RECLAMATION

Managing Water in the West

Lake Havasu Quagga Mussel Monitoring Program

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U.S. Department of the Interior
Bureau of Reclamation

Contents

- Background
- General Overview & Project History
- Purpose
- Data Summary
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Lake Havasu-
"Land of Blue Green Water"

- Located on the border of Arizona and California
- Created in 1938 – Parker Dam
  - Metropolitan Water District- CA
  - Central Arizona Project- AZ
- Surface area of approximately 19,300 acres
- Holds approximately 648,000 acre feet of water
- London Bridge purchased in 1968
- 14 Partners represented on the lake

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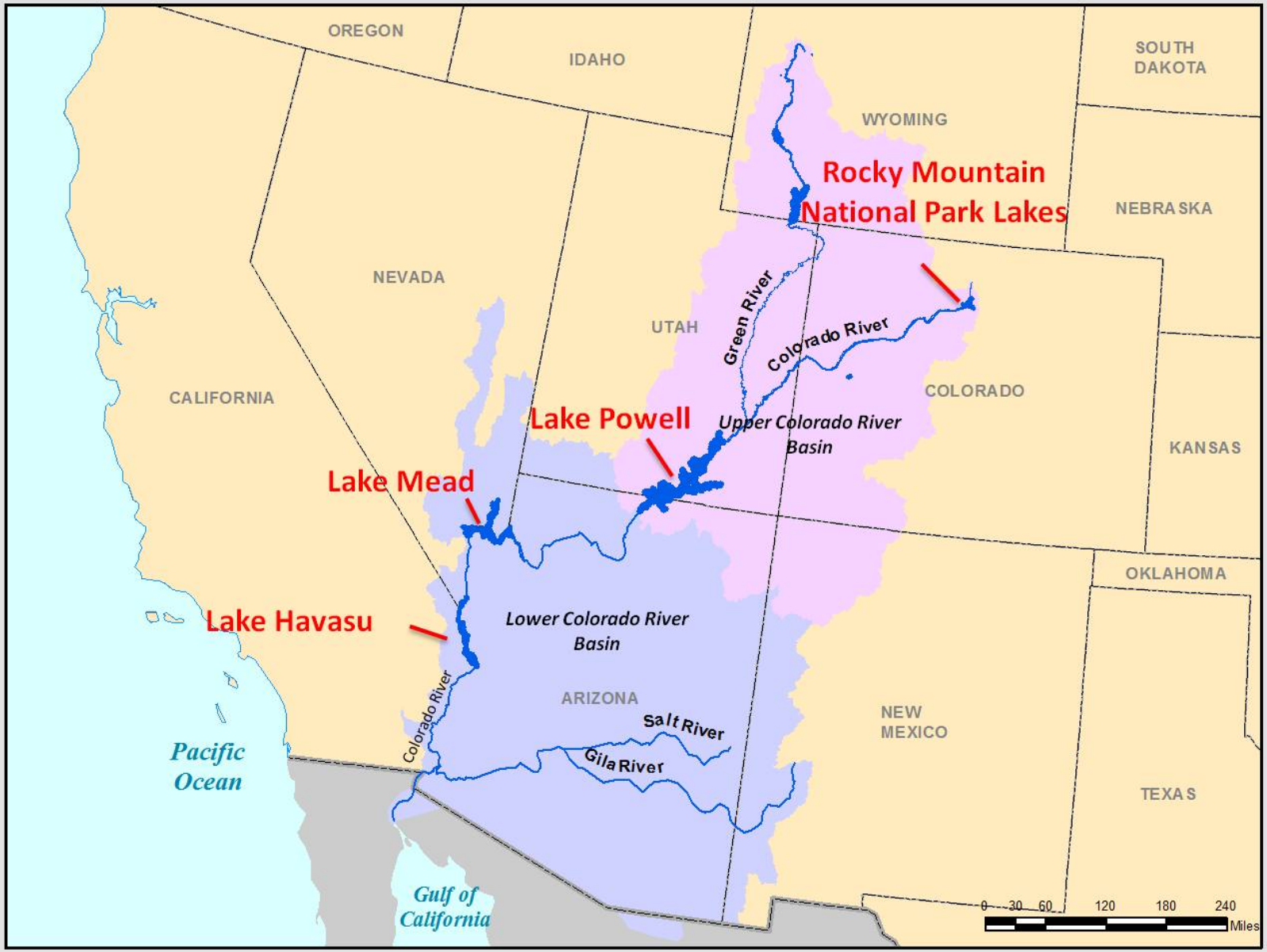

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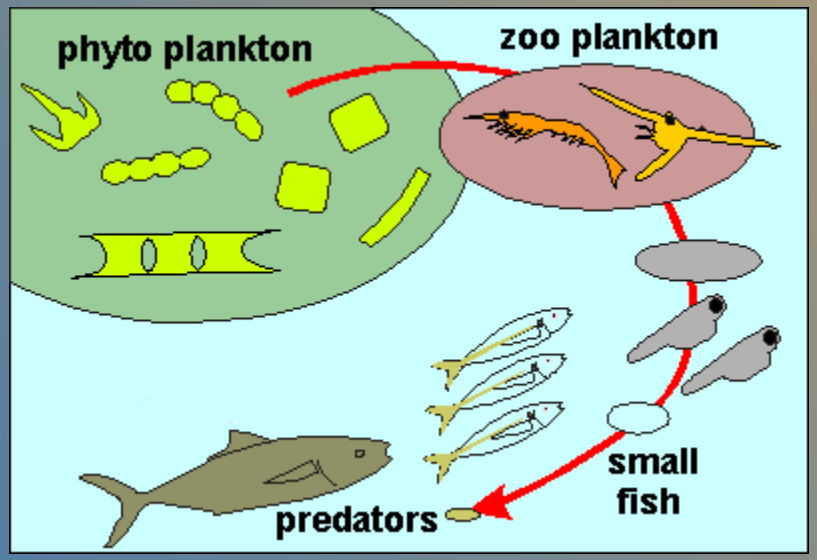
Purpose

- Collect plankton community and water chemistry data to monitor potential quagga mussel effects.
- To better understand this reservoir compared to Lakes Mead and Mohave.



http://bassfishingsystem.com/absolutely-the-best-bait-for-fishing/

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Study Timeline History Overview

- 2009 → Quagga veliger study
  - Monthly sampling- fish gut analysis
  - Secchi, water quality probe, zooplankton
- 2010 → Bi-monthly sample collection
- 2013 → Additional water quality parameters
  - Addition of phytoplankton, total phosphorus, chlorophyll
- 2014 → Nitrogen analysis added
  - Colorado River Inflow and Bill Williams River locations added
- *2015 →Meta- and Hypolimnion sampling added
  - LCR Regional Lab analyzing anions/cations, TDS

Will not be covered this presentation

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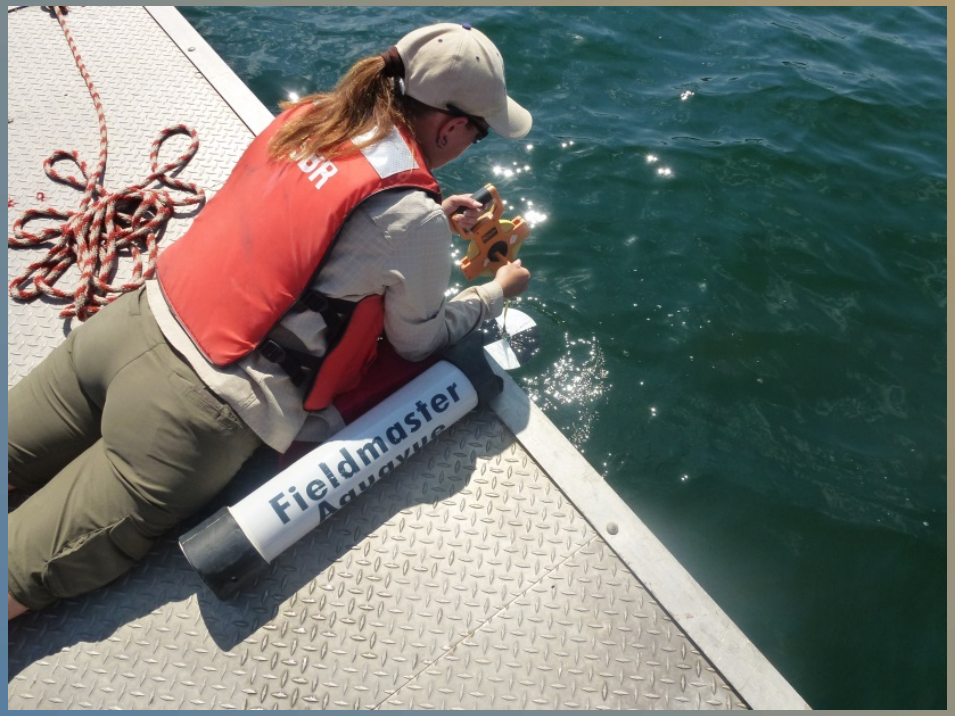
Measured Parameters

- Zooplankton
- Phytoplankton
- Nitrogen
- Phosphorus
- Chlorophyll
- Secchi
- Eureka Probe
  - Depth
  - Temperature
  - pH
  - Conductivity
  - DO mg/L
  - DO%
  - Turbidity
- Ambient Air Conditions



