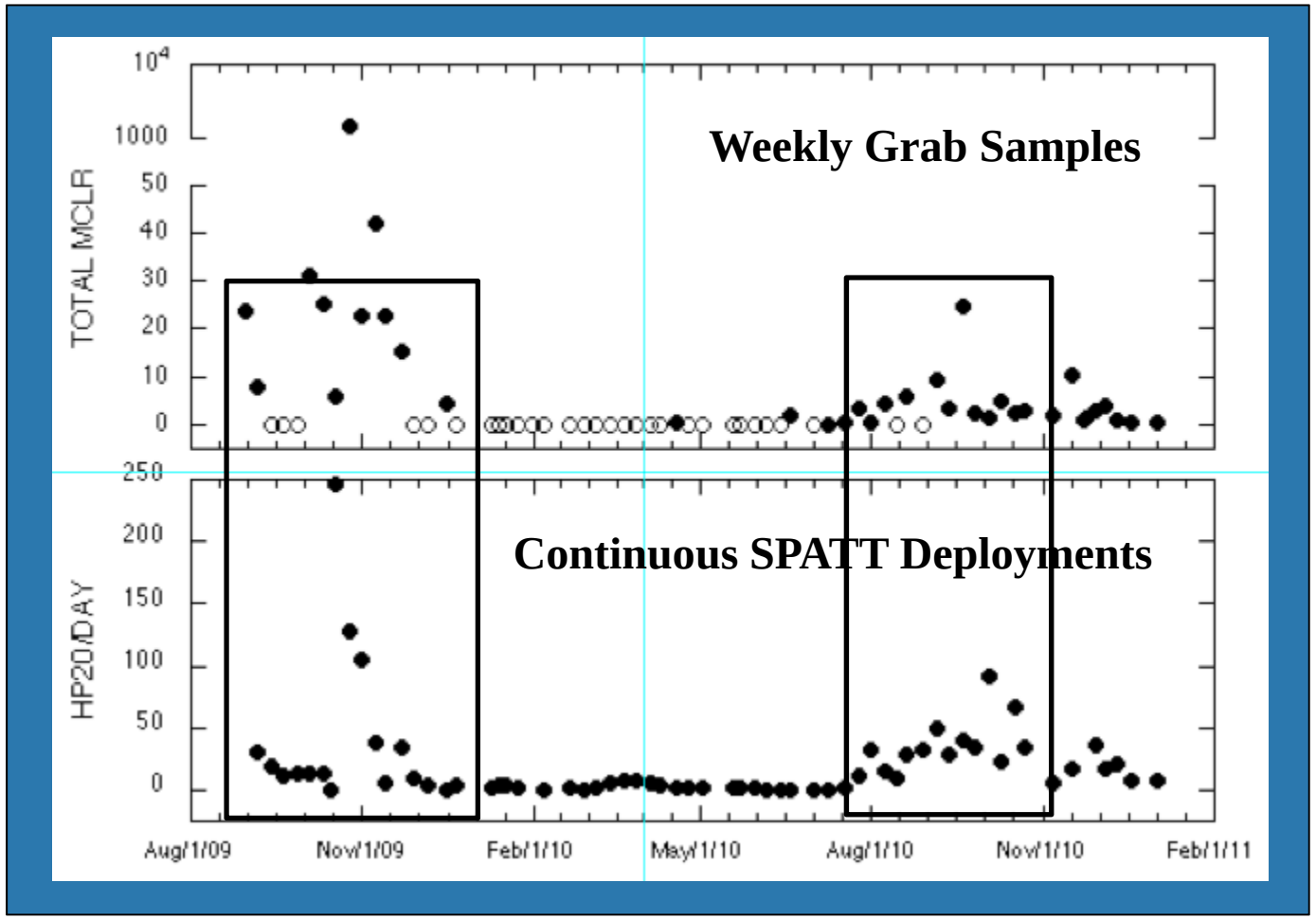
Grab Samples Can Miss Toxic Events



No Toxin Detected

Toxin Detected

Kudela, 2011

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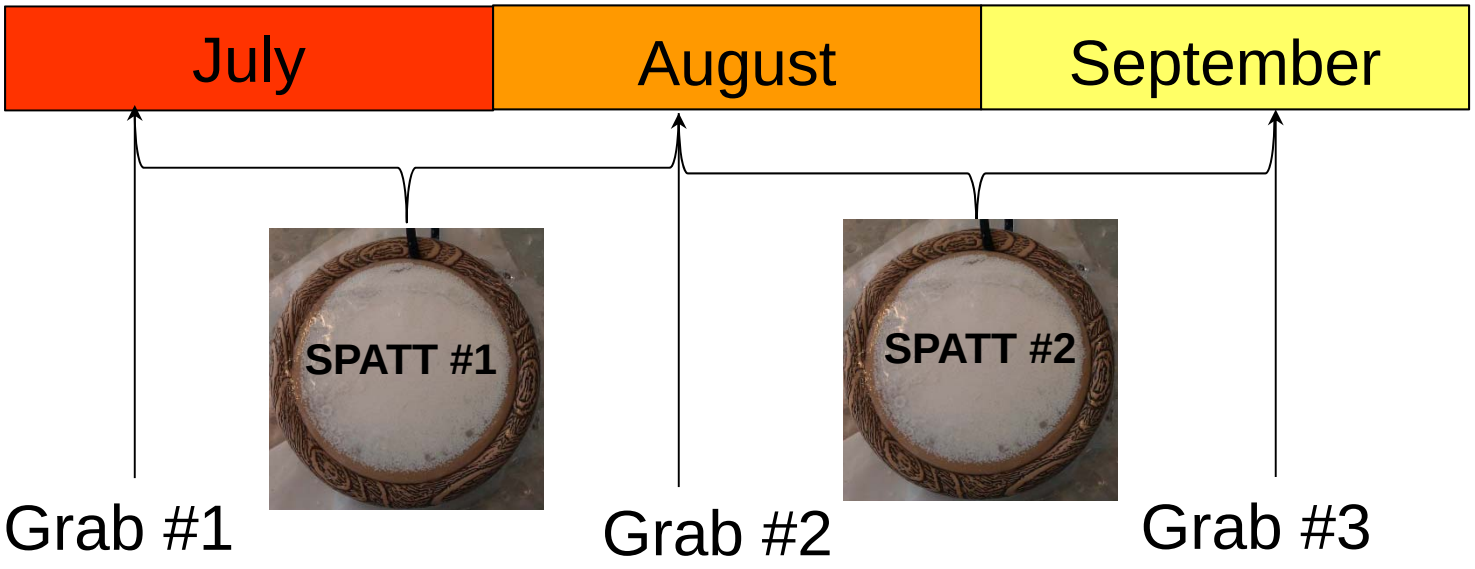
