Validation of DSM2 Volumetric Fingerprints Using Grab Sample Mineral Data

CWEMF Annual Meeting

March 2006

Presentation Content

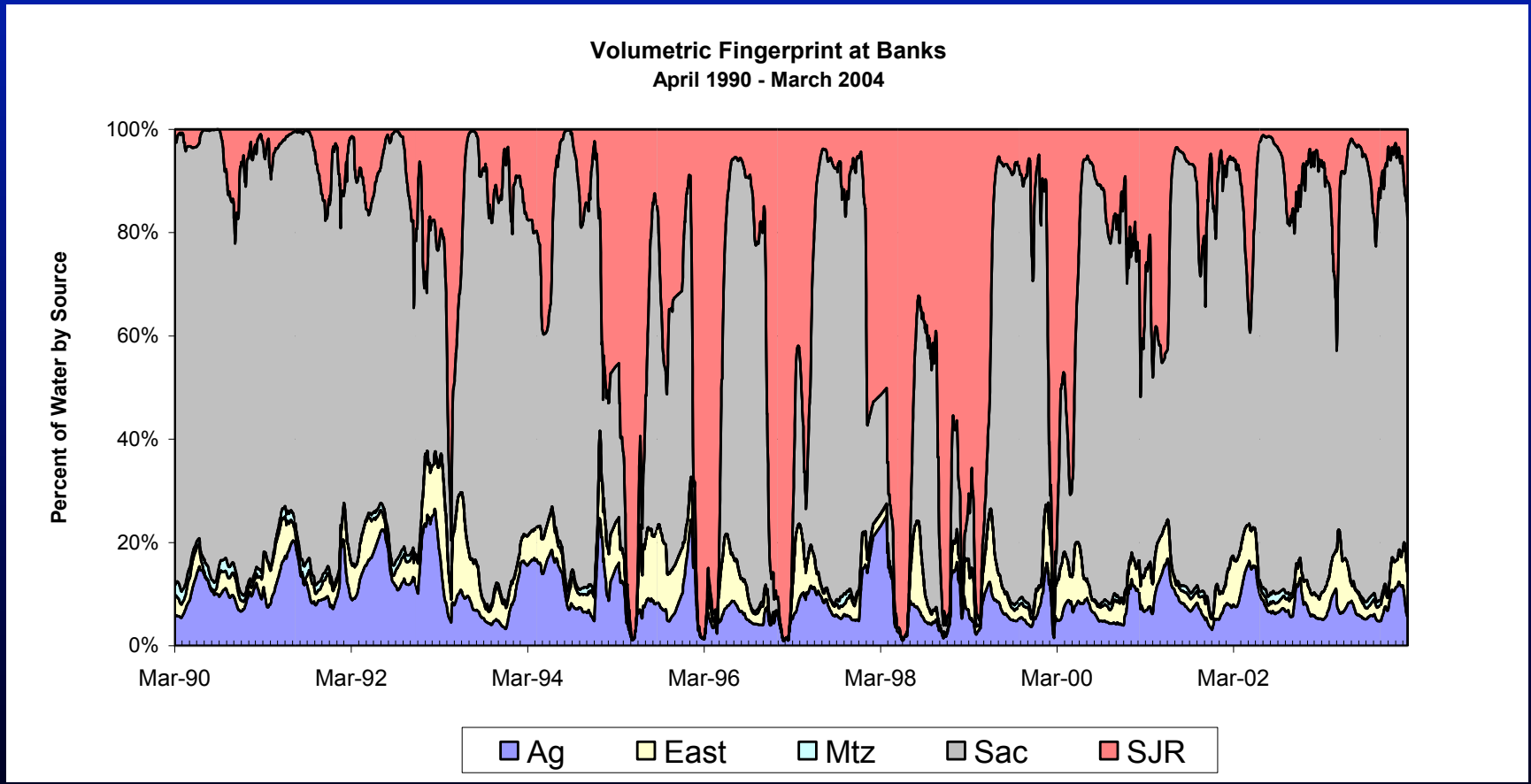
- **Objective**
- **Methodology**
- **Results**
- **Conclusions & Recommendations**

Objective

Develop an approach to validate volumetric fingerprinting results

Validate – According to Webster

To support or corroborate on a sound or authoritative basis


Volumetric Fingerprint at Banks
April 1990 - March 2004
Percent of Water by Source
100%
80%
60%
40%
20%
0%
Mar-90
Mar-92
Mar-94
Mar-96
Mar-98
Mar-00
Mar-02
Ag
East
Mtz
Sac
SJR

Presentation Content

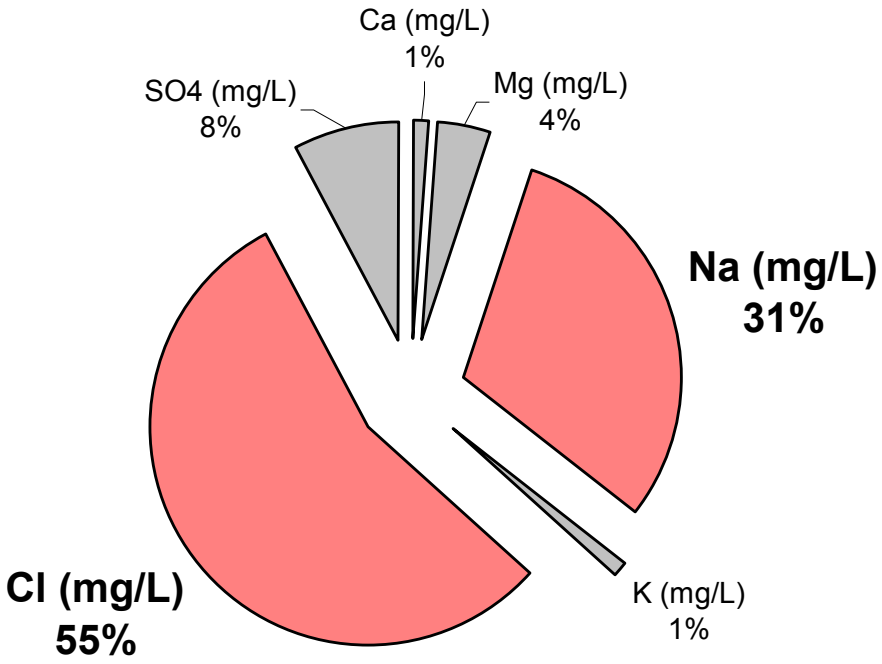
- Objective
- Methodology
  - Typical Mineral Composition of Source Waters
  - Promising Source Fingerprints
  - Data
- Results
- Conclusions & Recommendations

Methodology

Investigate the value of mineral data in fingerprinting source water contributions at various Delta locations

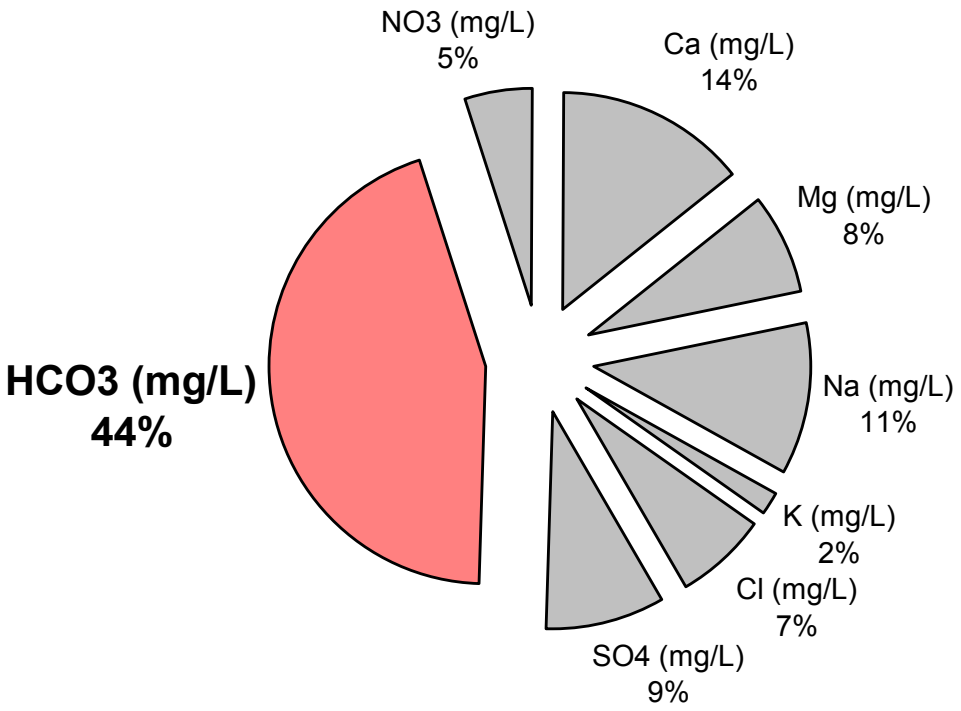
Typical Mineral Composition

Seawater (TDS = 34,500 mg/L)



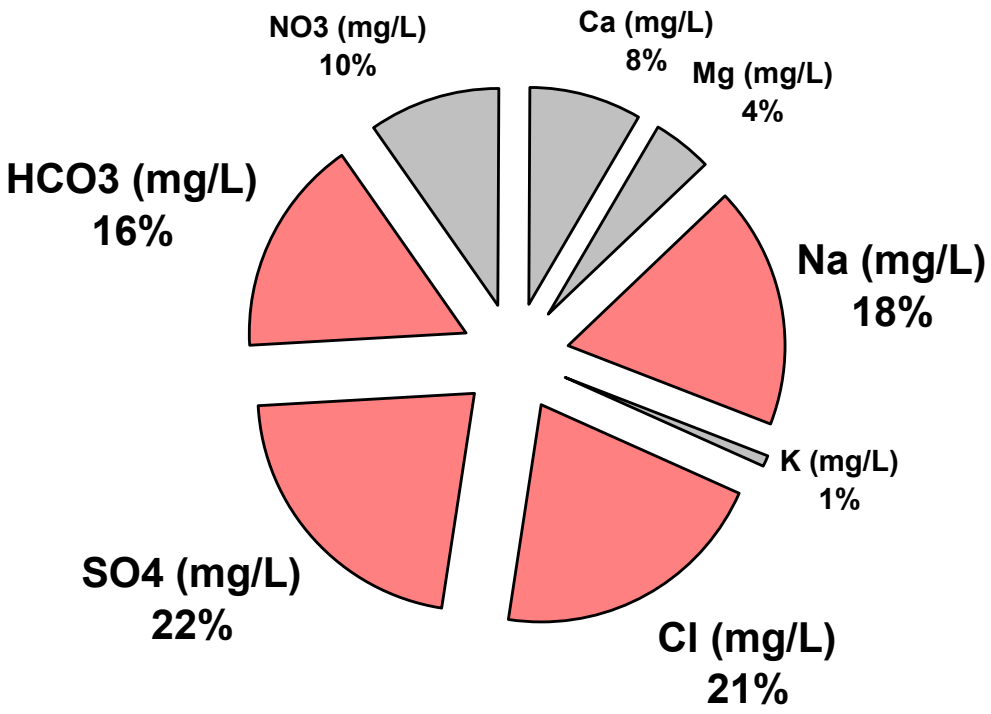
Typical Mineral Composition

Sacramento River at Greenes (TDS = 100 mg/L)



Typical Mineral Composition

San Joaquin River at Vernalis (TDS = 300 mg/L)



Methodology
Promising Source Fingerprints

- Seawater has a high chloride-to-sulfate ratio
  - Seawater ~ 7
  - Sacramento and San Joaquin Rivers ~ 1
- San Joaquin River has a high proportion of sulfate relative to Sacramento River
- Sacramento River has a high proportion of bicarbonate relative to San Joaquin River