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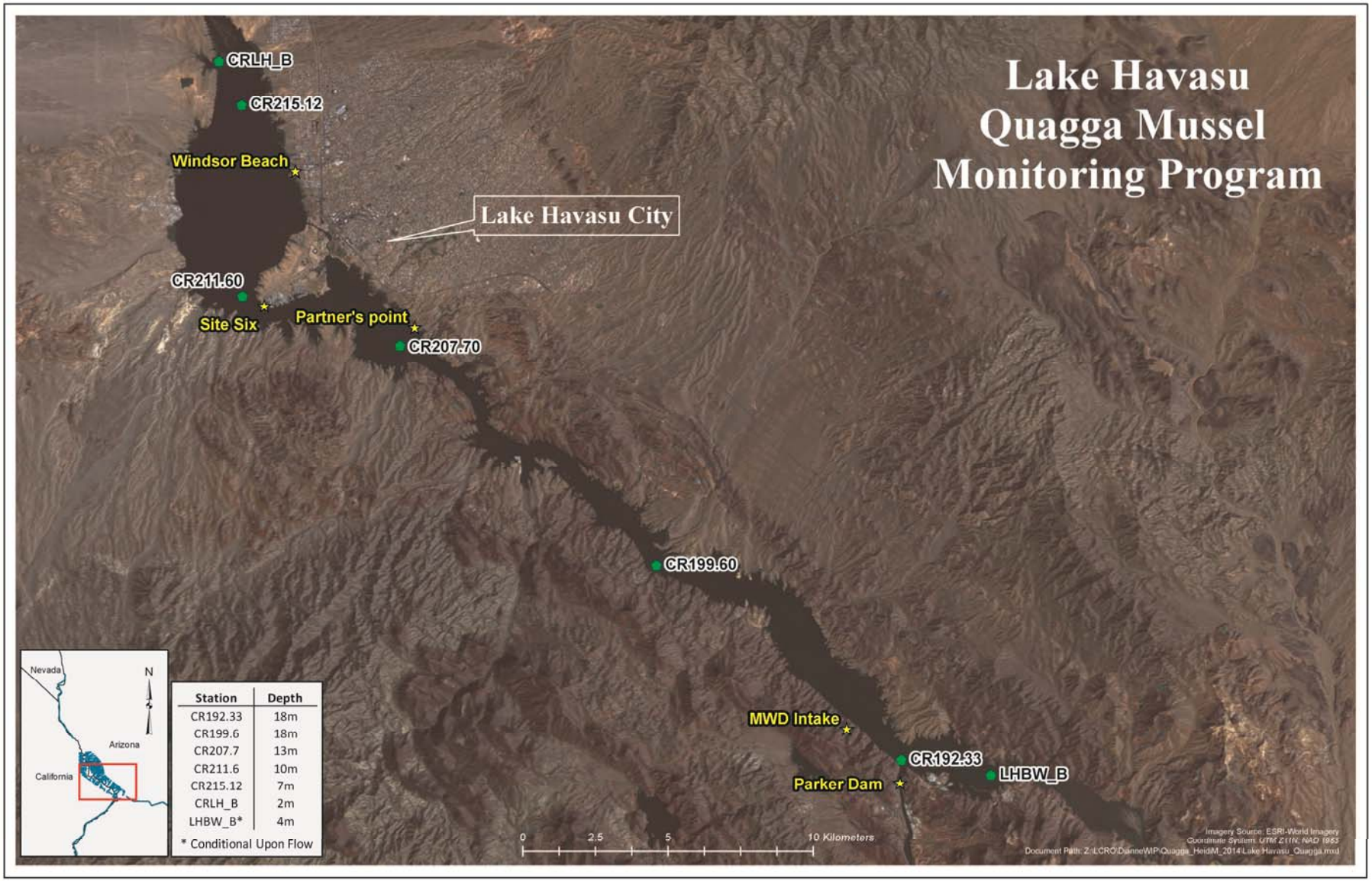

Station	Depth
CR192.33	18m
CR199.6	18m
CR207.7	13m
CR211.6	10m
CR215.12	7m
CRLH_B	2m
LHBW_B*	4m

* Conditional Upon Flow

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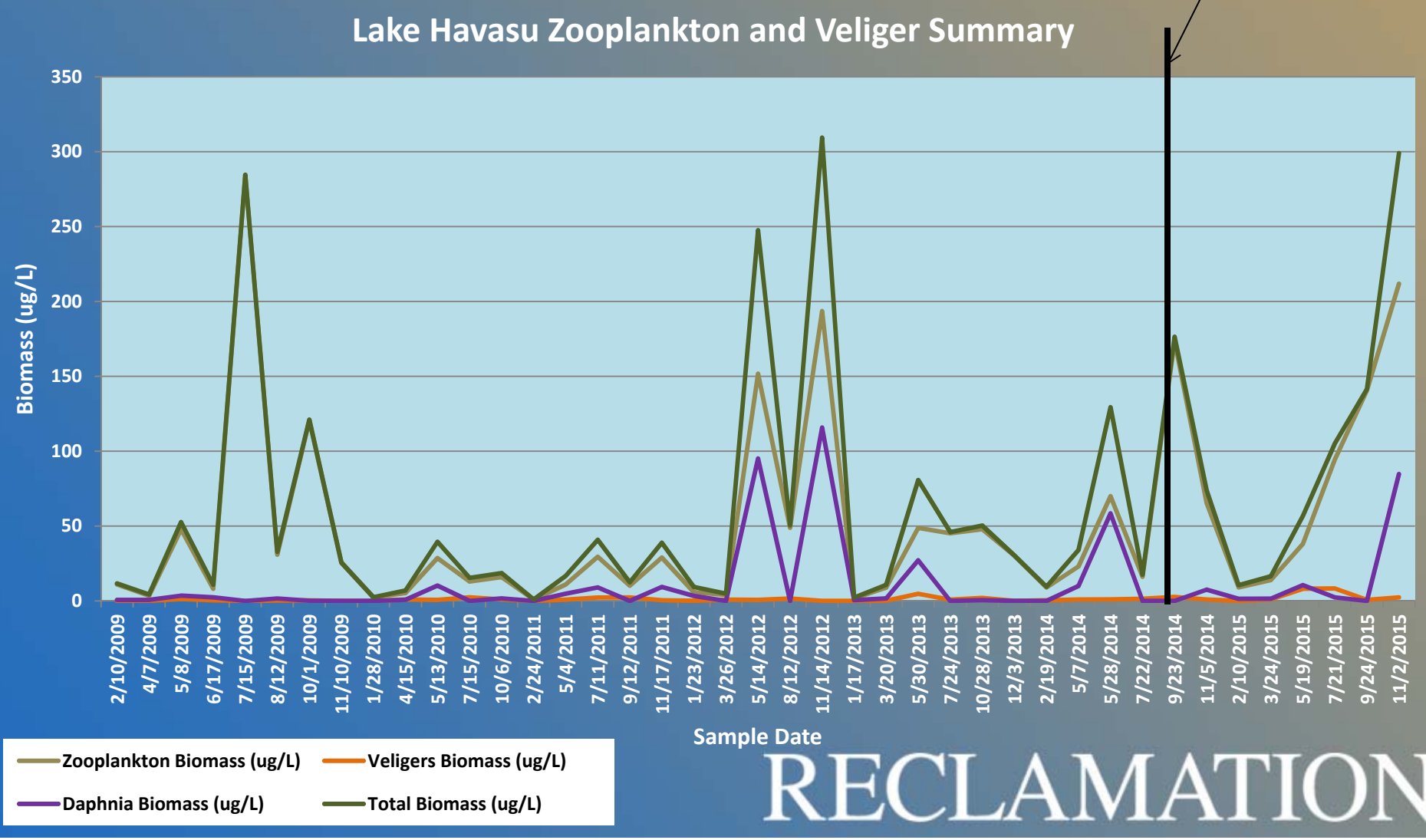
Total Zooplankton Biomass Summary



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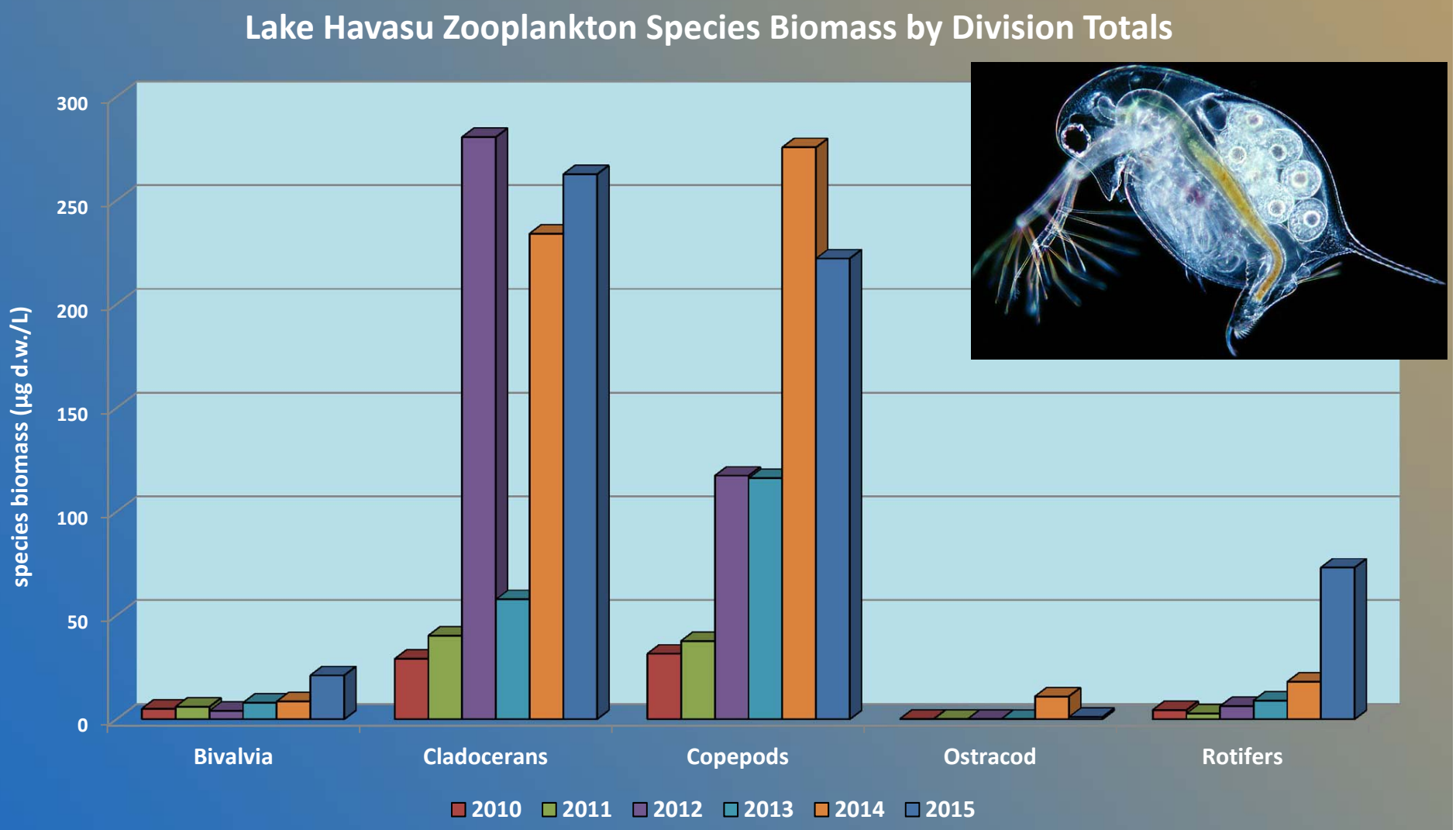
Zooplankton Division Biomass