Study Design of Lakes & Estuaries



9 Coastal Wetlands

10 Lakes/Reservoirs

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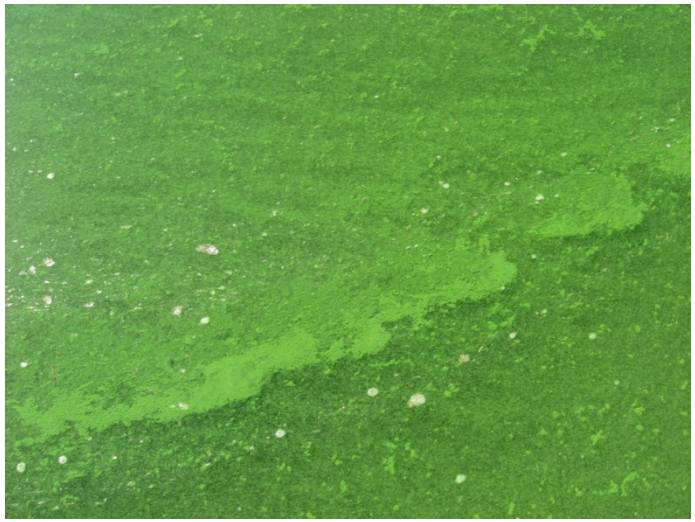
SPATT Results