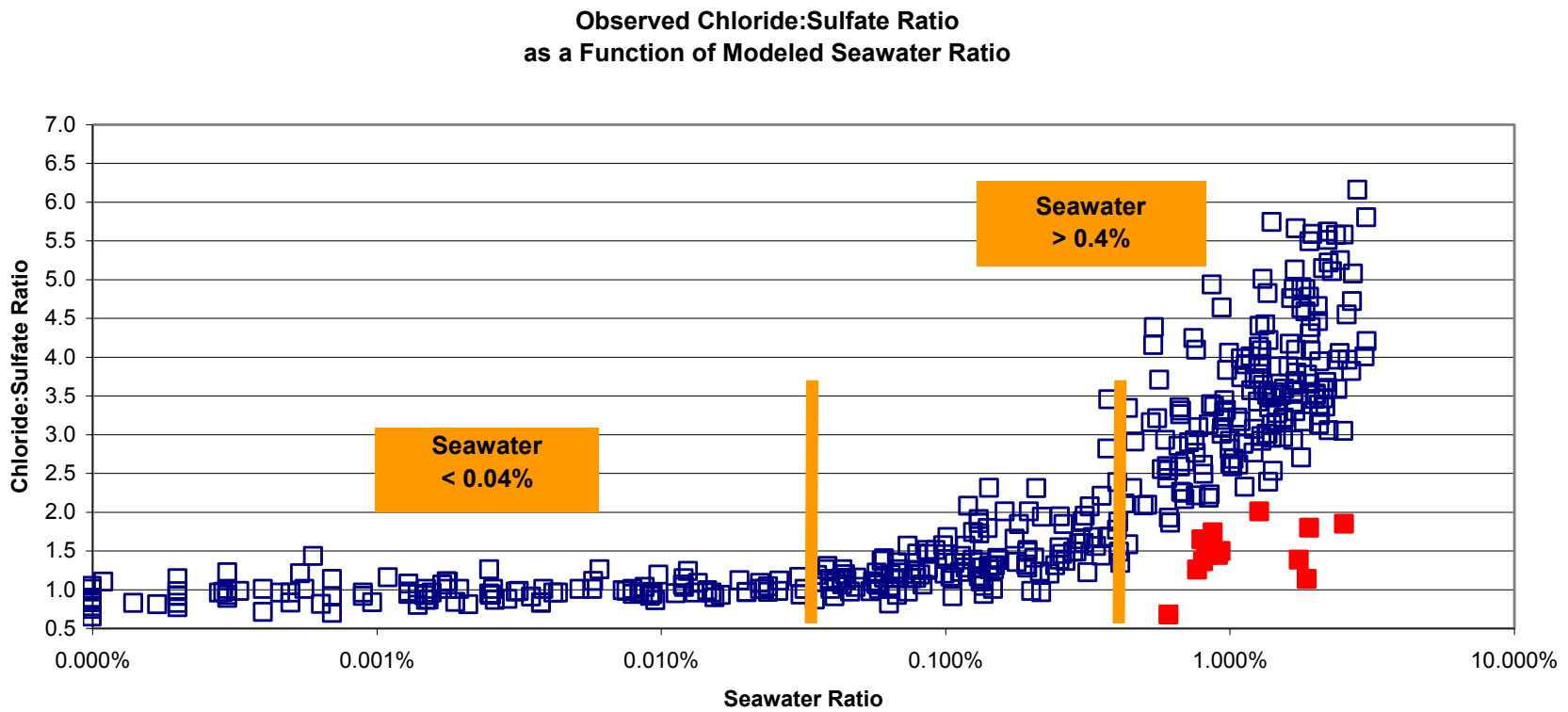
Methodology
Data

Location	Observations	Period	Source(s)
Old River @ Bacon	156	Nov 1994 – Oct 2005	MWQI
Banks	261	Apr 1990 – Mar 2004	MWQI DWR O&M
Tracy	141	Apr 1990 – May 1999	MWQI

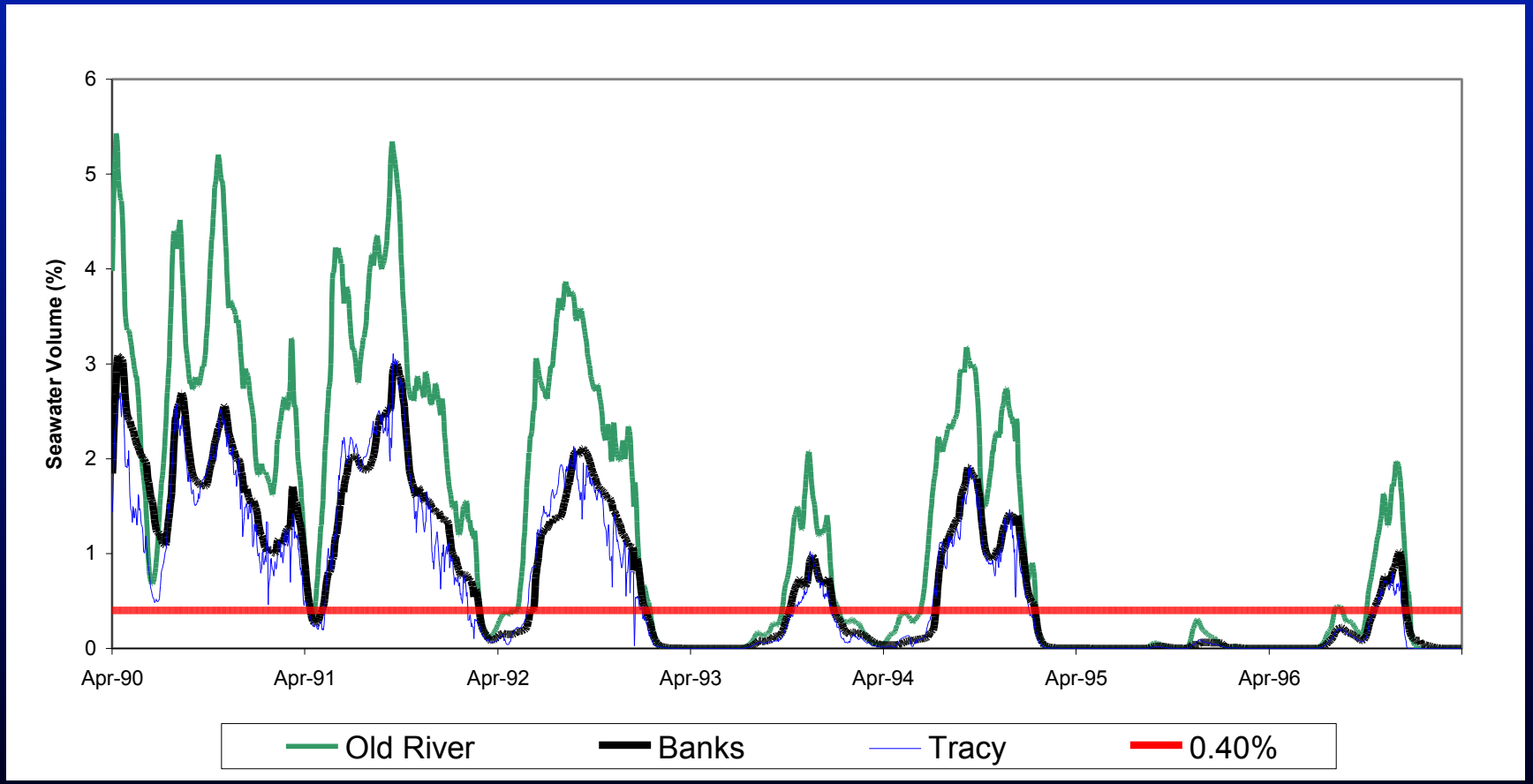
Presentation Content

- Objective
- Methodology
- Results
  - Seawater Fingerprints
  - Riverine Fingerprints
- Conclusions & Recommendations

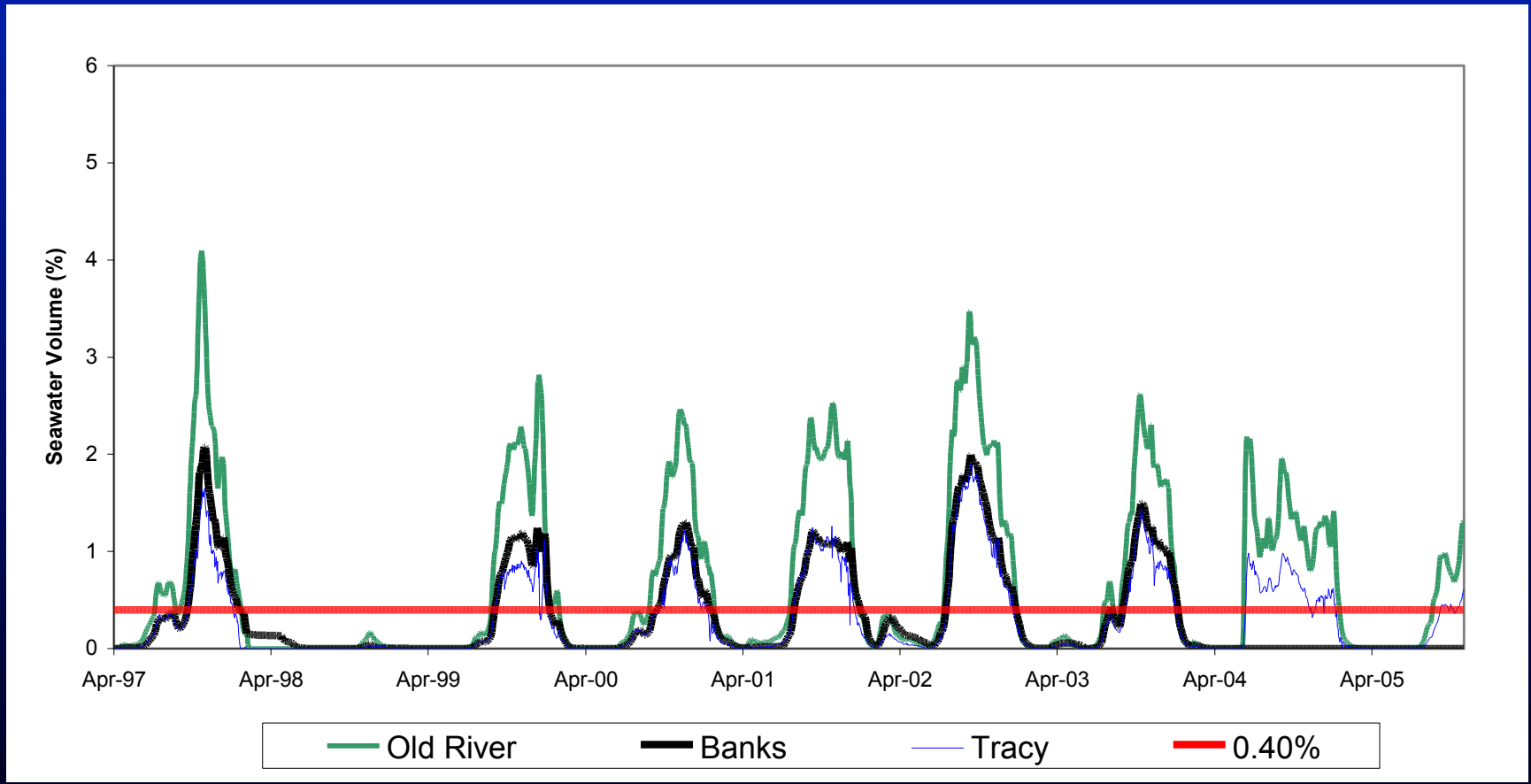
Seawater Fingerprint
Chloride-to-Sulfate Ratio