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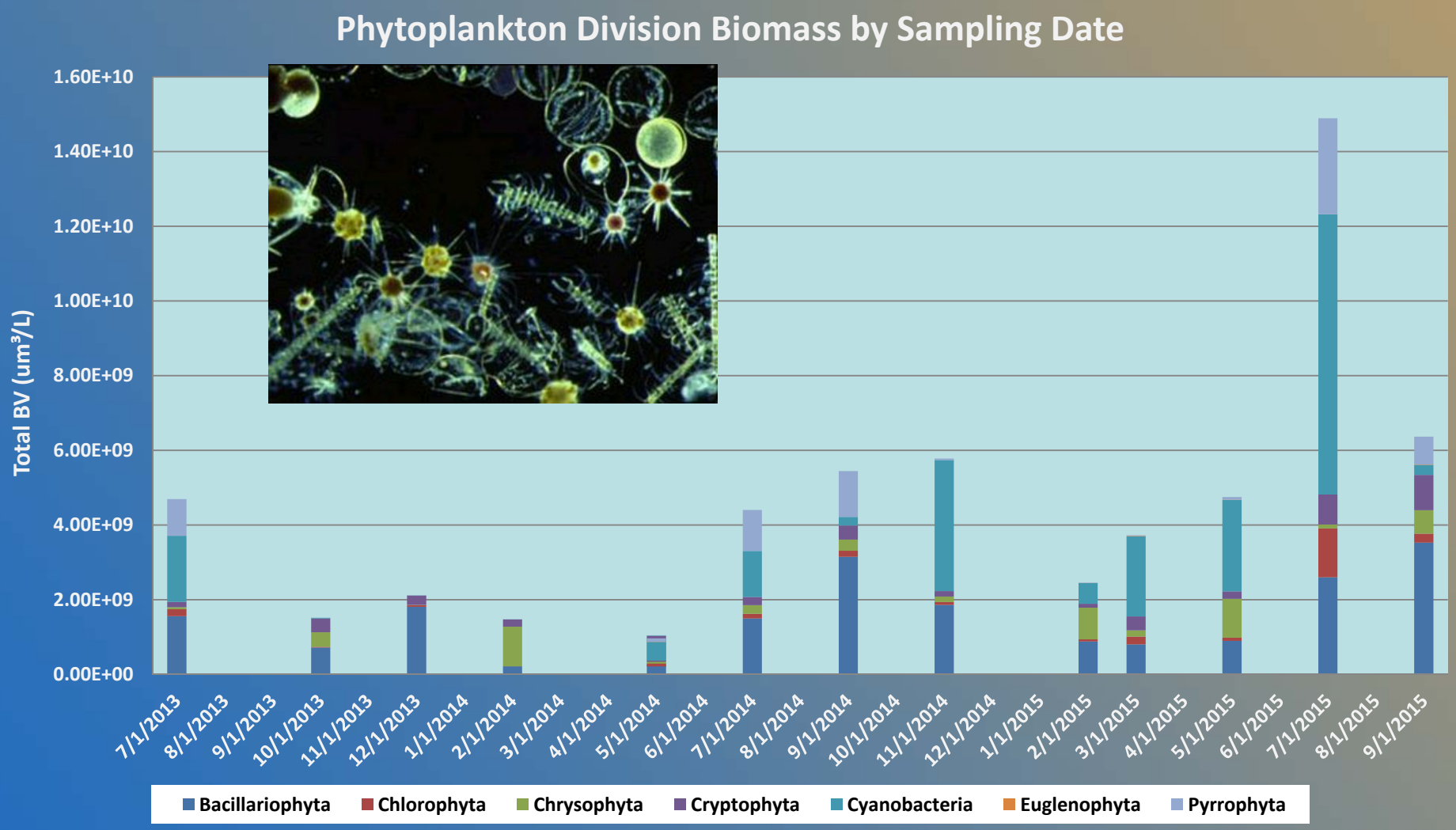
Phytoplankton Division Summary



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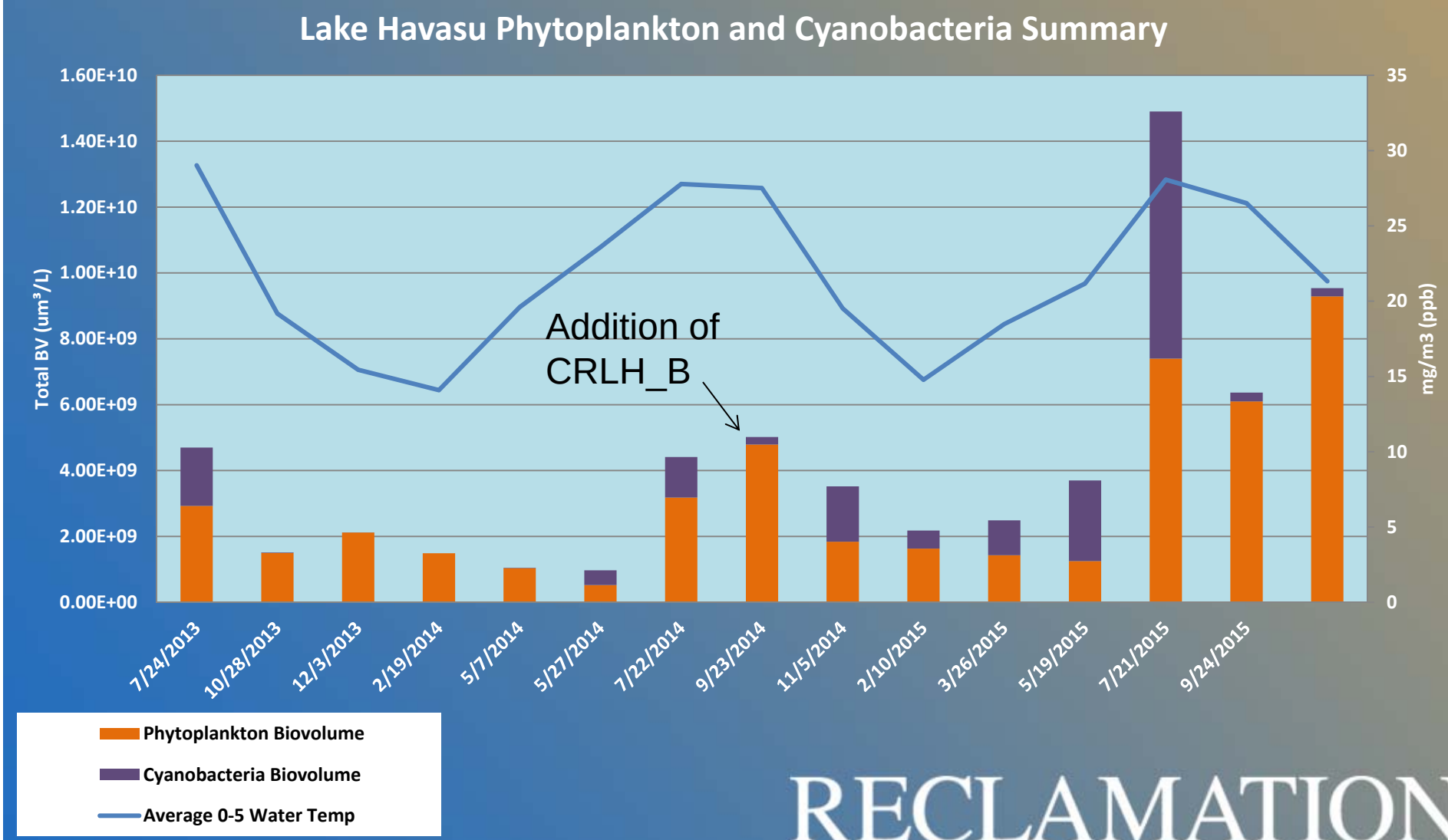
Total Phytoplankton/Cyanobacteria Summary



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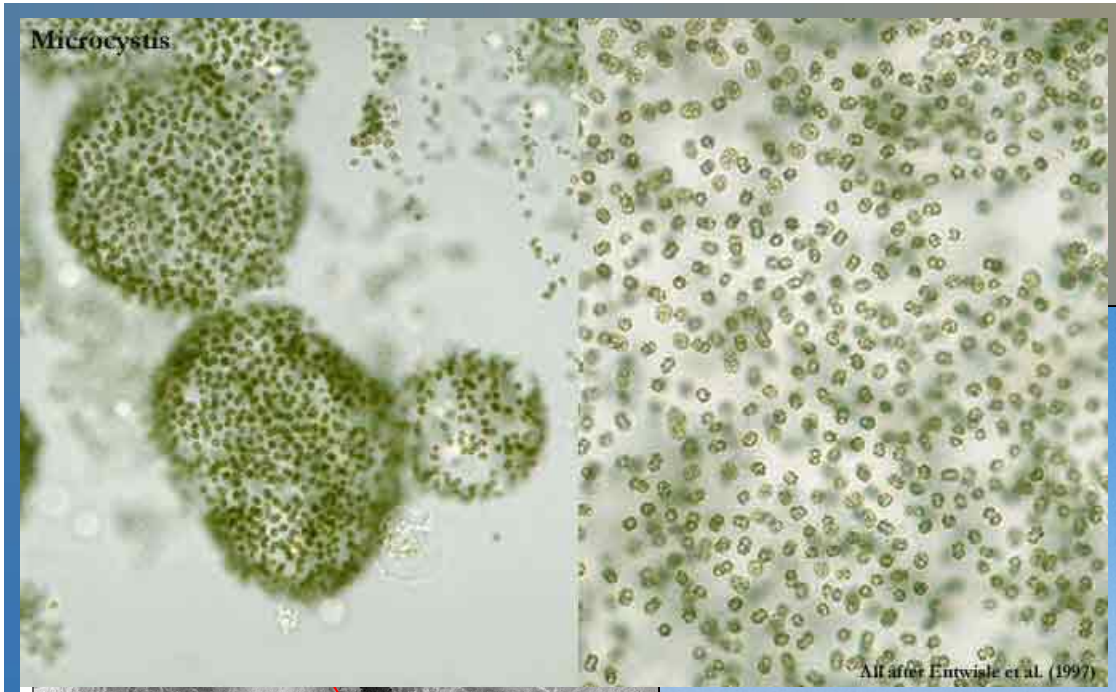