STATION	NAME	SPATT #1	SPATT #2
902TV0111	Vail Lake	No	Yes
903PLH214	Lake Henshaw	Yes	Yes
904SNELLG	San Elijo Lagoon	Yes	Yes
904SNELPD	San Elijo Pond	Yes	Yes
905PLH070	Lake Hodges	Yes	Yes
905PLS198	Lake Sutherland	Yes	No
90606MISS	Mission Bay	No	Yes
906LSPNLG	Los Penasquitos Lagoon	No	Yes
906PLM142	Lake Miramar	Yes	Yes
907CUYRES	Cuyamaca Reservoir	Yes	Missing
907LKMURR	Lake Murray	Yes	No
907PEC062	El Capitan Reservoir	Yes	No
907SDRVES	San Diego River Estuary	No	Yes
908SDBNTC	San Diego Bay near NTC	Yes	Yes
908SDBYSS	San Diego Bay Silver Strand	Yes	No
908SDBTSW	San Diego Bay Sweetwater	No	Yes
910PLO182	Lower Otay Reservoir	Missing	Damaged
911PMR110	Morena Reservoir	Missing	Yes
911TJRVES	Tijuana River Estuary	Yes!	Yes



- All sites had a “hit” during at least one of the SPATT deployments!

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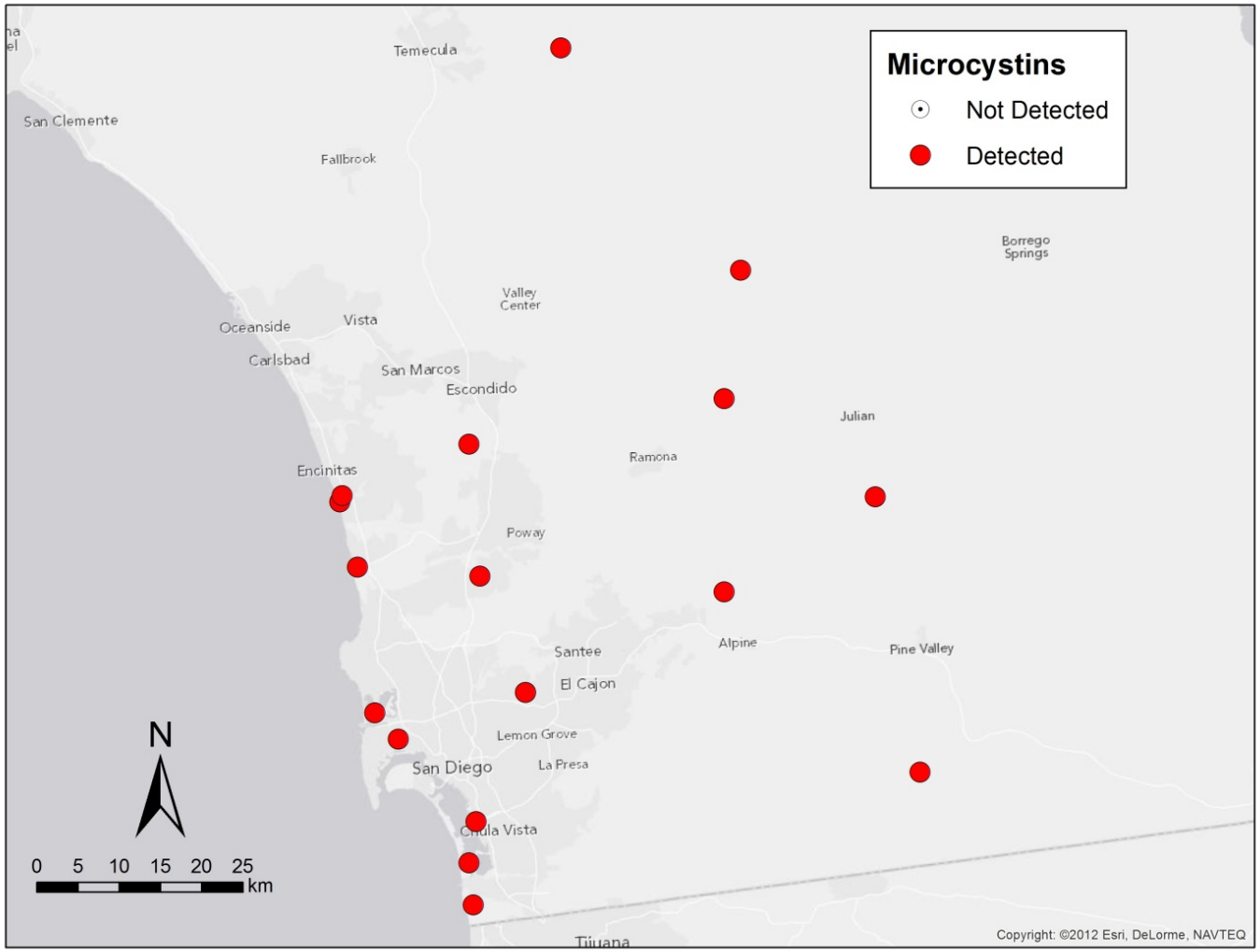
Microcystins Detected in Estuaries & Lakes (San Diego Region / Targeted)

