

# Assessment of Metals in Estuarine Waters

Modeling, Monitoring & Assessment Branch  
Delaware River Basin Commission

Environmental and Chemical Laboratory Services  
NJ Department of Health and Senior Services

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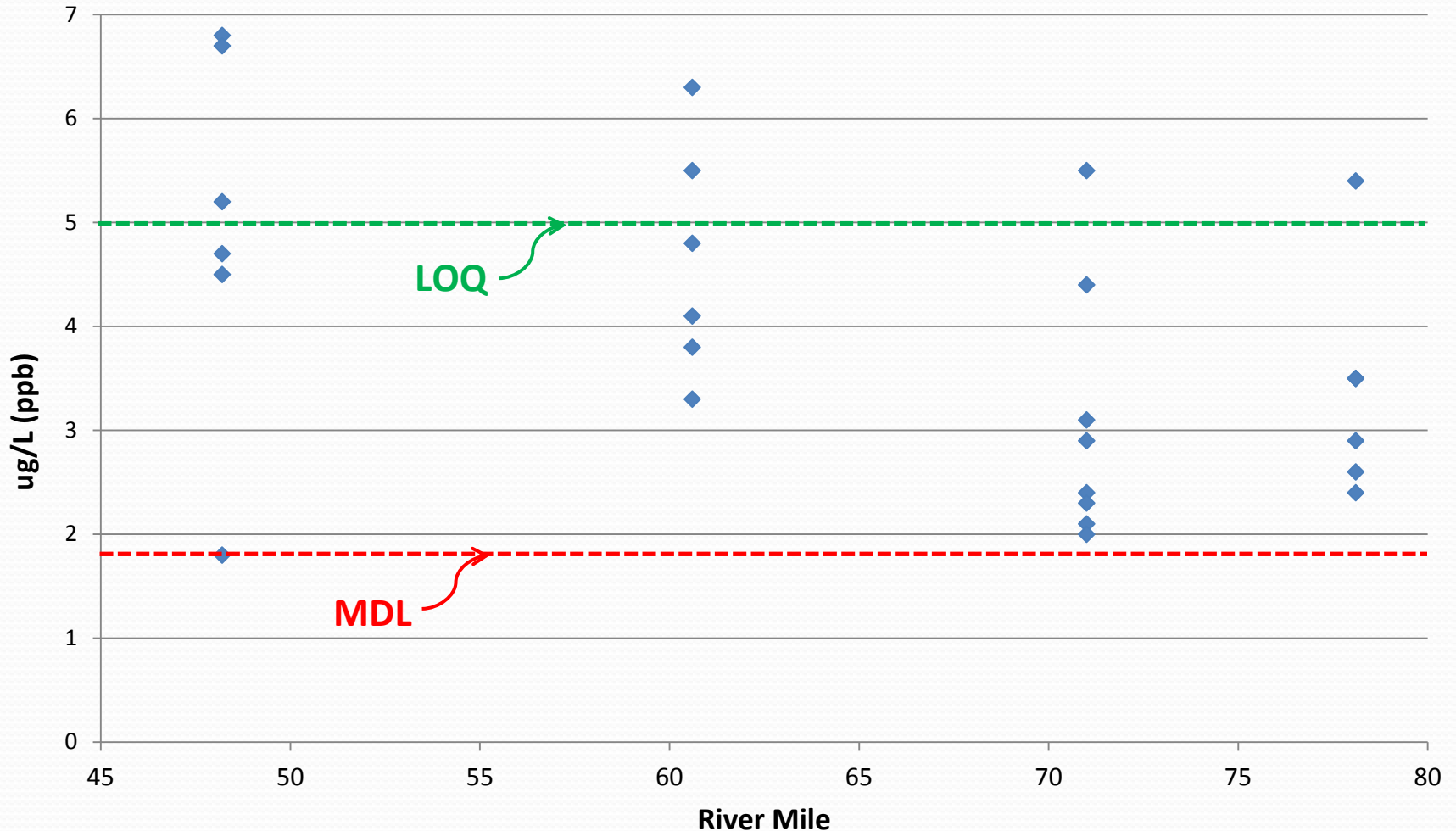
# Presentation Outline