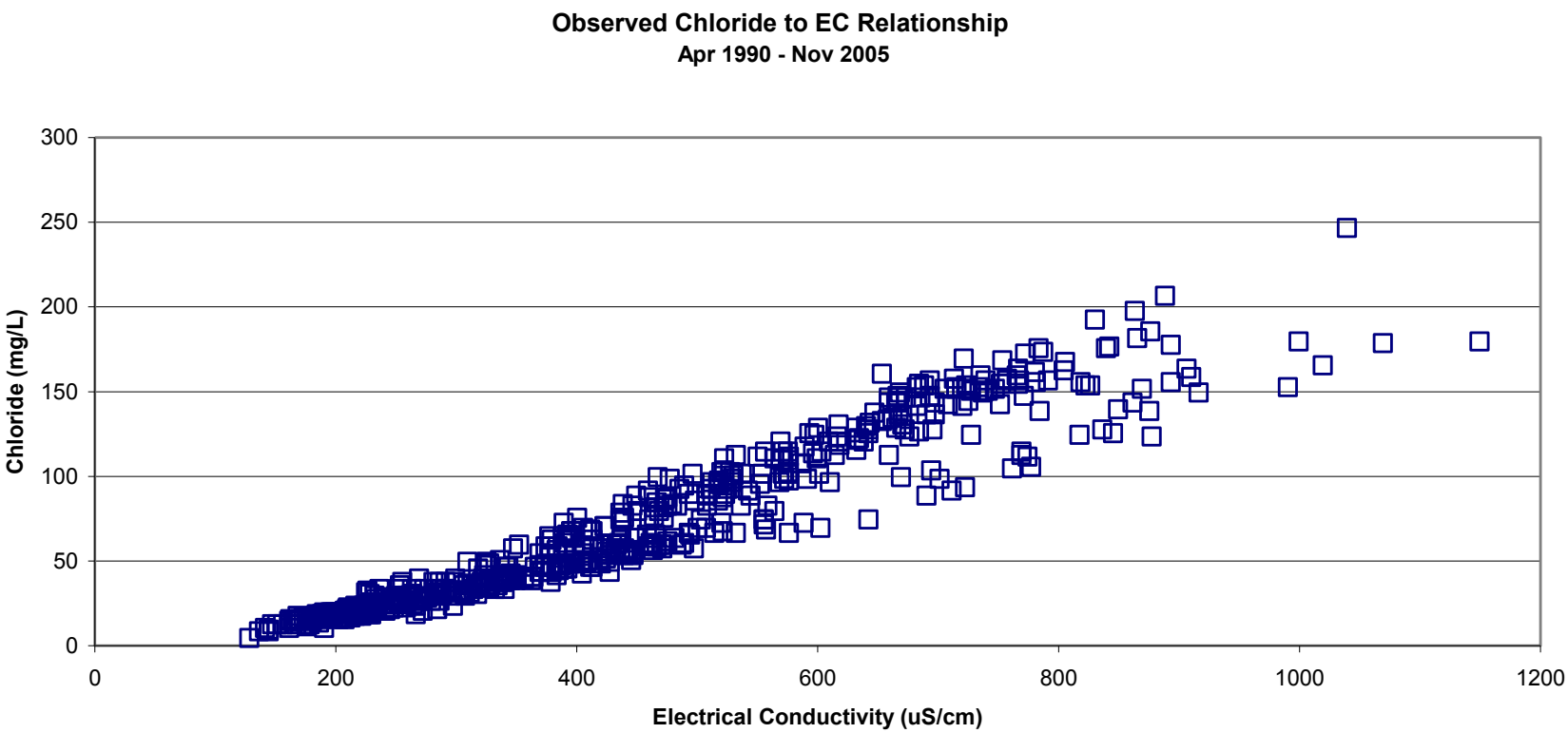
Seawater Fingerprint
Apr 1990 – Mar 1997



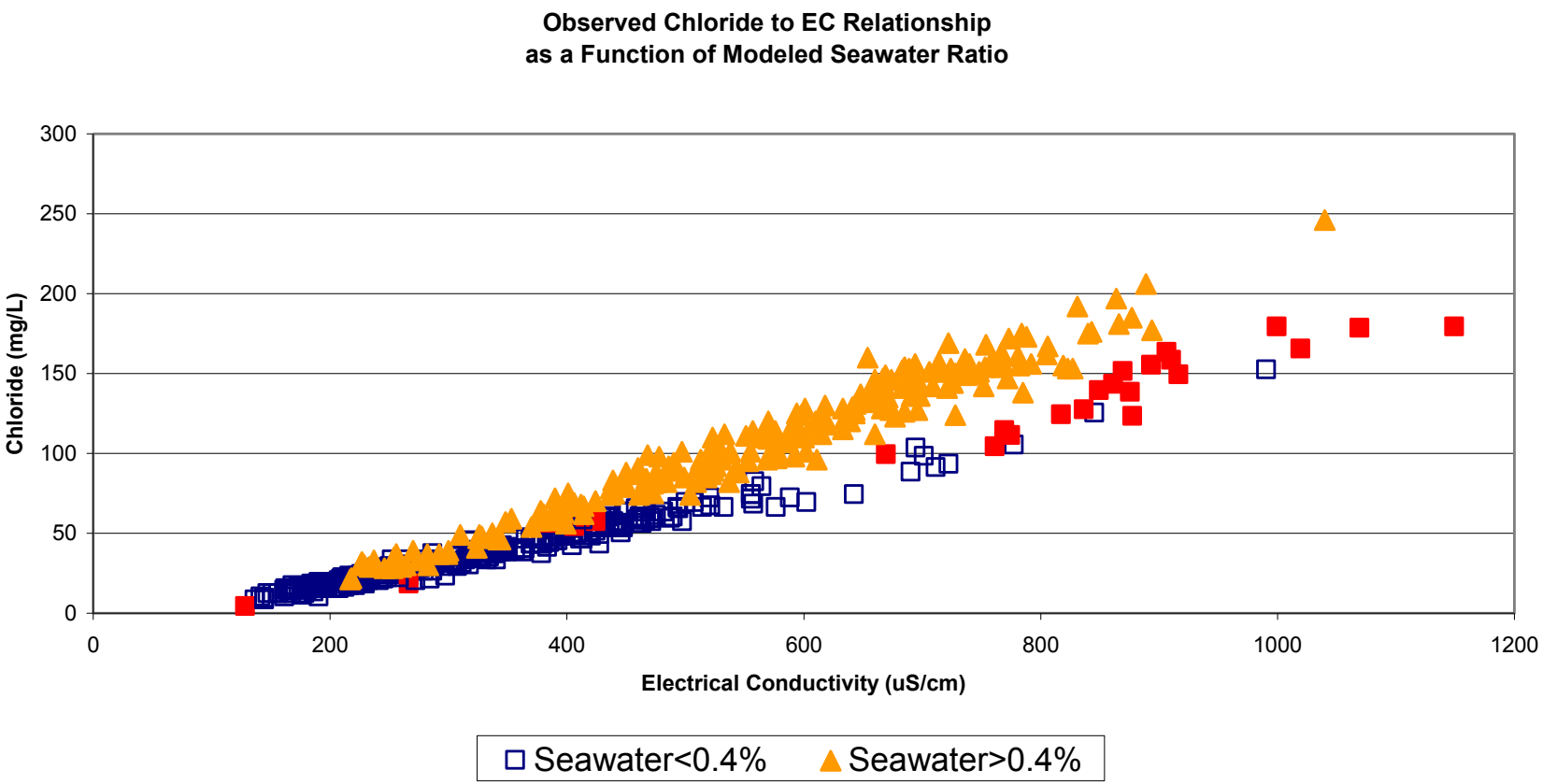
Seawater Fingerprint
Apr 1997 – Oct 2005