SPATT Results



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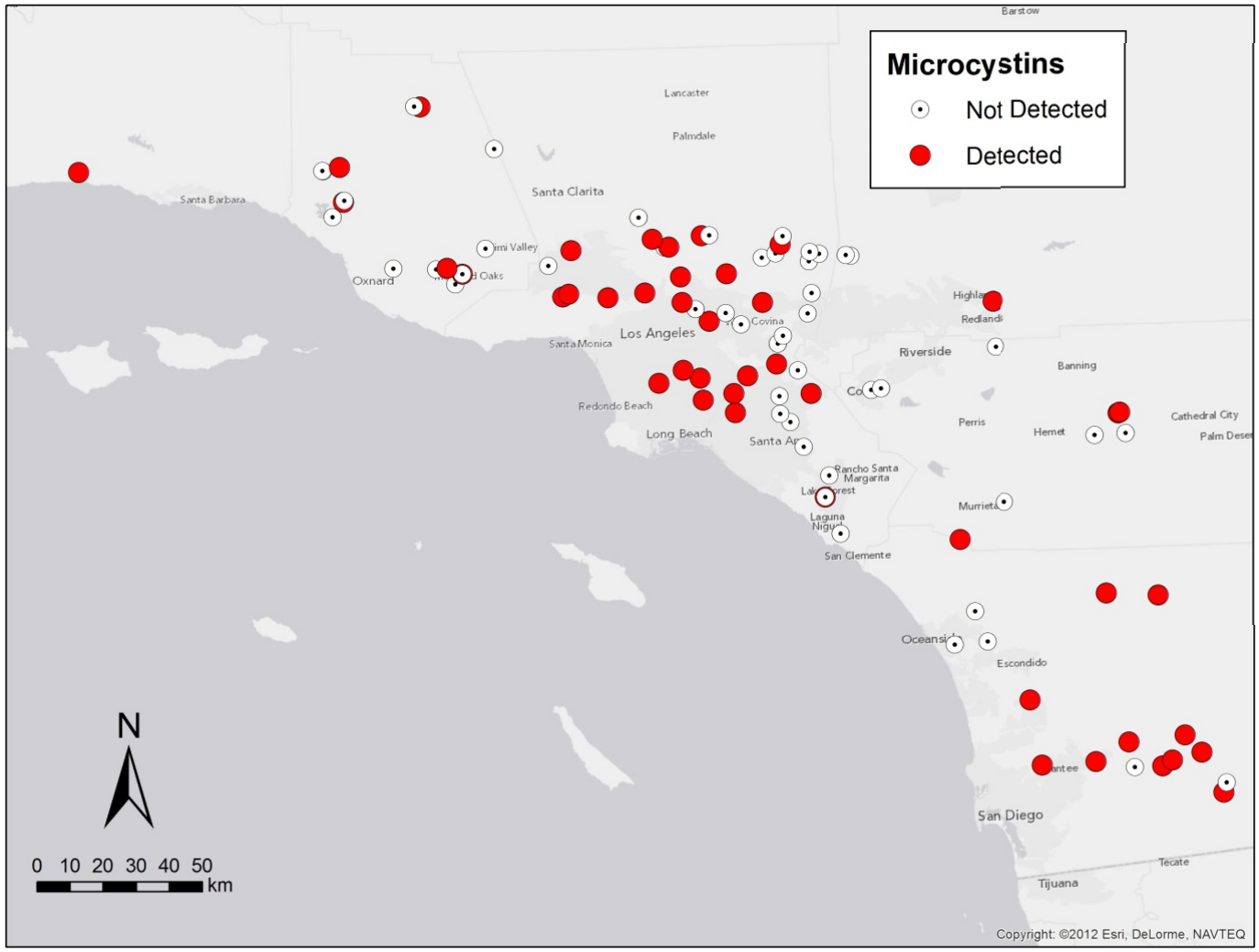
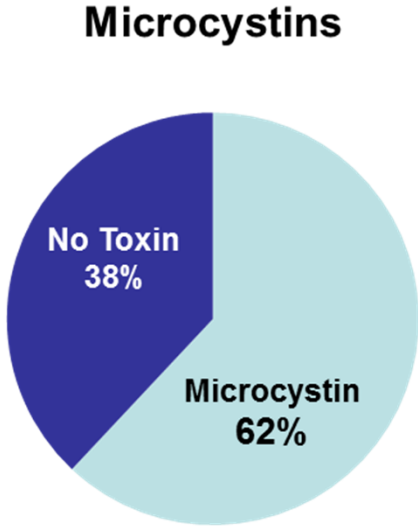
Microcystins Detected in Wadeable Streams (Southern CA / Probabilistic)
Filter Results