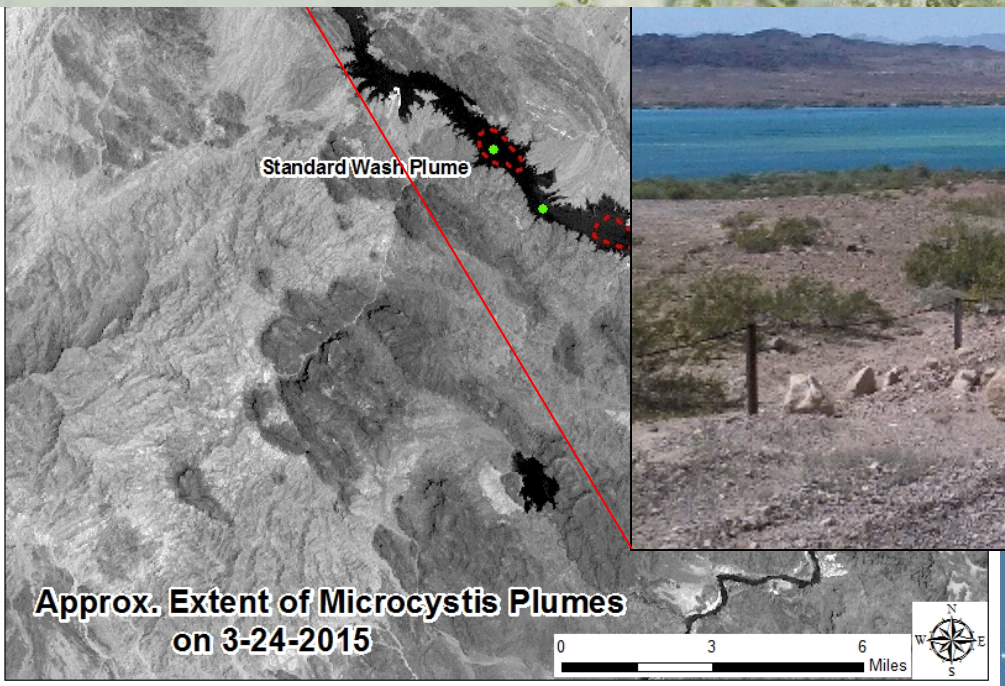

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Lake Havasu- Colorado River Inflow May 2015

Algal Toxin Analysis

- March 2015- Lake Mead positive for microcystin toxin
- March 24, 2015- collected samples at Lake Havasu for analysis
  - All sites positive for microcystin (ELISA)
- May 19, 2015- follow up sampling for toxins (MS)
  - All sites positive for microcystin, anabeanopeptin, euglenophycin, and anatoxin-a
- June 15, 2015- confirmed species via PCR
- July 21, 2015- continued monitoring of toxins
  - All sites positive for microcystin
- September- tested via Abraxis test strips
  - All sites positive but low levels

http://www2.epa.gov/nutrient-policy-data/policies-and-guidelines

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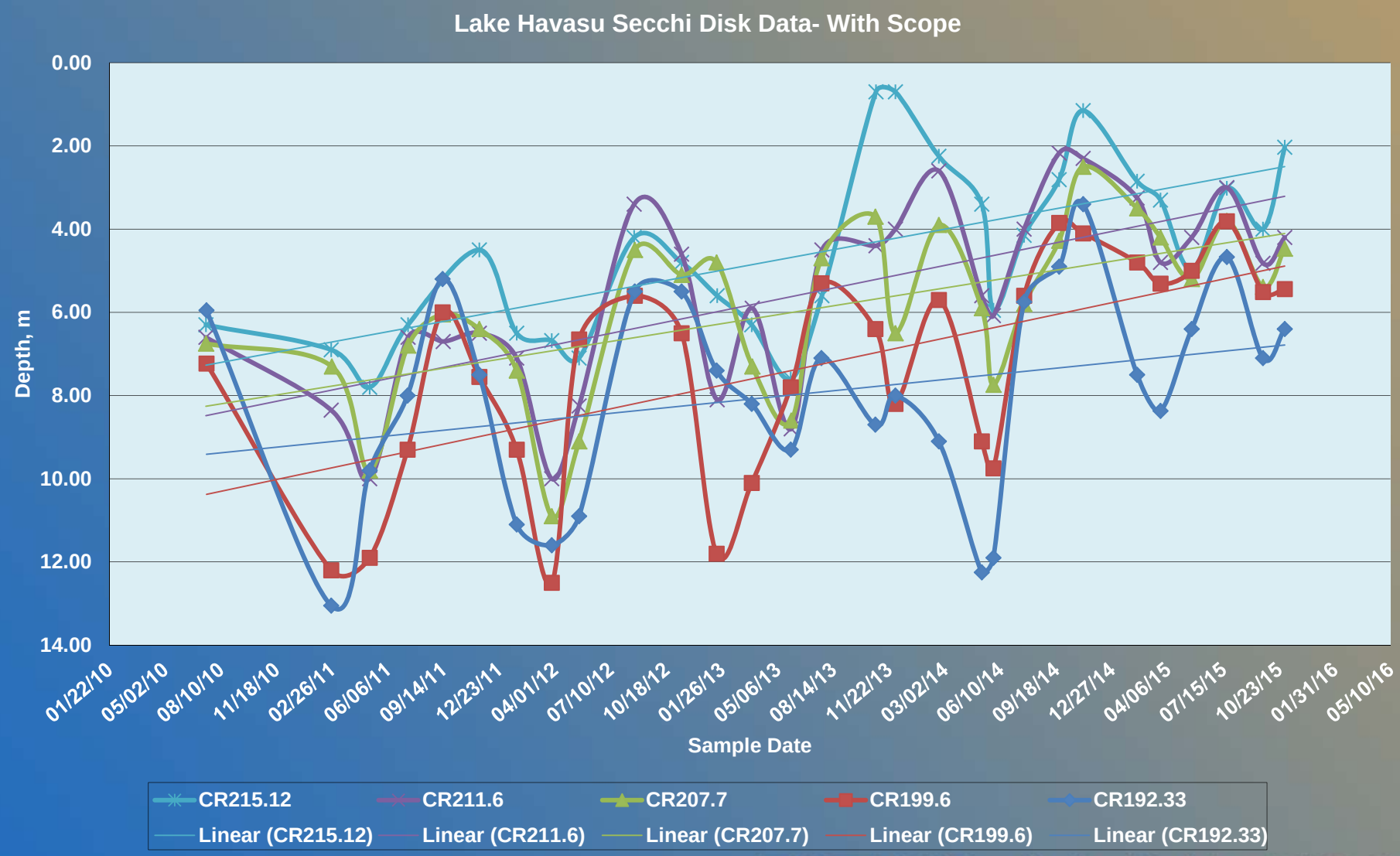
Secchi Depth (with scope)