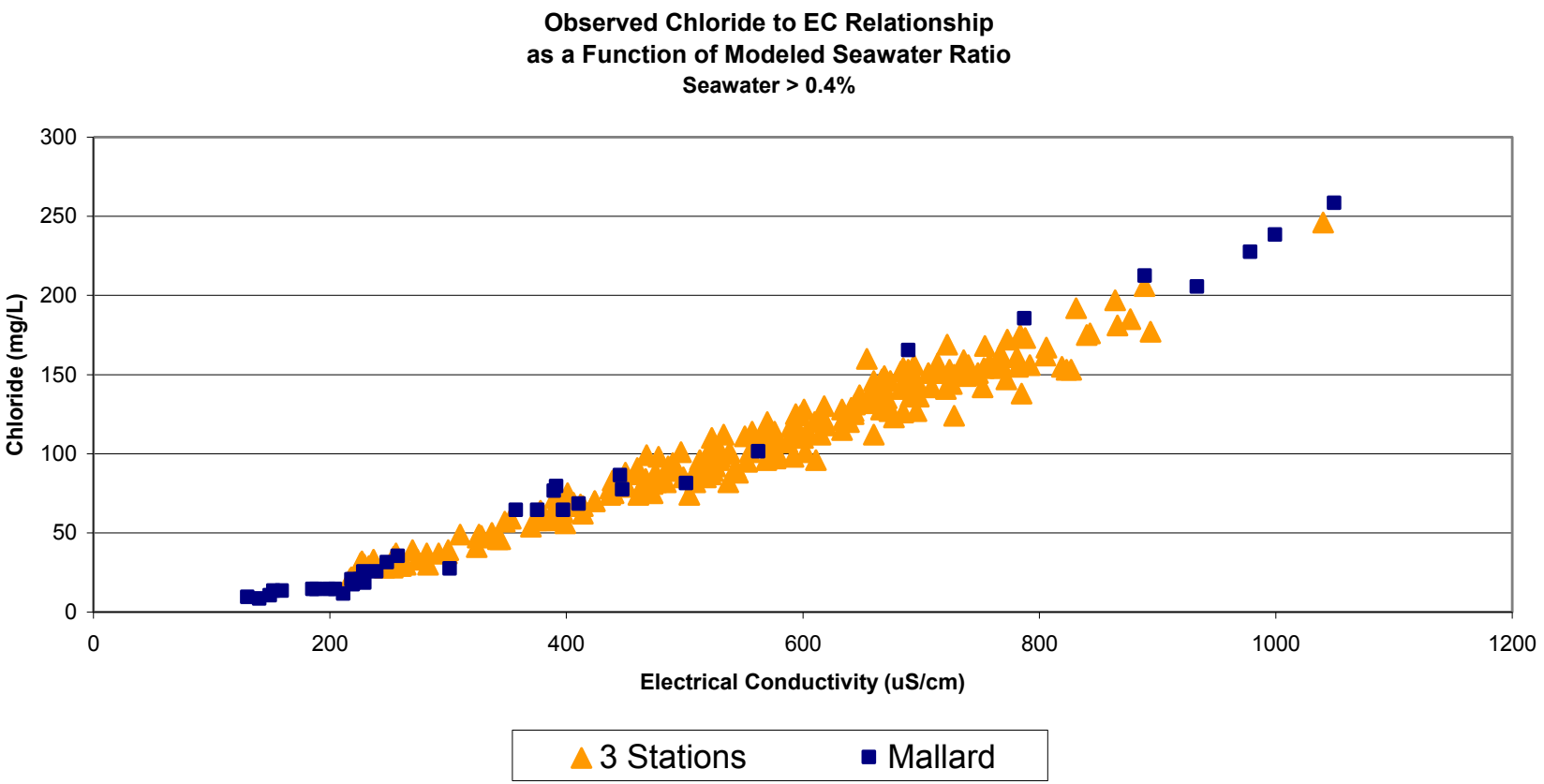
Seawater Fingerprint
Chloride



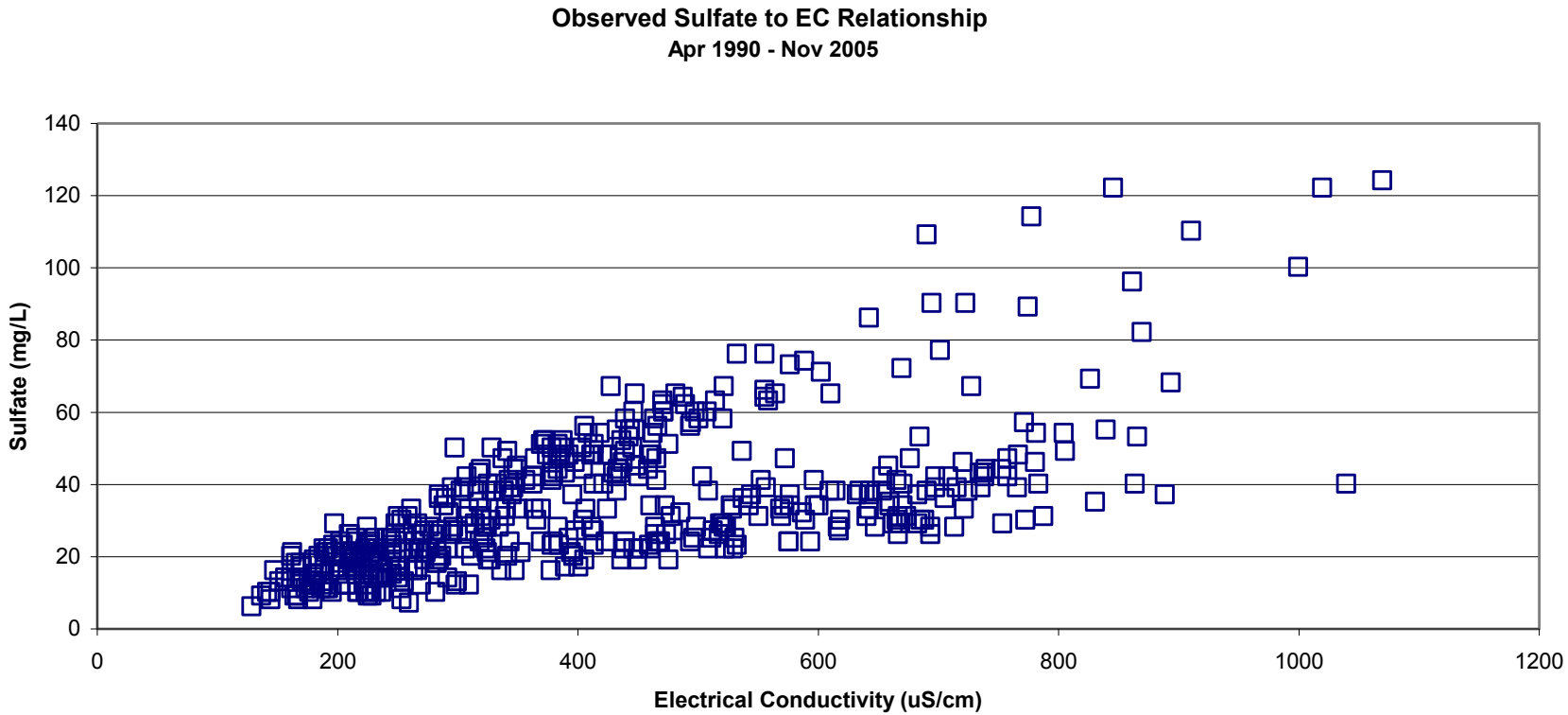
Seawater Fingerprint
Chloride



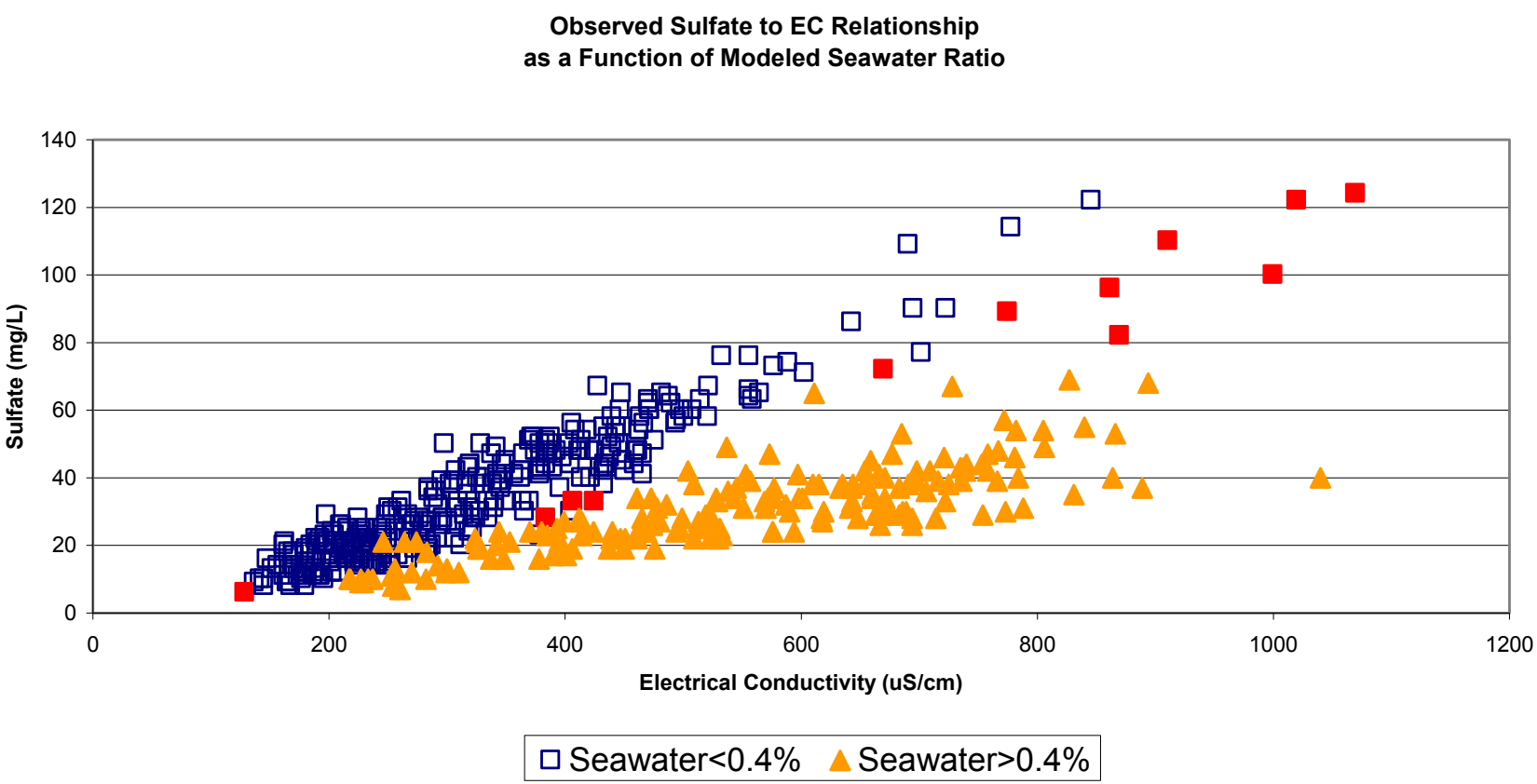
Seawater Fingerprint
Chloride



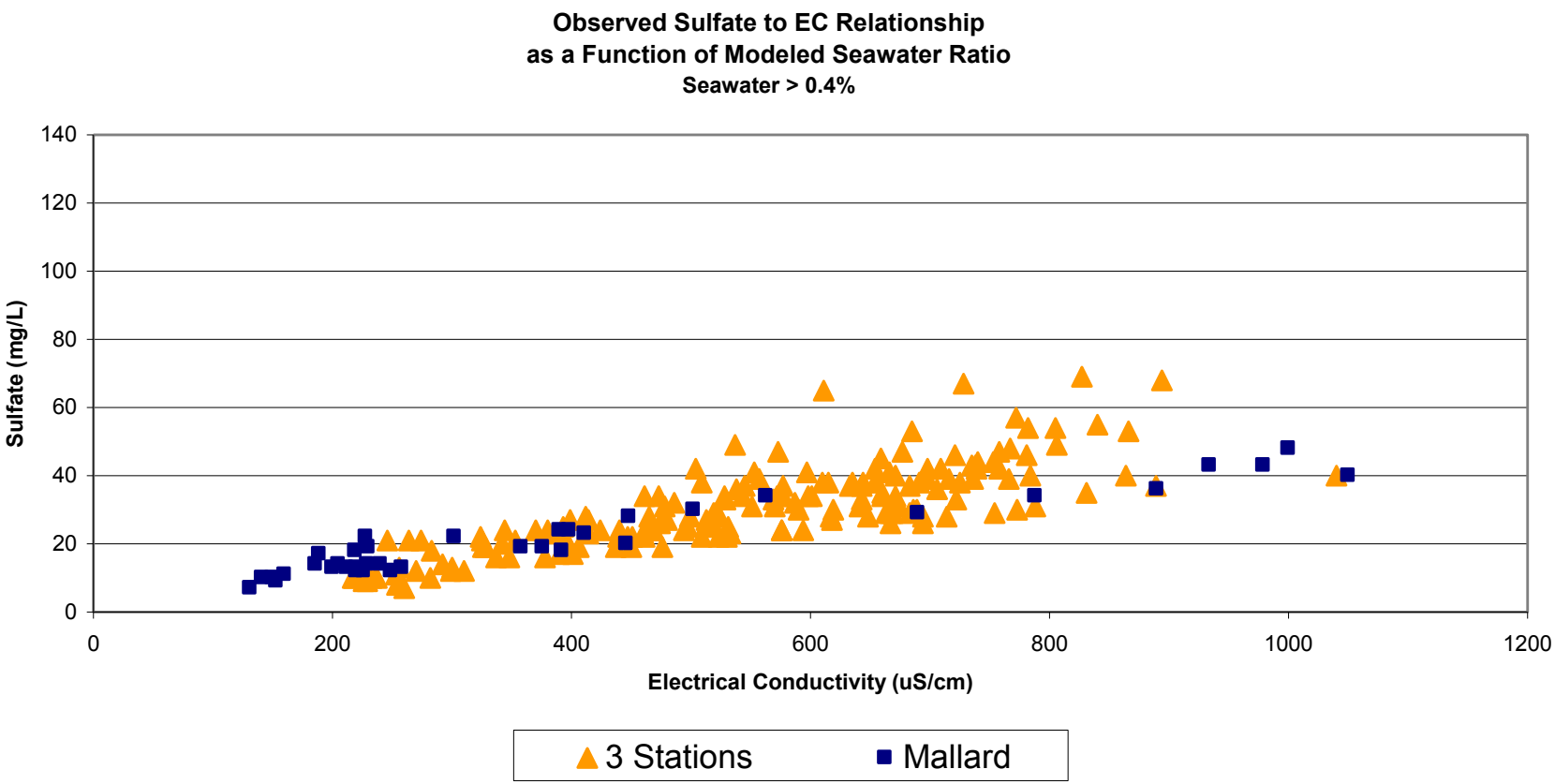
Seawater Fingerprint
Sulfate



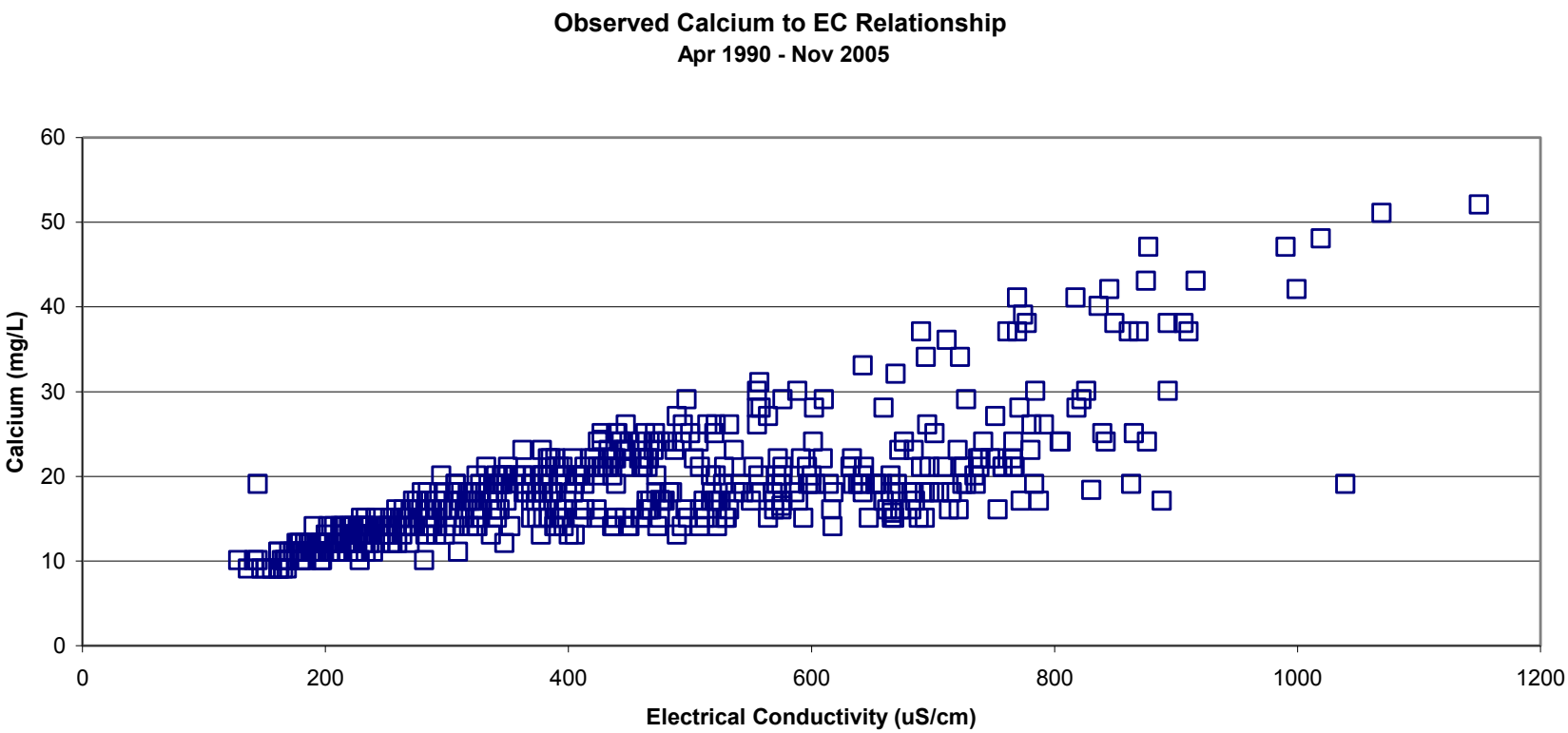