- Introduction
  - Problem
  - Objective of Study
- Approach
- Results
- Summary and Recommendations

# Introduction

- Problem:
  - Copper concentrations measured during yearly surveys continue to be near applicable water quality criteria with several apparent exceedances of the marine criteria in the vicinity of Pea Patch Island (RM 60.6).
  - Assessment is complicated by possible contamination associated with sampling and analytical procedures, detection limits achieved by analytical methods, and proximity of ambient data to criteria.
- Objective:
  - Evaluate *Clean Hands/Dirty Hands* sampling techniques and more sensitive analytical procedures for the assessment of copper and other metals (zinc, nickel and cadmium) concentrations in ambient waters of Zone 5.

# Boat Run Dissolved Copper Surface Samples - 2012



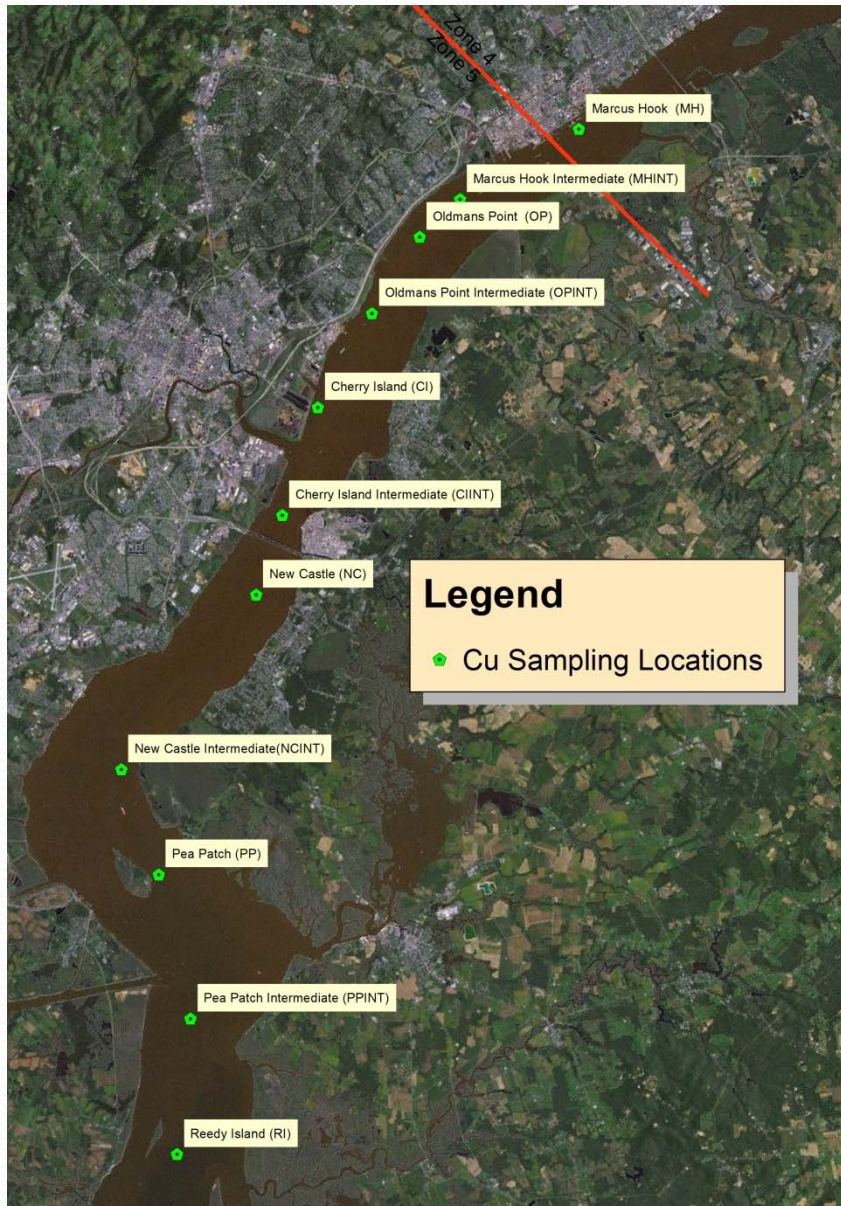
# Approach

- Samples were collected at six existing Boat Run sampling locations from Reedy Island (RM 55) to Marcus Hook (RM 80.3) and an additional five monitoring stations between each of these existing stations.
- Three sampling events were conducted under varying river flow conditions: November 2011, April 2012 and July 2012.
- Implemented *Clean Hands/Dirty Hands* techniques to reduce contamination associated with sample collection
- Utilized high resolution analytical techniques (ICP/MS) and clean lab procedures to reduce analytical contamination (*NJDHSS Environmental and Chemical Laboratory Services*)