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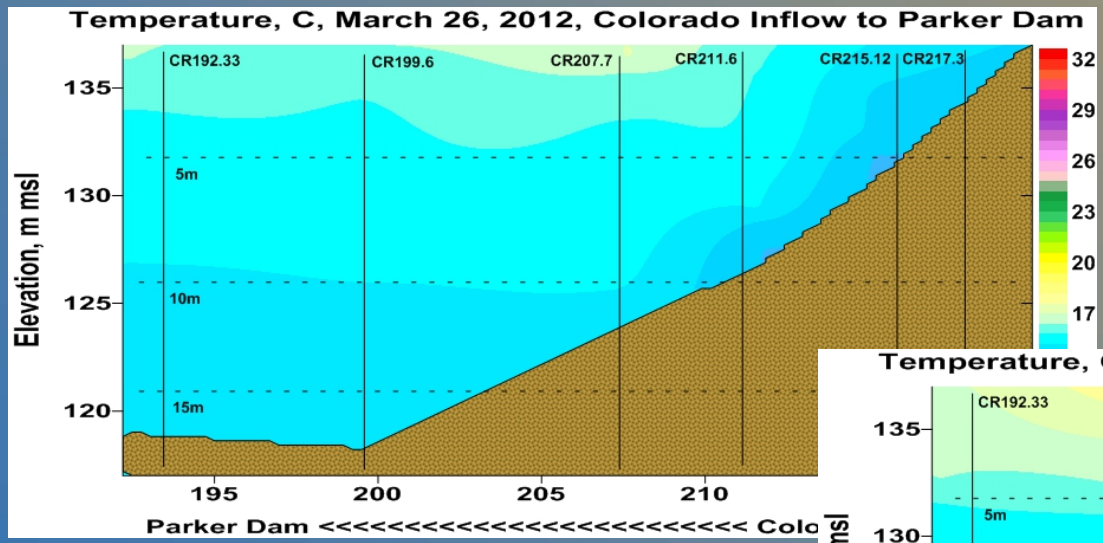
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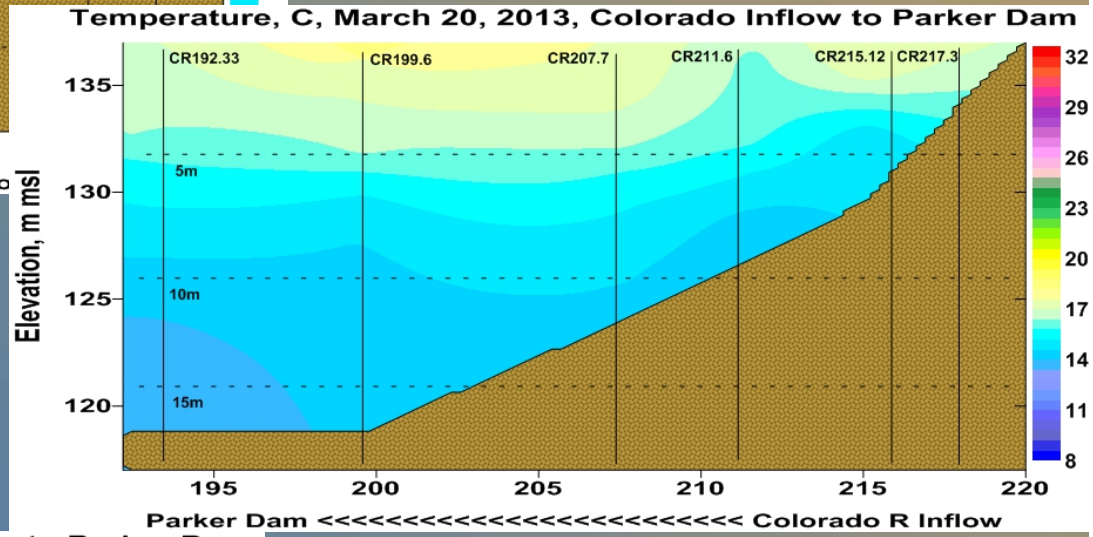
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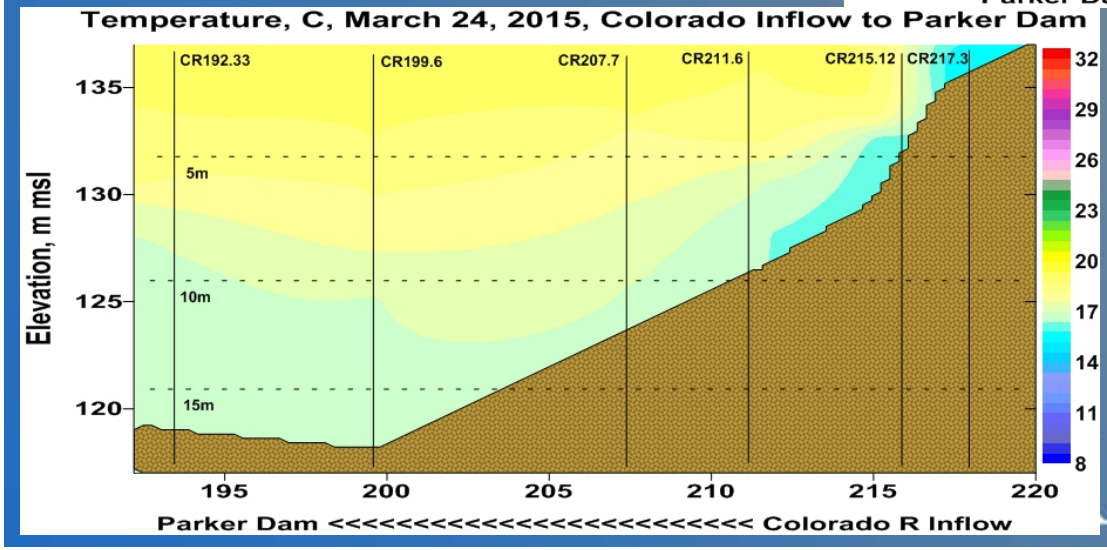
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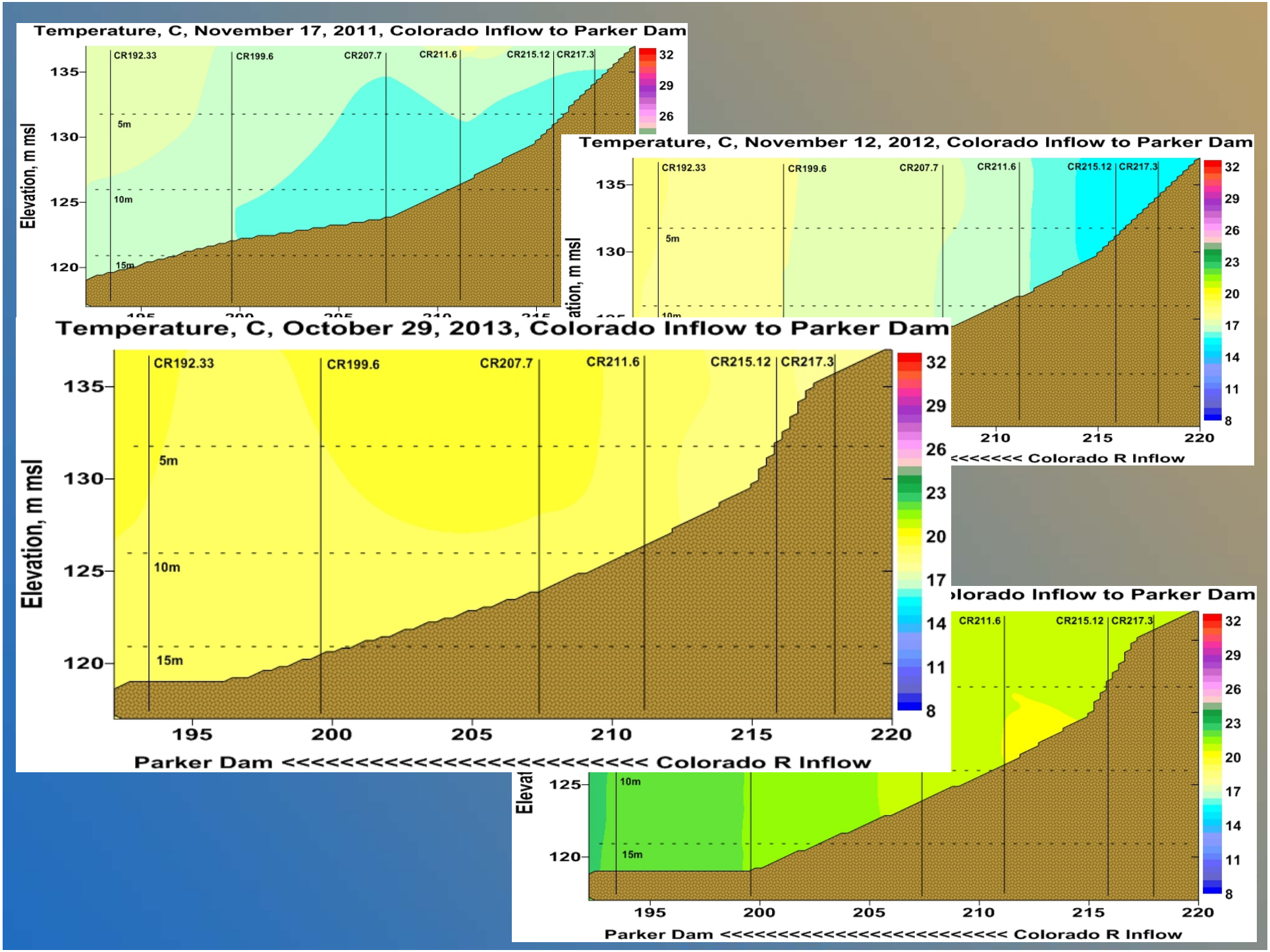
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Temperature, C, November 12, 2012, Colorado Inflow to Parker Dam
Temperature, C, October 29, 2013, Colorado Inflow to Parker Dam
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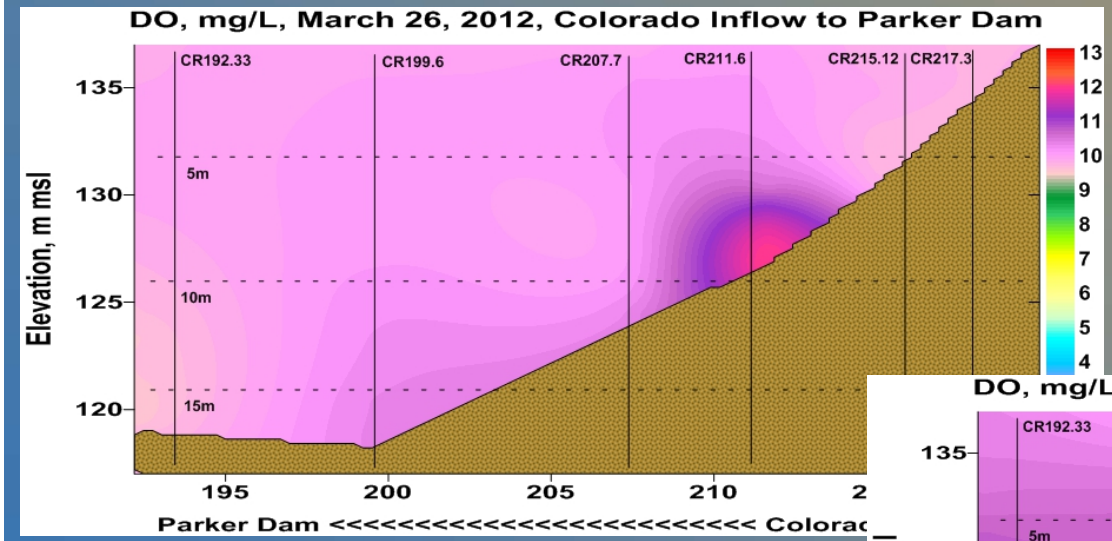
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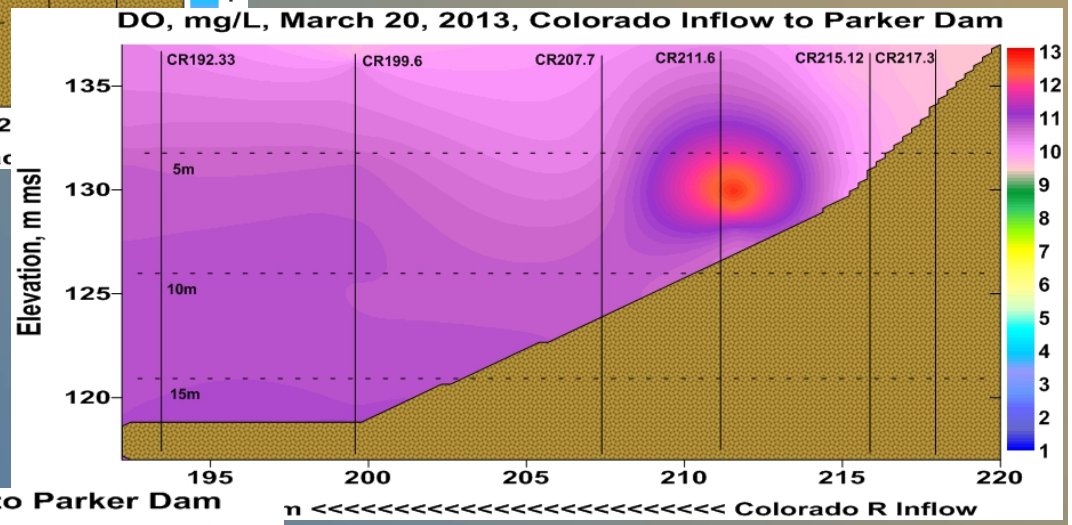
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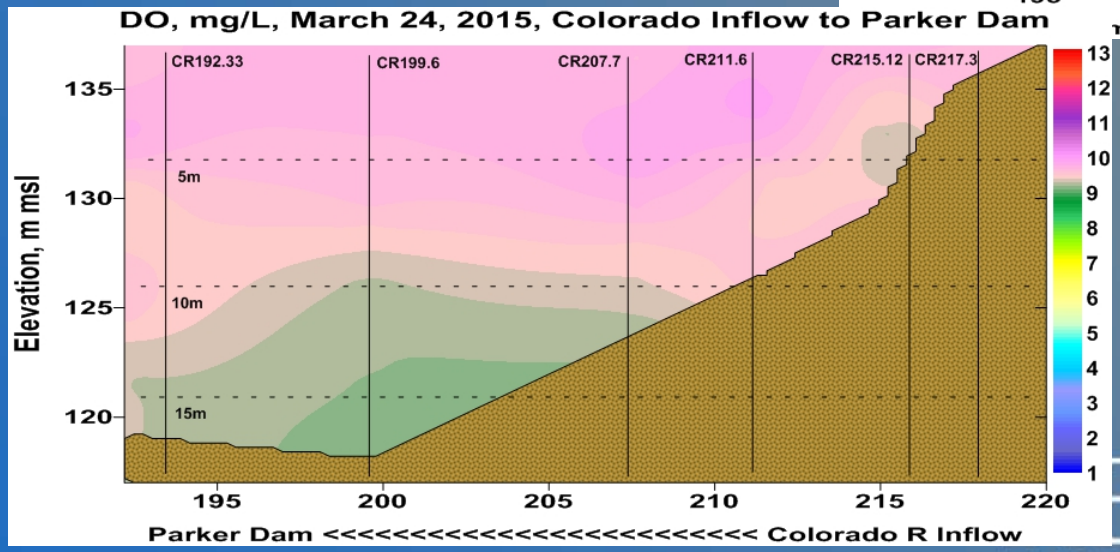
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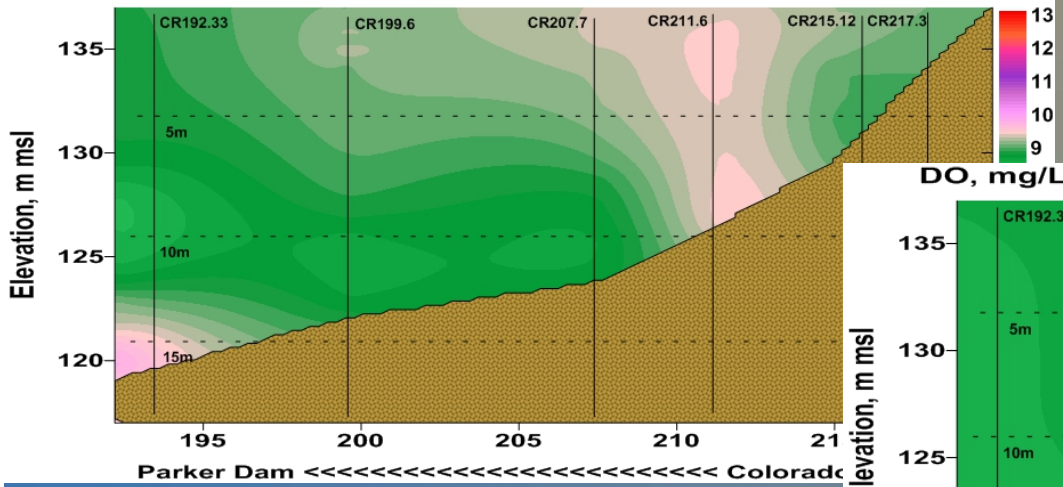