Seawater Fingerprint
Sulfate



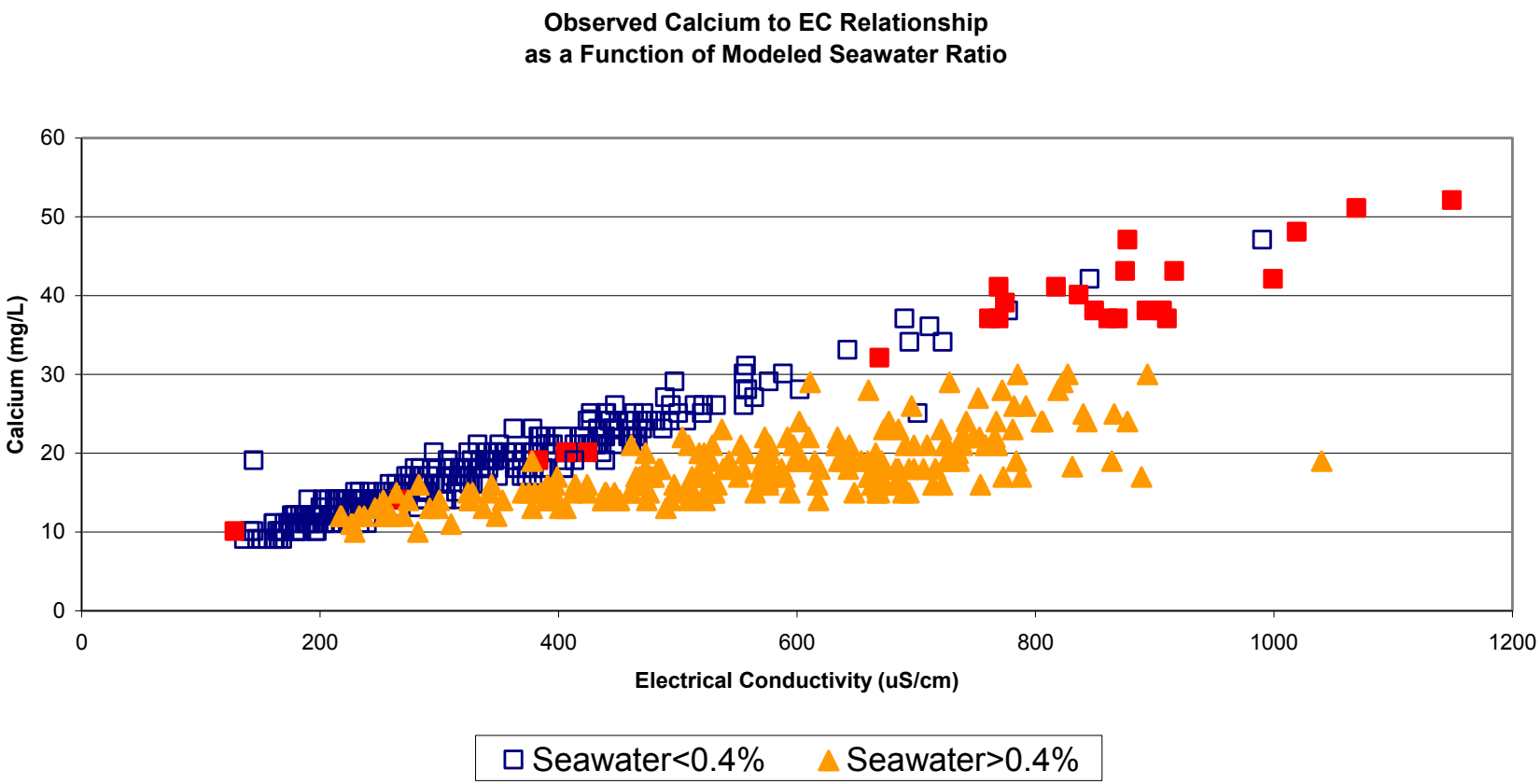
Seawater Fingerprint
Sulfate



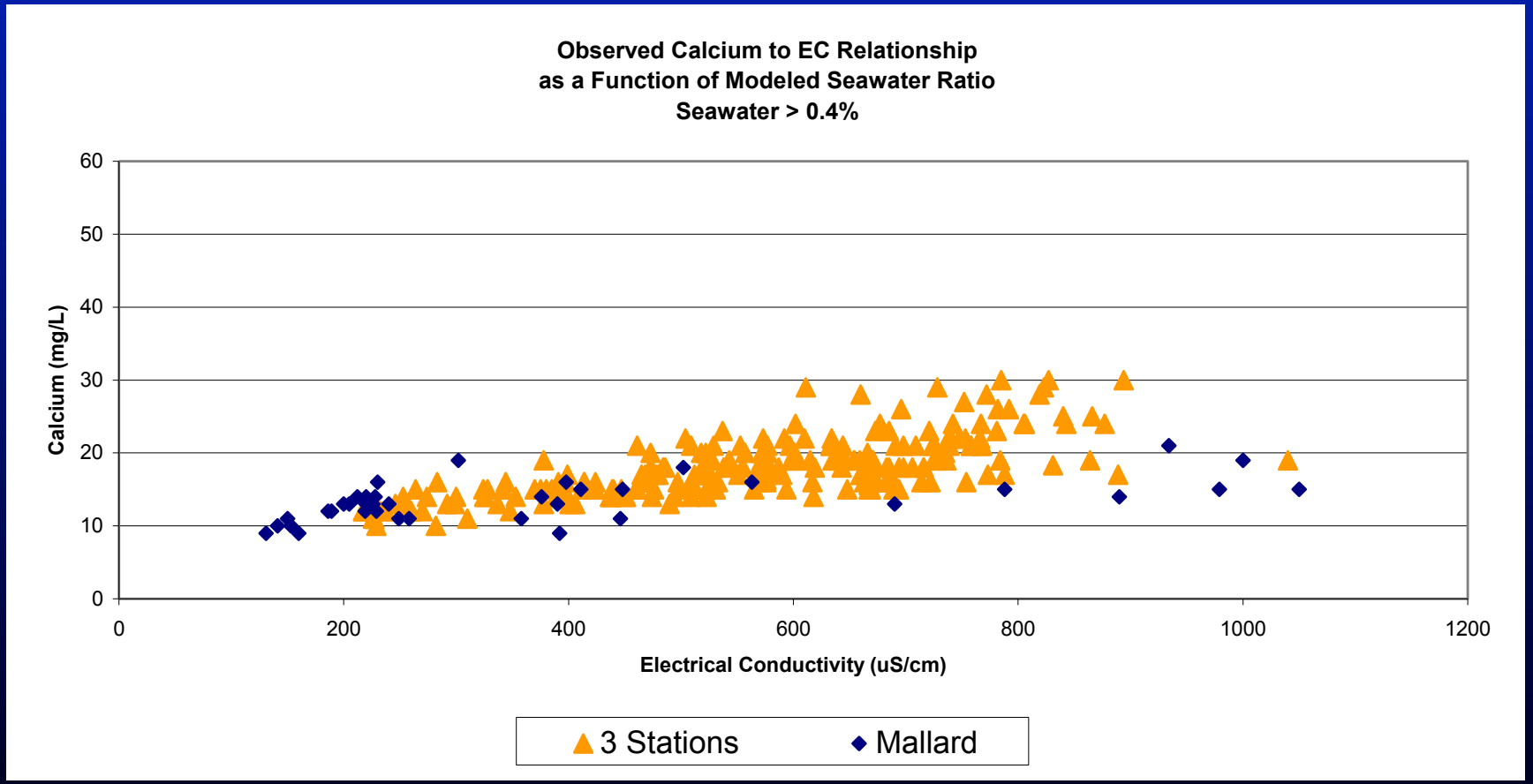
Seawater Fingerprint
Calcium



Seawater Fingerprint
Calcium



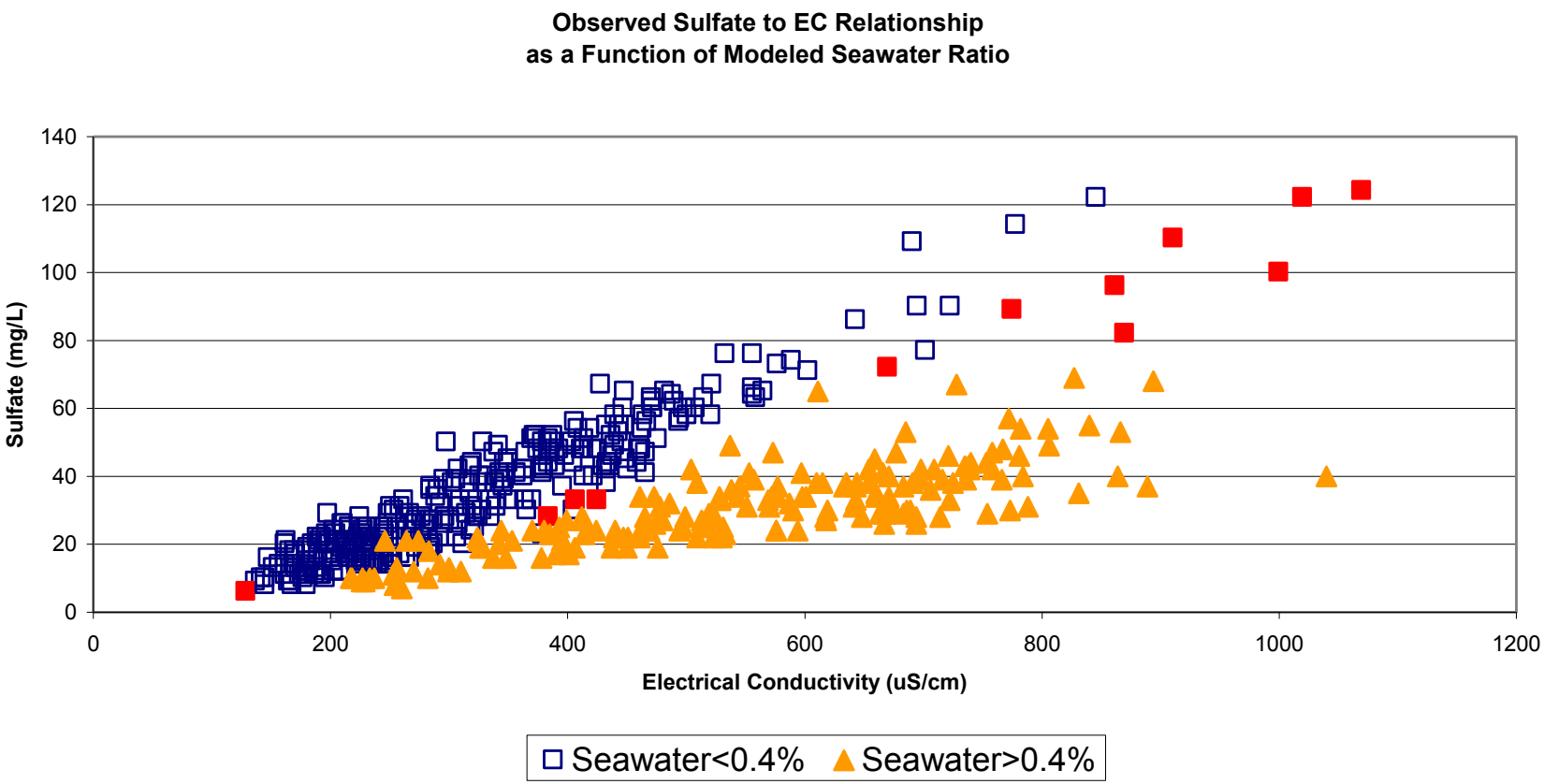
Seawater Fingerprint
Calcium



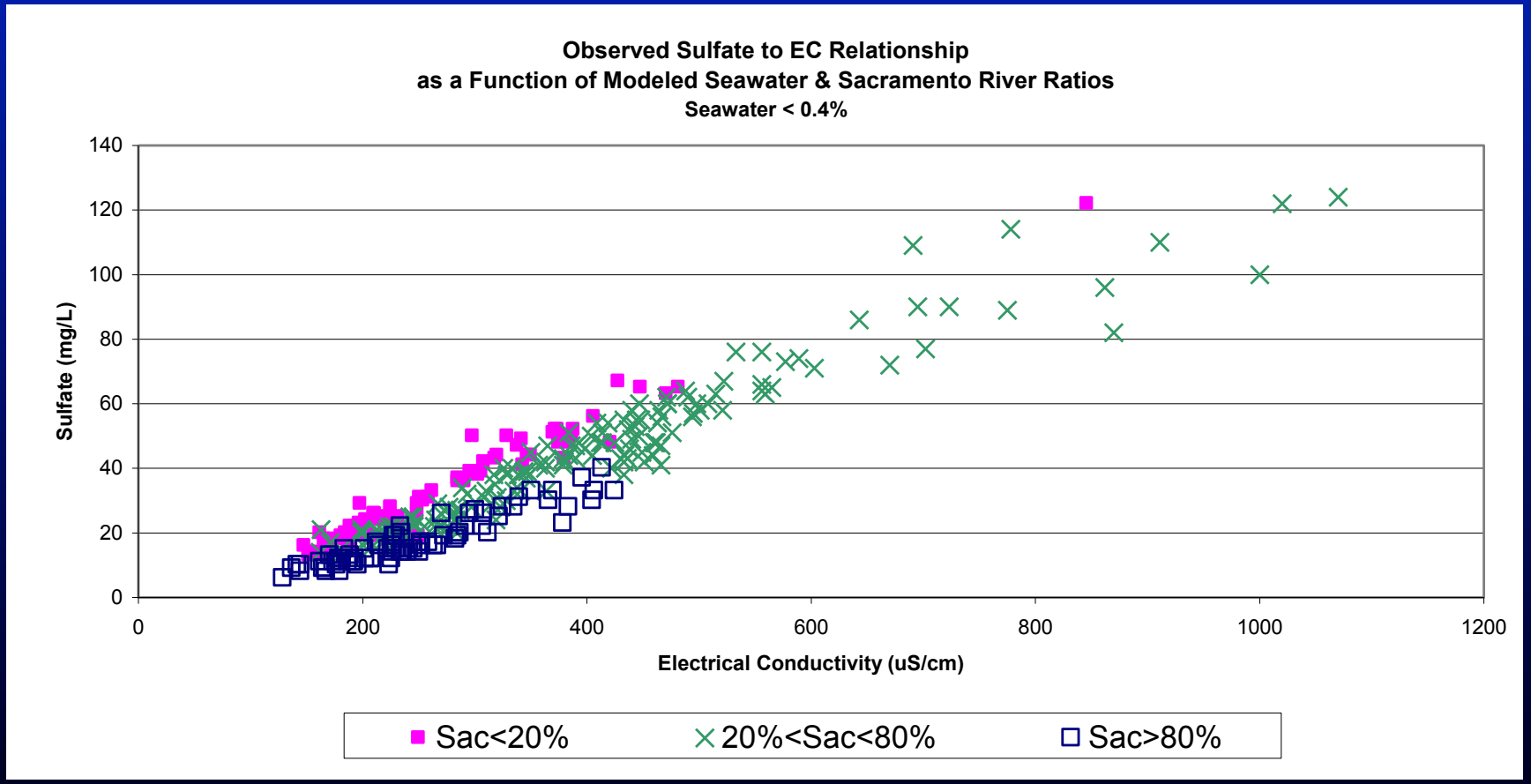
Riverine Fingerprints

- **Classification**
  - Sac volume fingerprint < 20% (dominated by San Joaquin River and agricultural drainage)
  - Sac volume fingerprint 20-80%
  - Sac volume fingerprint > 80% (dominated by Sacramento and Mokelumne Rivers)
- **Riverine fingerprints are not detected when seawater > 0.4%**