# Analytical Parameters and Methods

Parameter	Method	MDL	Units
Total Organic Carbon	5310 C	0.166	mg/L
pH	4500H-B		pH Units
Total Alkalinity	2320B	1	mg/L
Chloride	300	0.0377	mg/L
Sulfate	300	0.104	mg/L
Specific Conductance (EC)	2510B		umhos/cm
Calcium	200.7	0.006	mg/L
Hardness, Total	200.7	0.019	mg/L
Magnesium	200.7	0.001	mg/L
Sodium	200.7	0.006	mg/L
Potassium	200.7	0.026	mg/L
Copper	200.8	0.02	ug/L
Nickel	200.8	0.02	ug/L
Zinc	200.8	0.08	ug/L
Cadmium*	200.8	0.01	ug/L

\*Cadmium analysis conducted for April and July/August samples only.



# Sampling Locations

Station Description *	River Mile
Marcus Hook	79.5
Marcus Hook Intermediate	76.4
Oldmans Point	75.2
Oldmans Point Intermediate	73.5
Cherry Island	71.5
Cherry Island Intermediate	69.4
New Castle	67.7
New Castle Intermediate	62.9
Pea Patch	60.5
Pea Patch Intermediate	57.5
Reedy Island	54.7

\* Samples were collected as grabs at the surface and near bottom using either direct pumping or Niskin samplers.

# Applicable Water Quality Criteria

- Chronic and acute criteria are established by the Commission in its Water Quality regulations (Section 3.10.3C.)
- Criteria for metals of concern are expressed in the dissolved form.
- Applicable criteria vary based on location:
  - Above RM 69 (Delaware Memorial Bridge) freshwater criteria is applied.
  - Between RM 69 and 48 the more stringent of either the fresh water (hardness dependent) or marine criteria apply.