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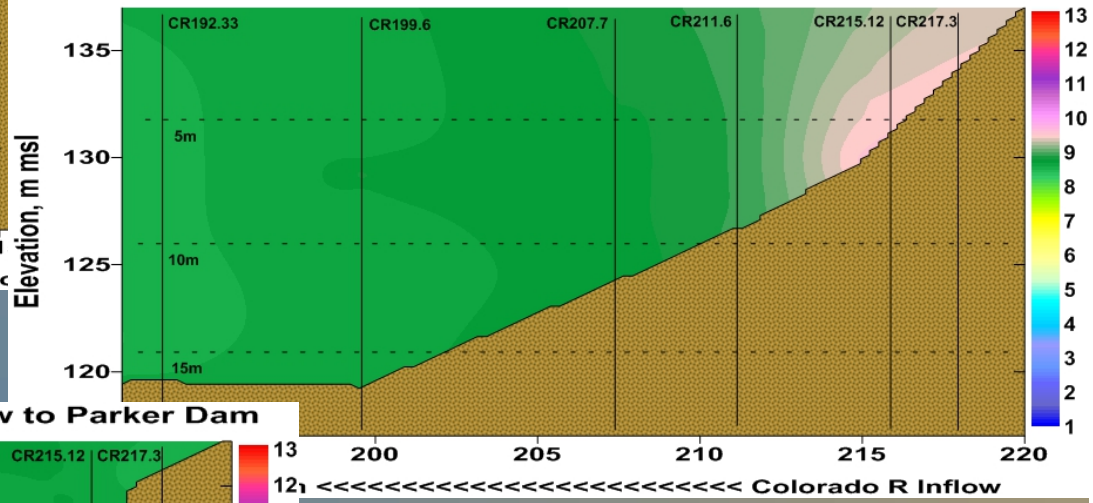
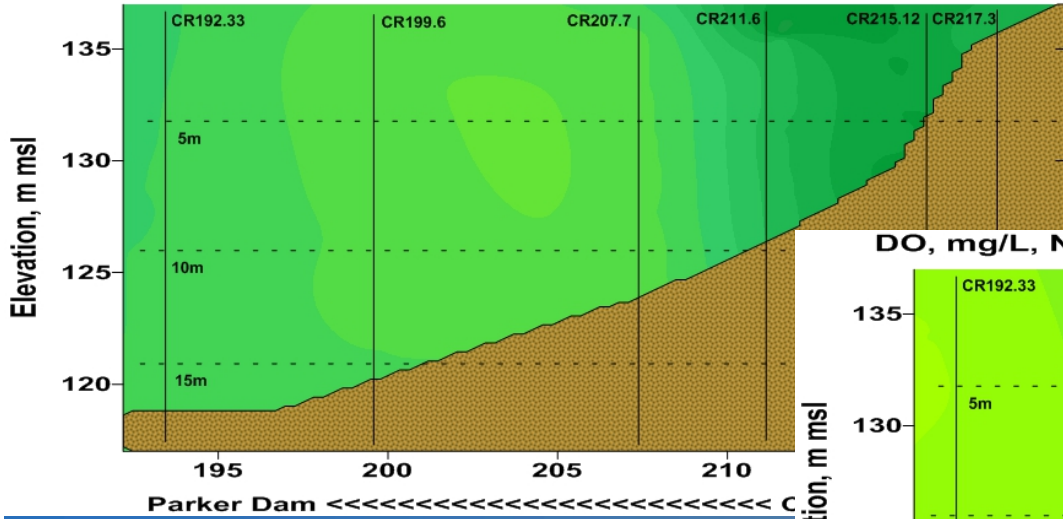
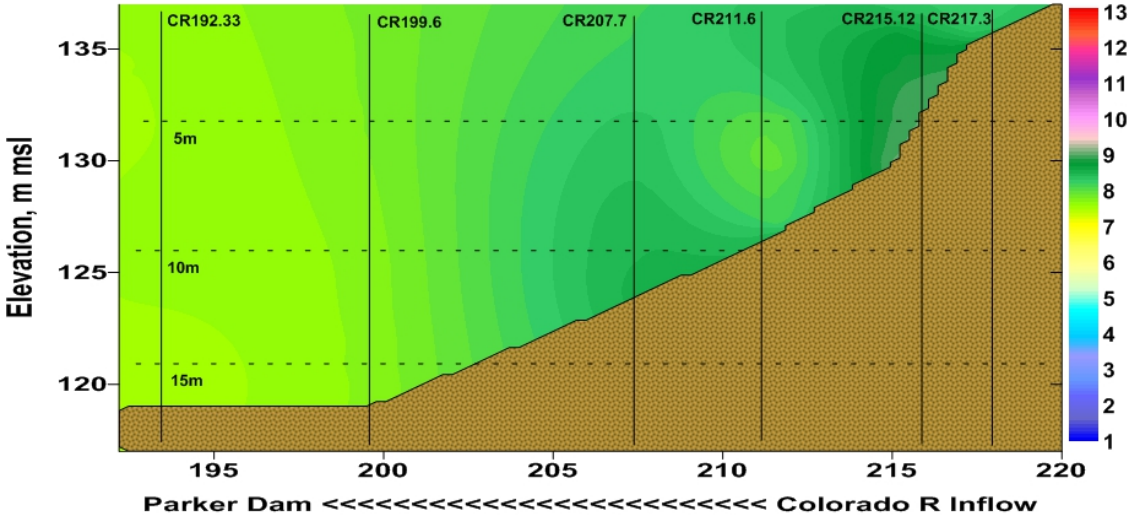