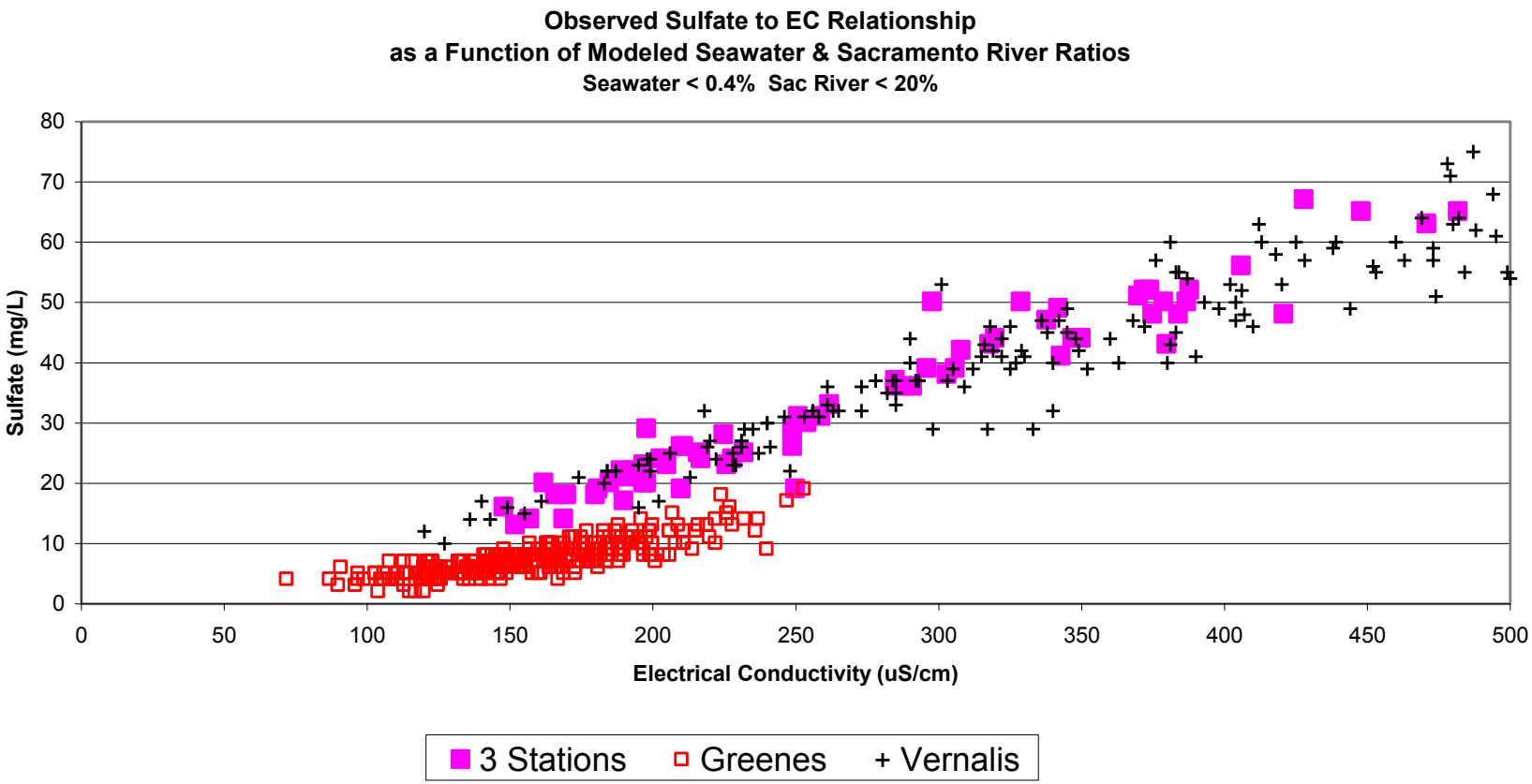
Riverine Fingerprint
Sulfate



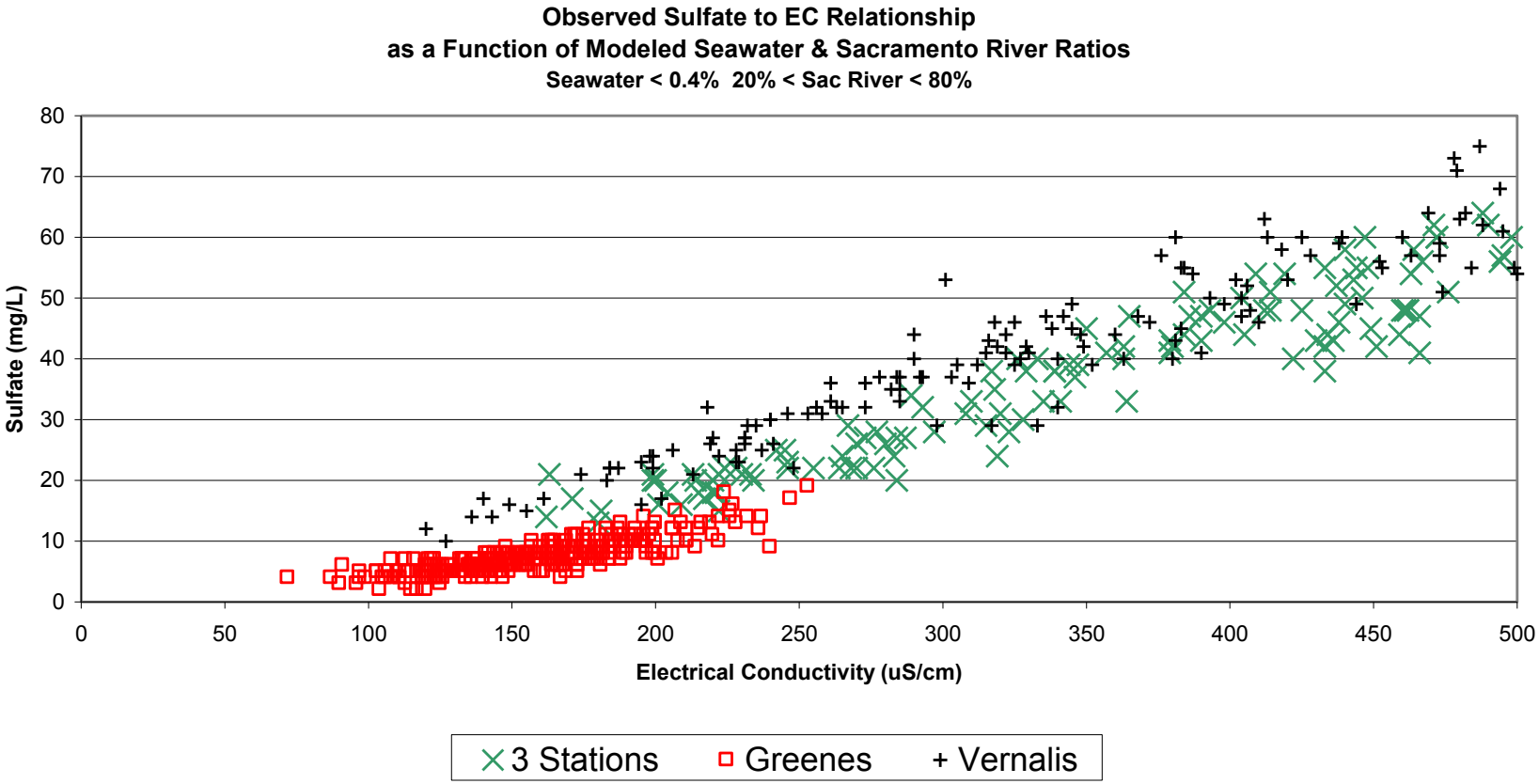
Riverine Fingerprint
Sulfate



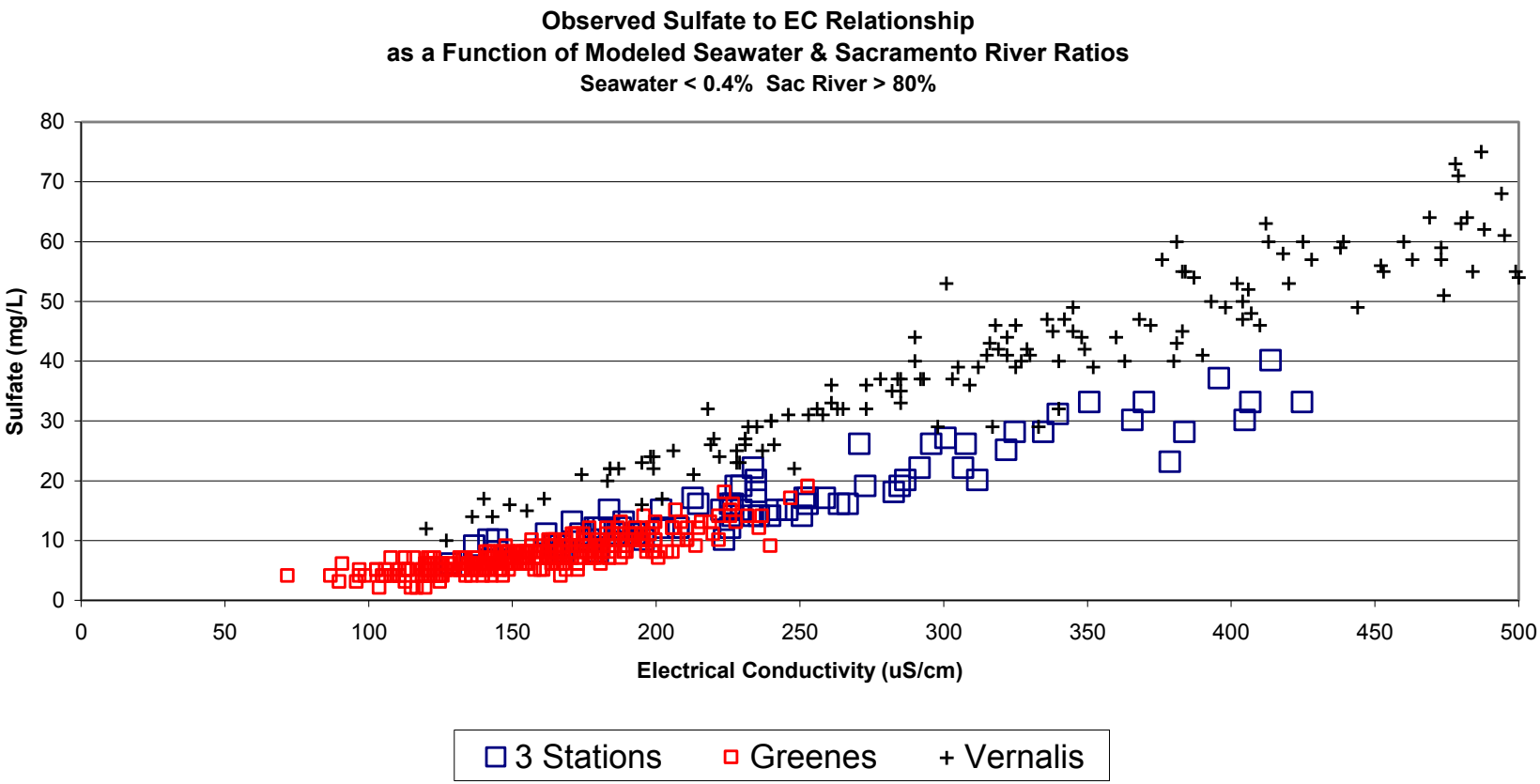
Riverine Fingerprint
Sulfate



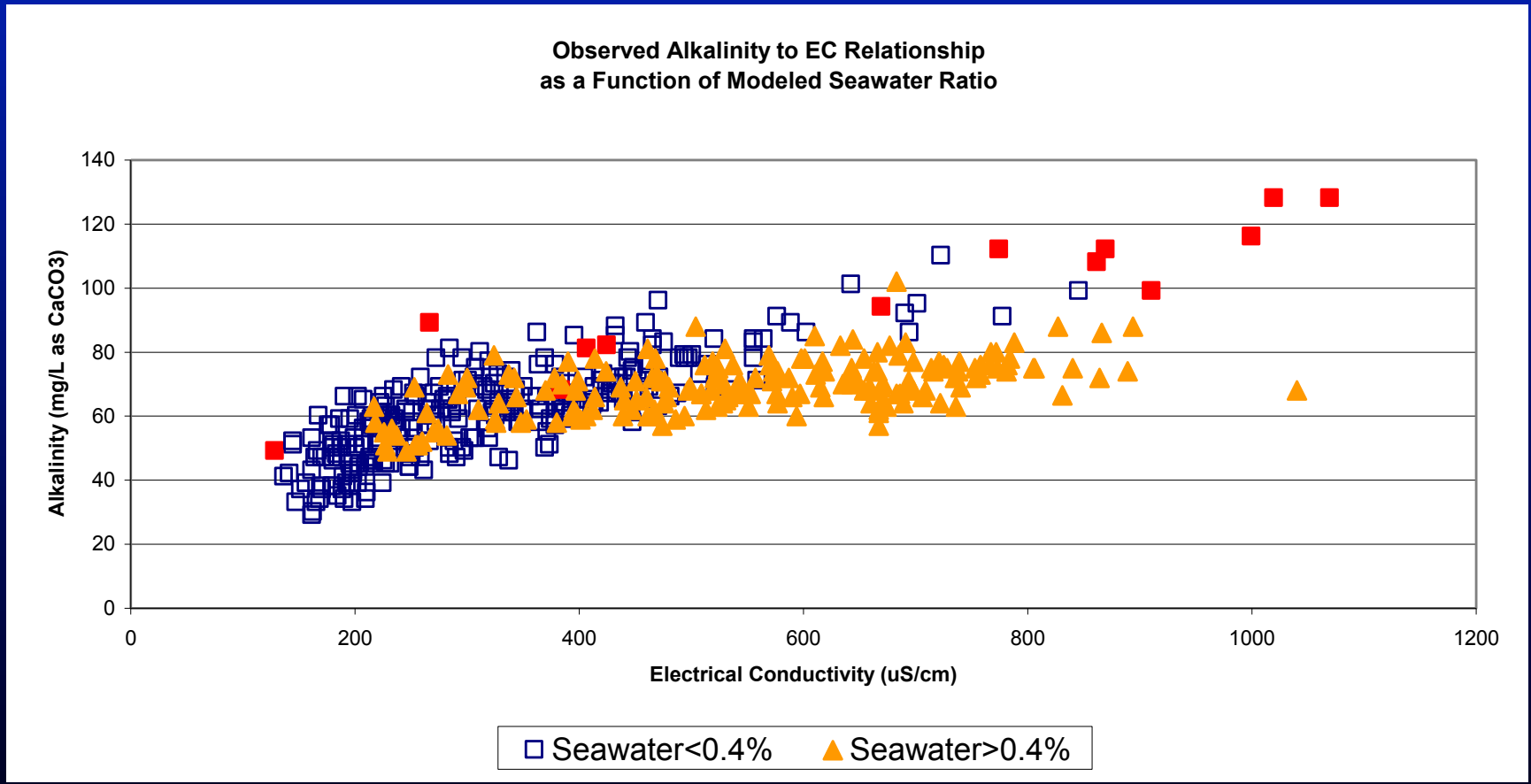
Riverine Fingerprint
Sulfate



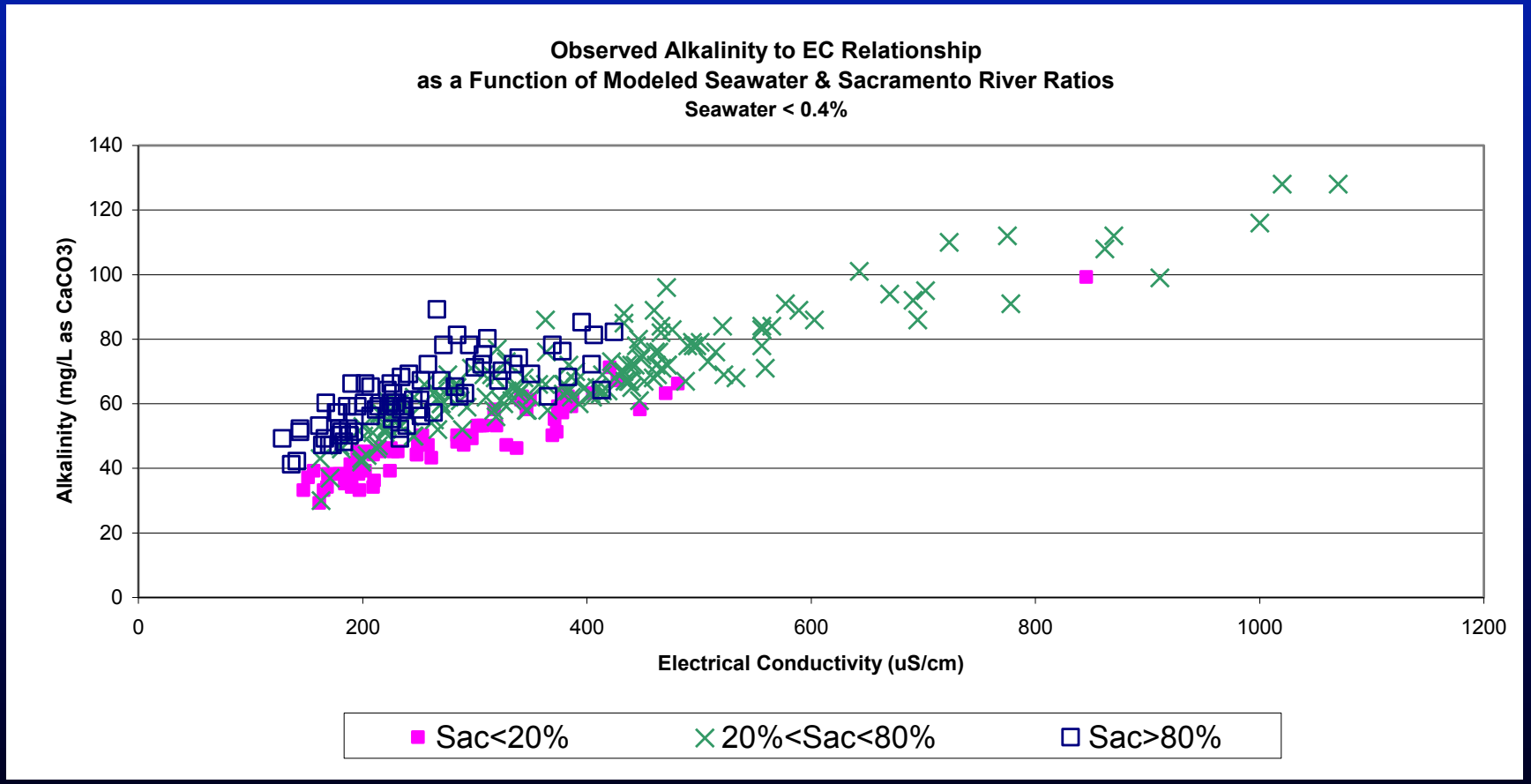
Riverine Fingerprint
Sulfate