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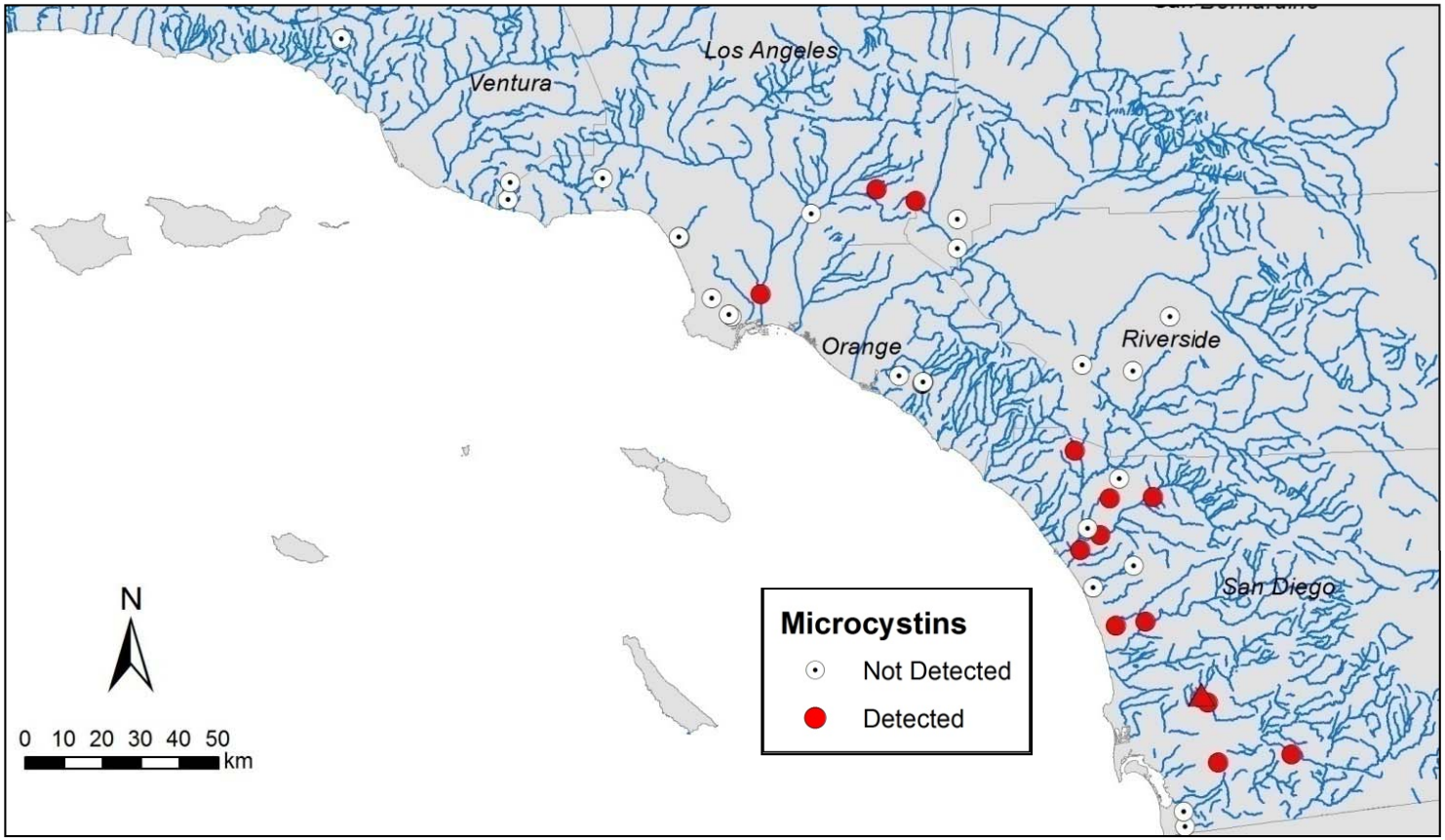
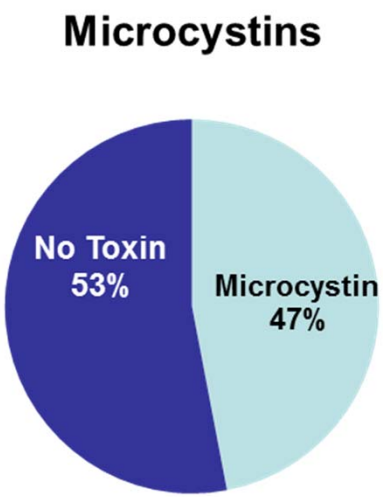
Microcystins Detected in Depressional Wetlands
(Southern CA / Probabilistic)
Filter & SPATT Results