DO, mg/L, November 5, 2014, Colorado Inflow to Parker Dam



DO, mg/L, November 02, 2015, Colorado Inflow to Parker Dam



Average Chlorophyll, Total Phosphorous Data, Combined Inorganic Nitrogen

N=14
* = 7

Sample Site River Mile	Chlorophyll a, Corrected (mg/m3 (ppb))+	Phosphate, Total, as (P mg/L)	Combined Inorganic Nitrogen (mg/L)	P:N Ratio
CRLH_B*	1.21	0.03	0.33	1:11
CR215.12	2.22	0.011	0.28	11:280
CR211.6	2.37	0.0062	0.26	31:1300
CR207.7	2.58	0.0062	0.28	31:1400
CR199.6	2.93	0.0062	0.25	31:1250
CR192.33	2.47	0.0051	0.24	17:800

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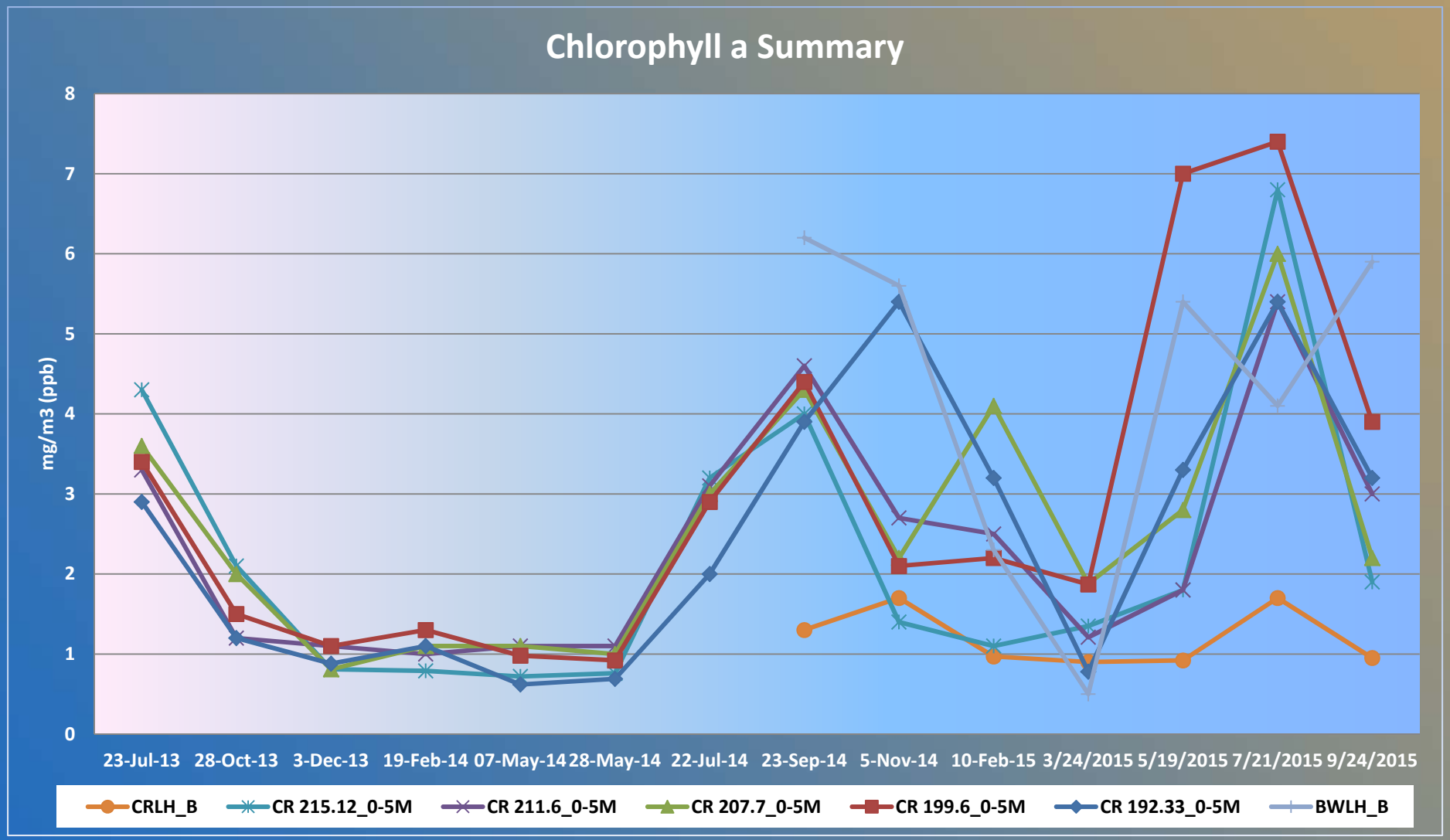
Chlorophyll a