# Analytical Results - All Three Surveys

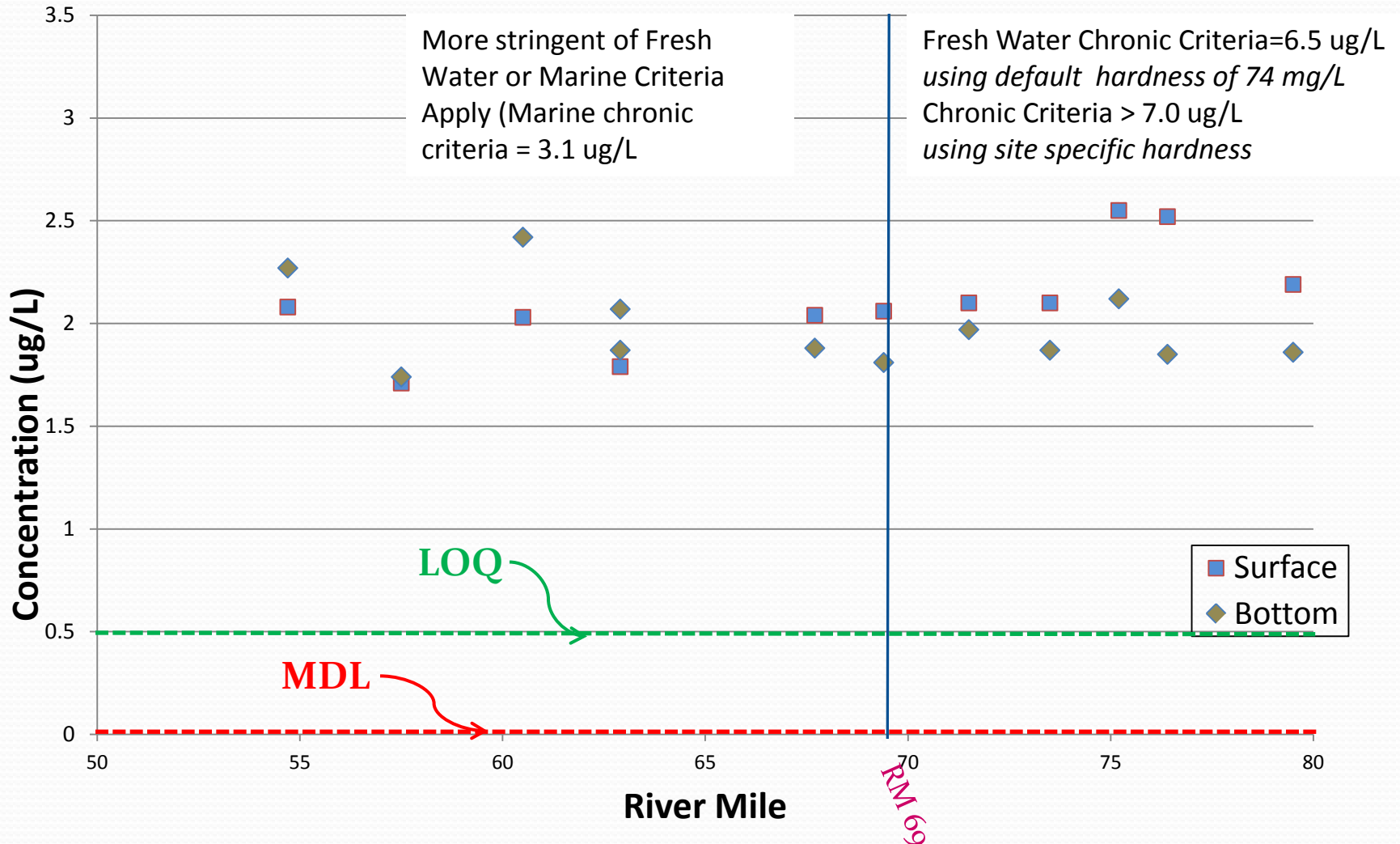
- Data quality objectives were met:
  - Method Detection Limits (MDL) were achieved:

MDLs	Median	Maximum
Copper	0.02 µg/L	0.1 µg/L
Nickel	0.02 µg/L	0.04 µg/L
Zinc	0.08 µg/L	0.16 µg/L
Cadmium	0.01 µg/L	0.02 µg/L