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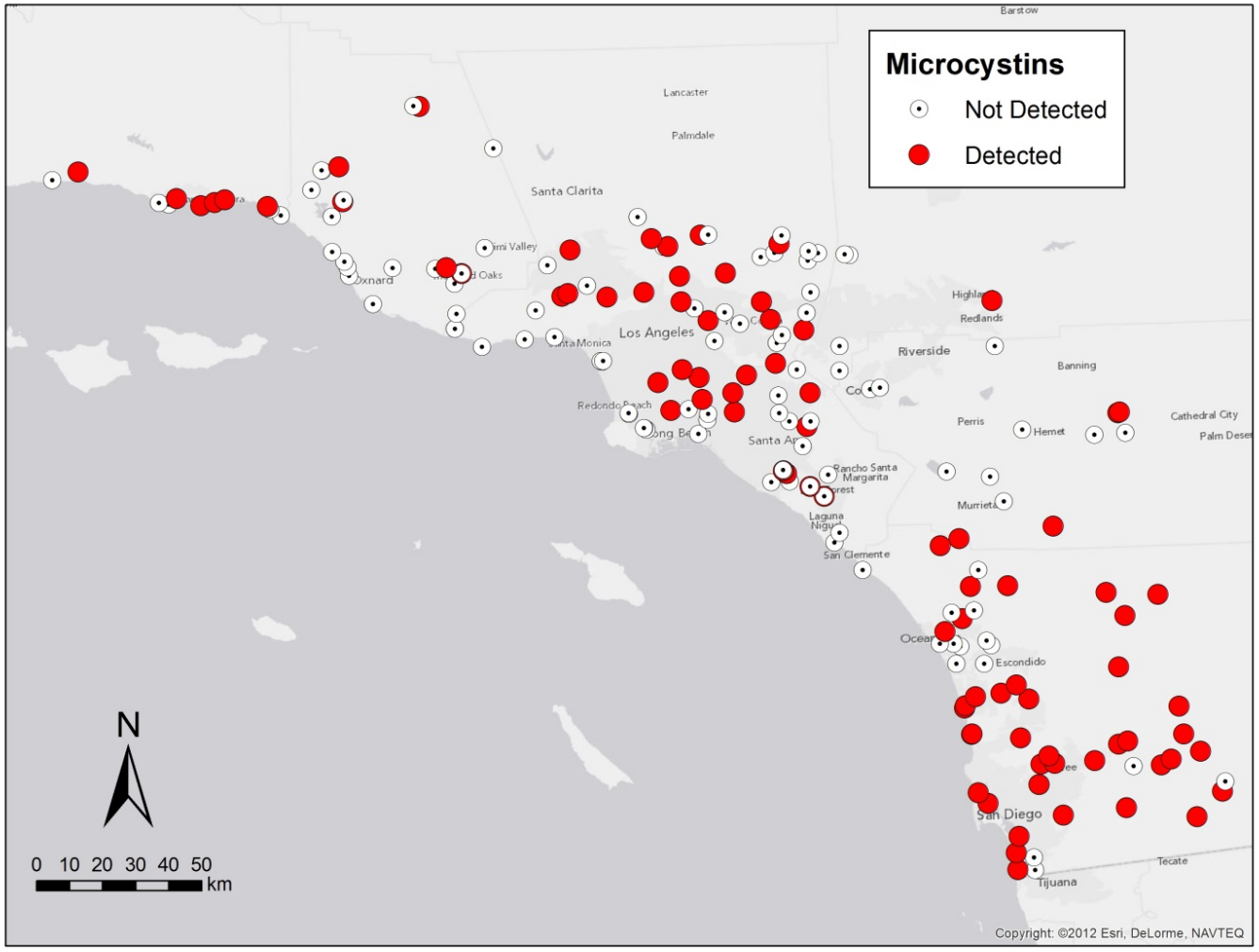
Microcystins Widespread in Southern California Water Bodies



- Depressional wetlands, Coastal lagoons, Lakes, Streams, Rivers, Estuaries
- Plankton, Benthos, Dissolved
- Across many land use types

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Take Home Messages

- Cyanotoxins have been detected throughout southern California, in a wide variety of water bodies
- Multiple types of cyanotoxins have been detected, sometimes simultaneously
  - Microcystins, Anatoxin-a, Cylindrospermopsin, Lyngbyatoxin, Saxitoxin
- Cyanotoxins can affect areas far downstream from their biological origin
- SPATT (passive sampler) provides continuous monitoring of microcystins – **Great screening tool!**
  - captures ephemeral events that traditional grab samples miss

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Next Steps

- Create report that includes streams, depressional wetlands, lakes/reservoirs, and coastal wetlands
- Future cyanotoxin monitoring studies, beyond screening-level (e.g., bioaccumulation)
- Develop monitoring program

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Thank you!

Microcystins found here

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