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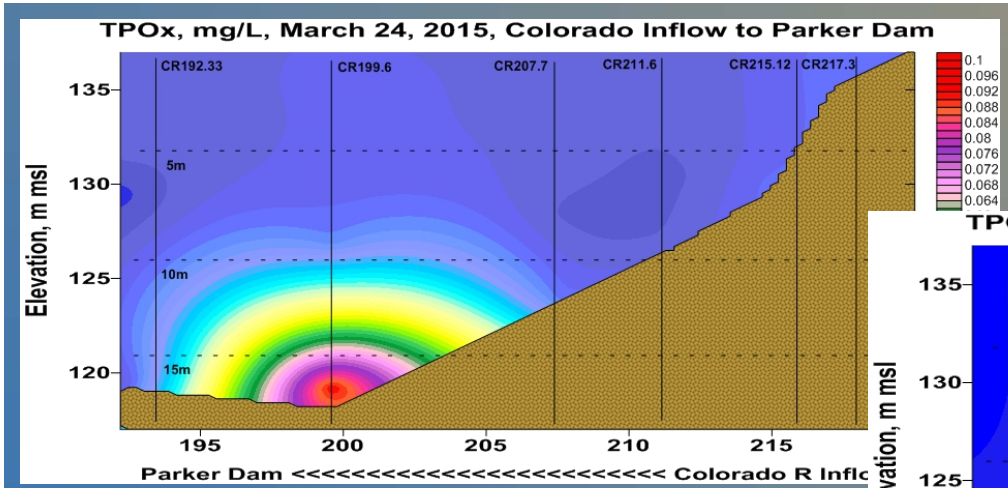
TPOx, mg/L, March 24, 2015, Colorado Inflow to Parker Dam
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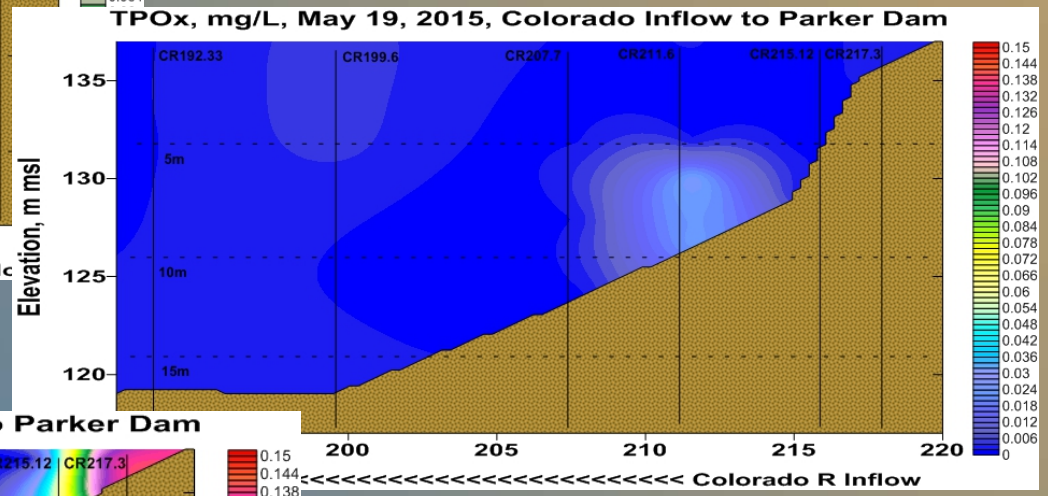
TPOx, mg/L, May 19, 2015, Colorado Inflow to Parker Dam
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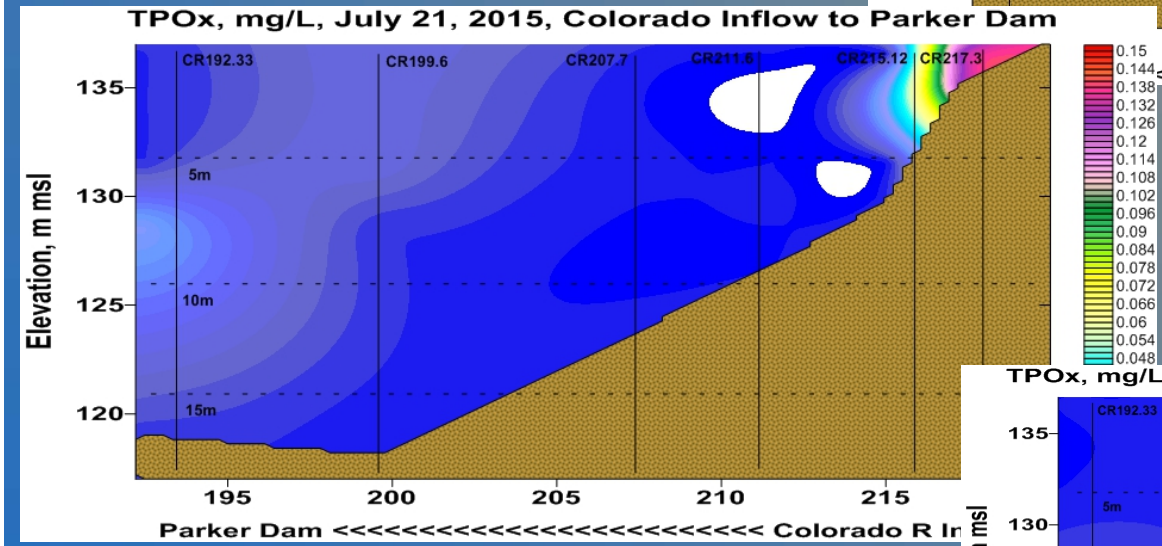
TPOx, mg/L, July 21, 2015, Colorado Inflow to Parker Dam
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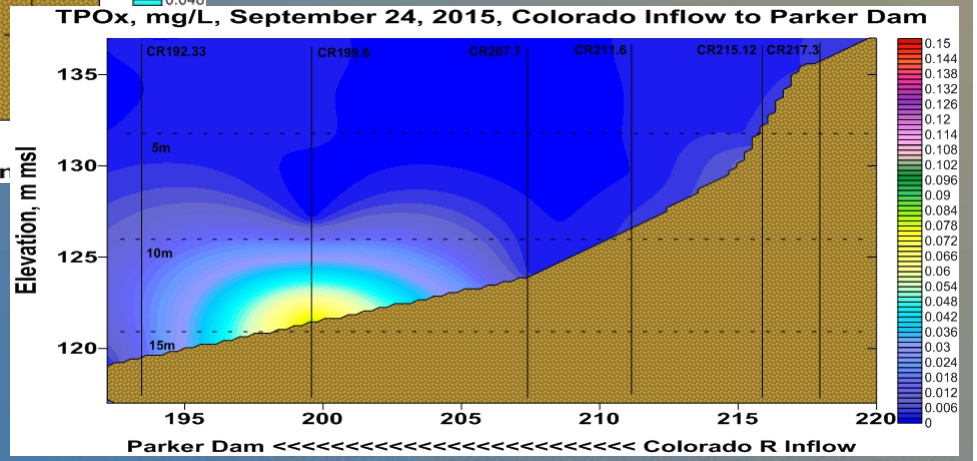
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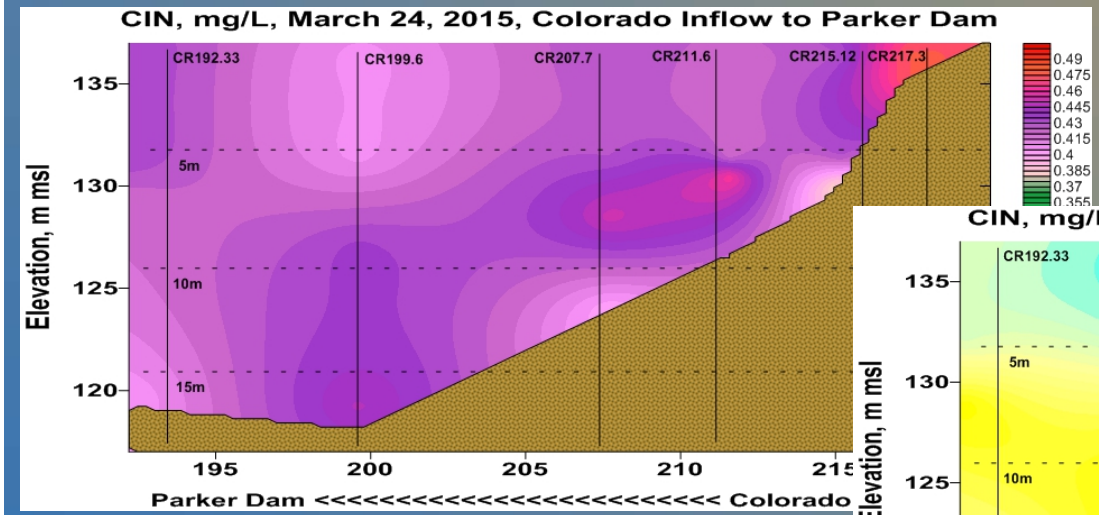
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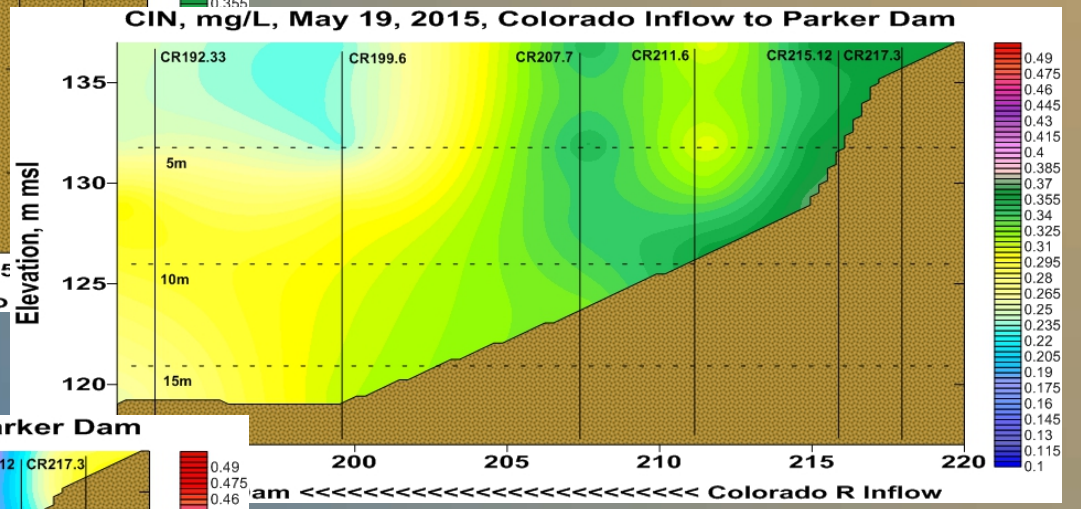
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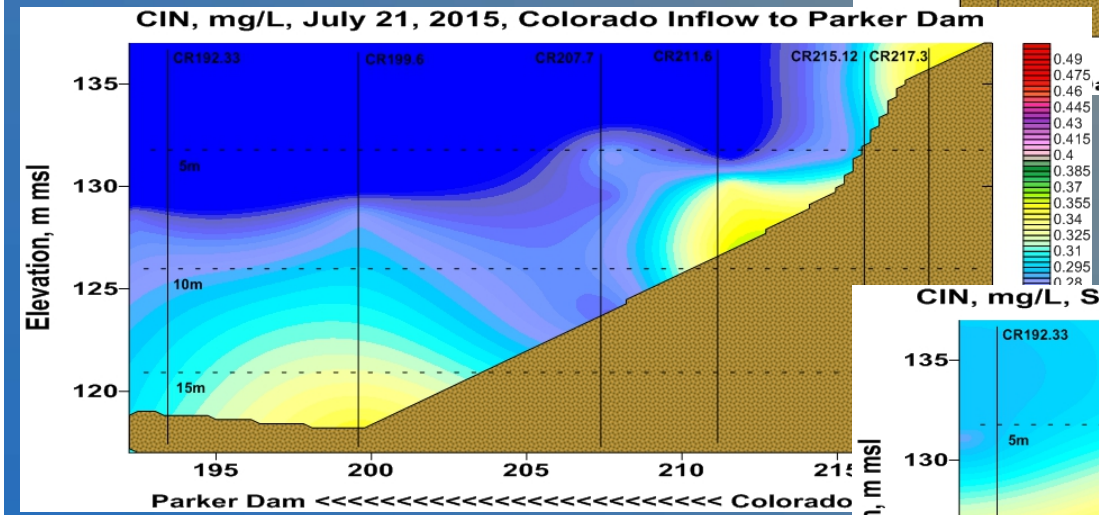
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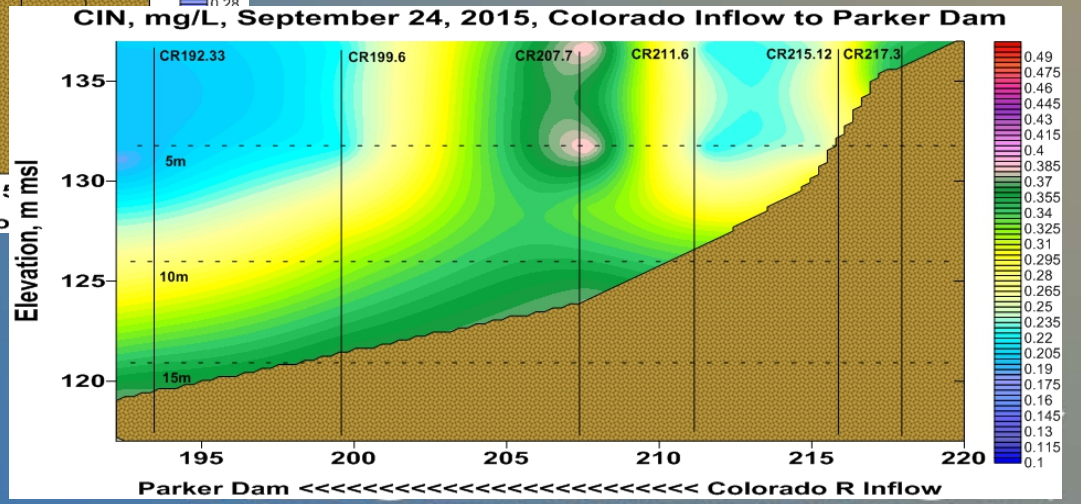
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Future & Path forward

- Reclamation will continue to monitor the lake and add additional sampling parameters when possible in the future
- Continue to work with sister and partner agencies
- Future Questions:
  - Are we seeing a potential ecosystem shift as a result of quagga mussel establishment? Or climate change?

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References

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Acknowledgements

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