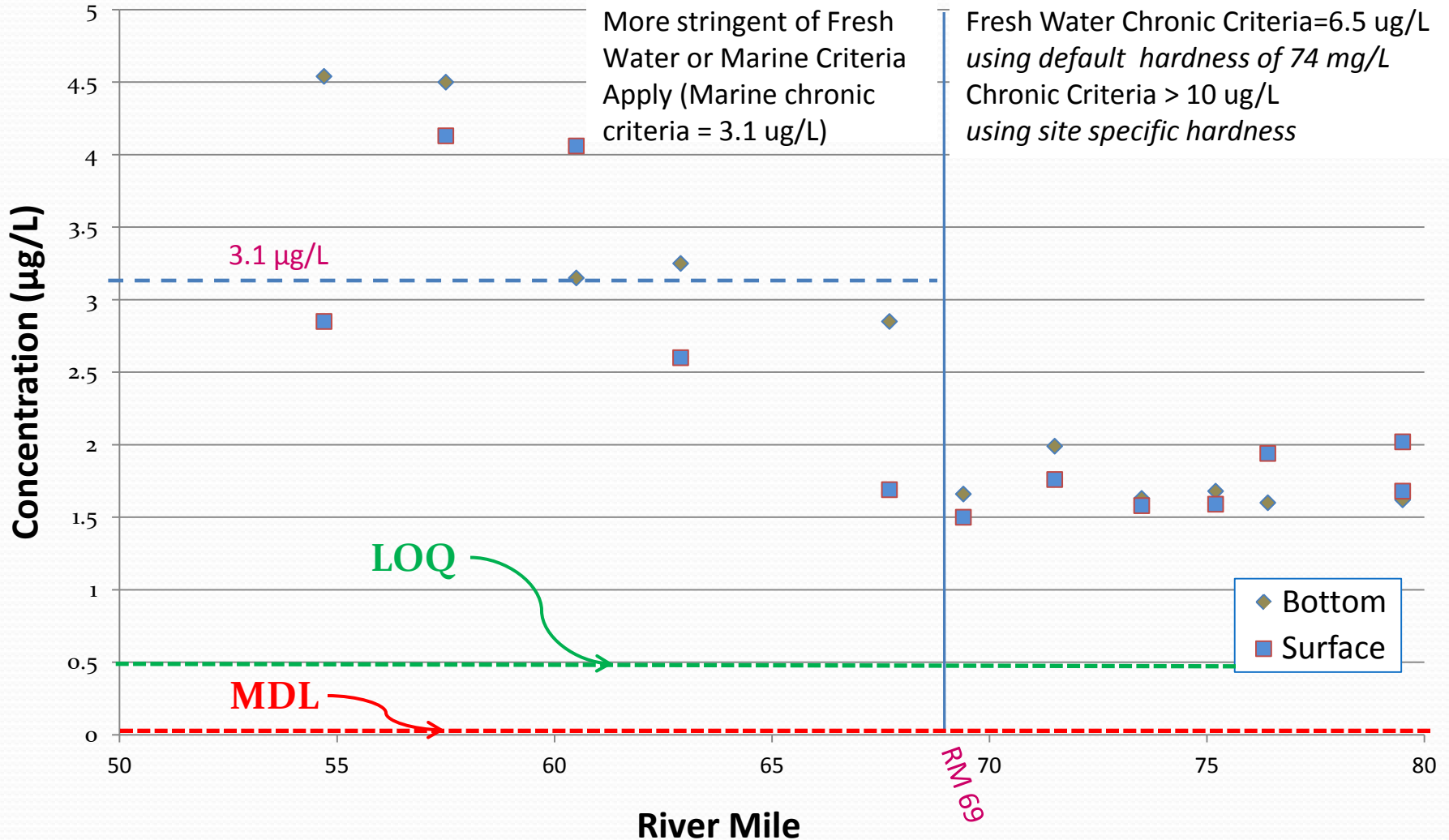
- Field/lab contamination was acceptable:

Field/Rinsate Blanks	Median	Maximum
Copper	0.09 µg/L	0.28 µg/L
Nickel	0.10 µg/L	0.12 µg/L
Zinc	0.4 µg/L	0.78 µg/L
Cadmium	<0.01 µg/L	0.061 µg/L

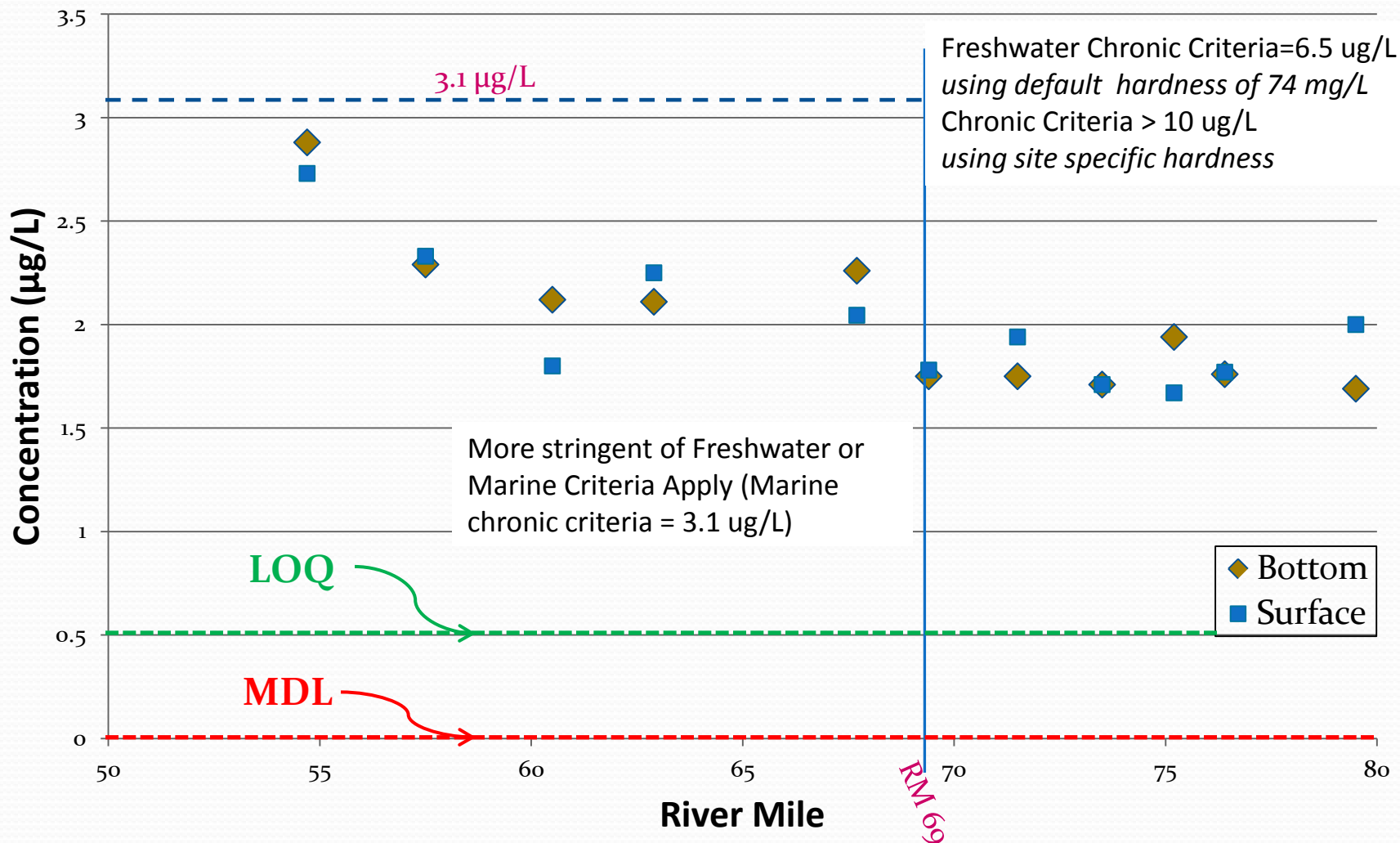
# November Dissolved Copper Concentrations



# April Dissolved Copper Concentrations



# July/August Dissolved Copper Concentrations



# Summary for All Surveys

- Observed Cu concentrations do not exceed the Commission's freshwater chronic criteria in the areas studied, using default and site specific hardness values.
- Selected sampling locations below Delaware Memorial Bridge (RM 68.75) exhibit Cu concentrations which exceed the Commission's marine chronic criteria at three locations: RM 54.7, 57.5 and 60.5.
- Cu concentrations approach marine chronic criteria (<factor of 2) selected locations below Delaware Memorial Bridge in Nov and July/August surveys.
- Zn and Ni concentrations are typically an order of magnitude (10x) lower than their applicable chronic criteria.

# Summary and Recommendations

- *Clean Hands/Dirty Hands* techniques and clean metals analytical procedures provide more precise data and data with lower detection limits to enhance assessment of ambient metals data.
- Lower method detection limits and blank data can be consistently achieved.
- Recommend use of these techniques where ambient data is close to water quality criteria.
- Please see our poster for more details on the *Clean Hands/Dirty Hands* techniques used.

# Acknowledgements

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# Copper Survey Dissolved as Percentage of Total