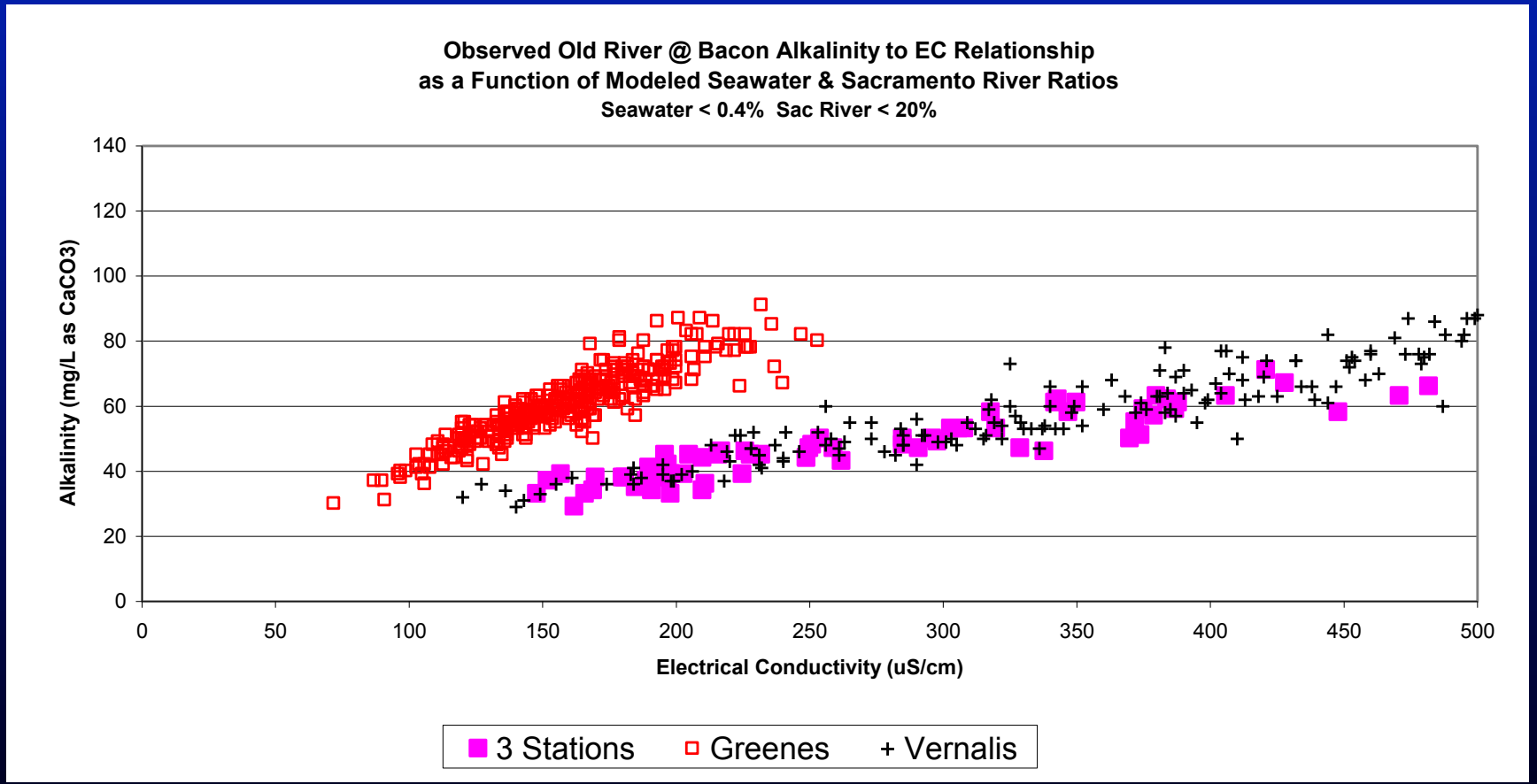
Riverine Fingerprint
Bicarbonate



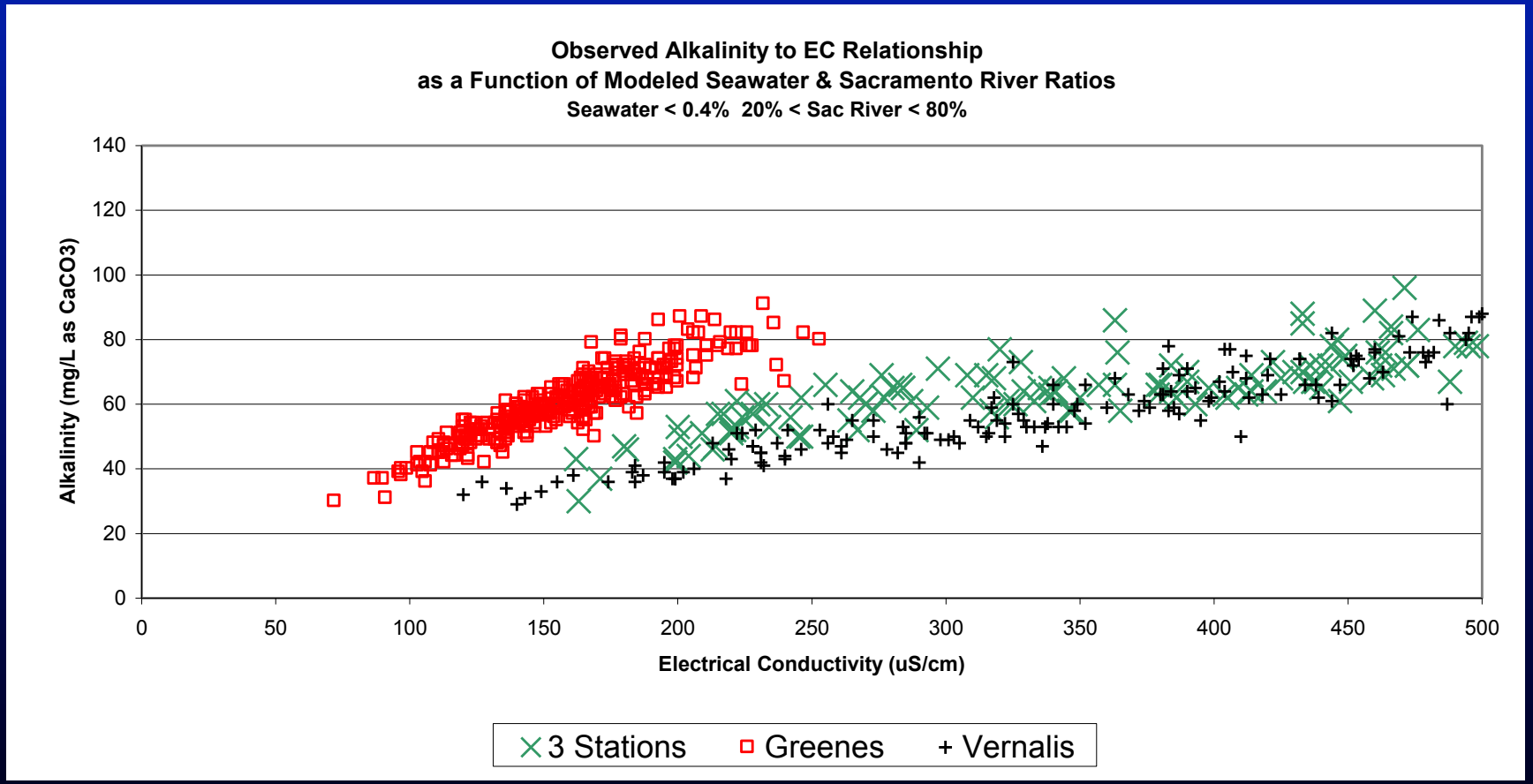
Riverine Fingerprint
Bicarbonate



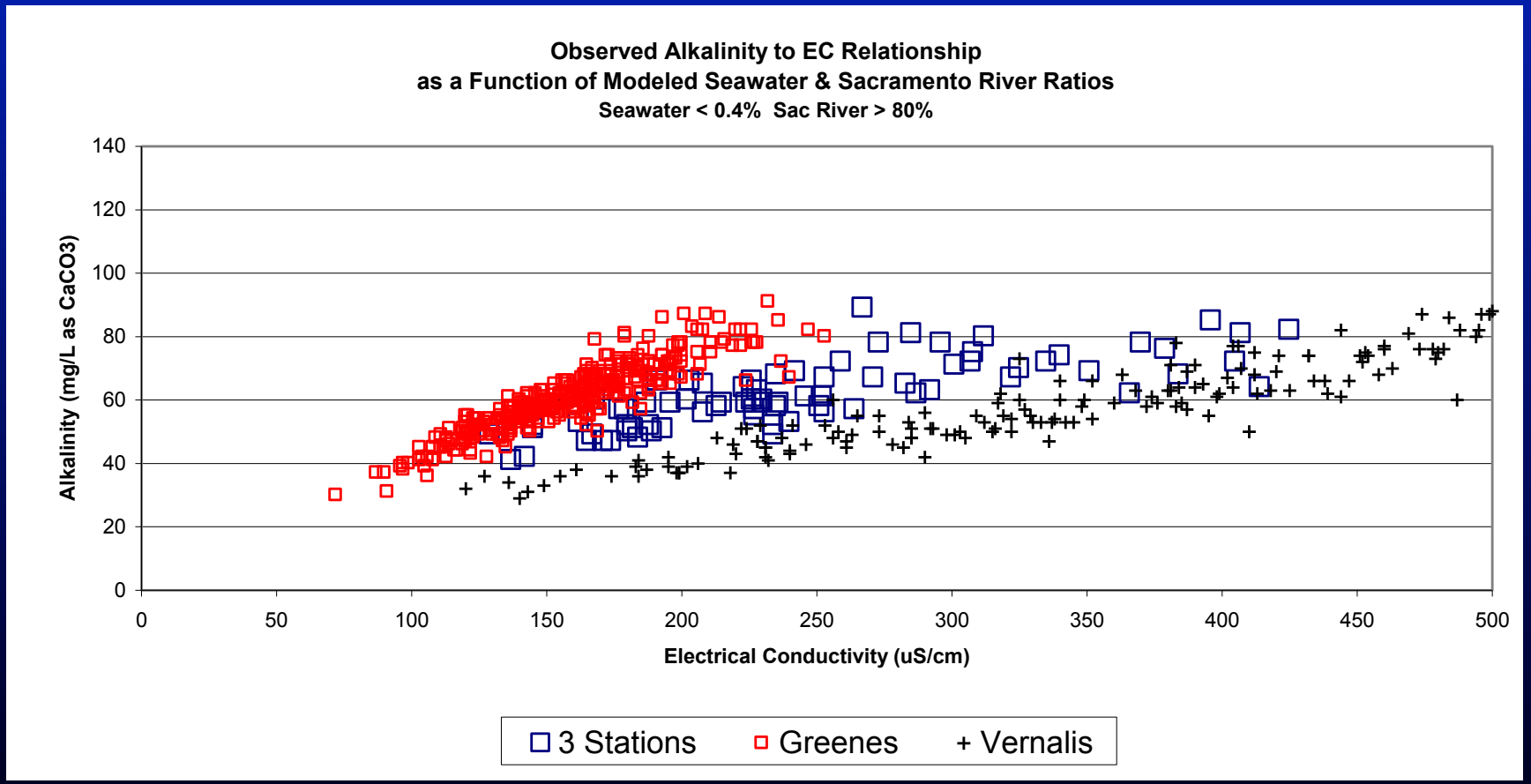
Riverine Fingerprint
Bicarbonate



Riverine Fingerprint
Bicarbonate



Riverine Fingerprint
Bicarbonate



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Conclusions

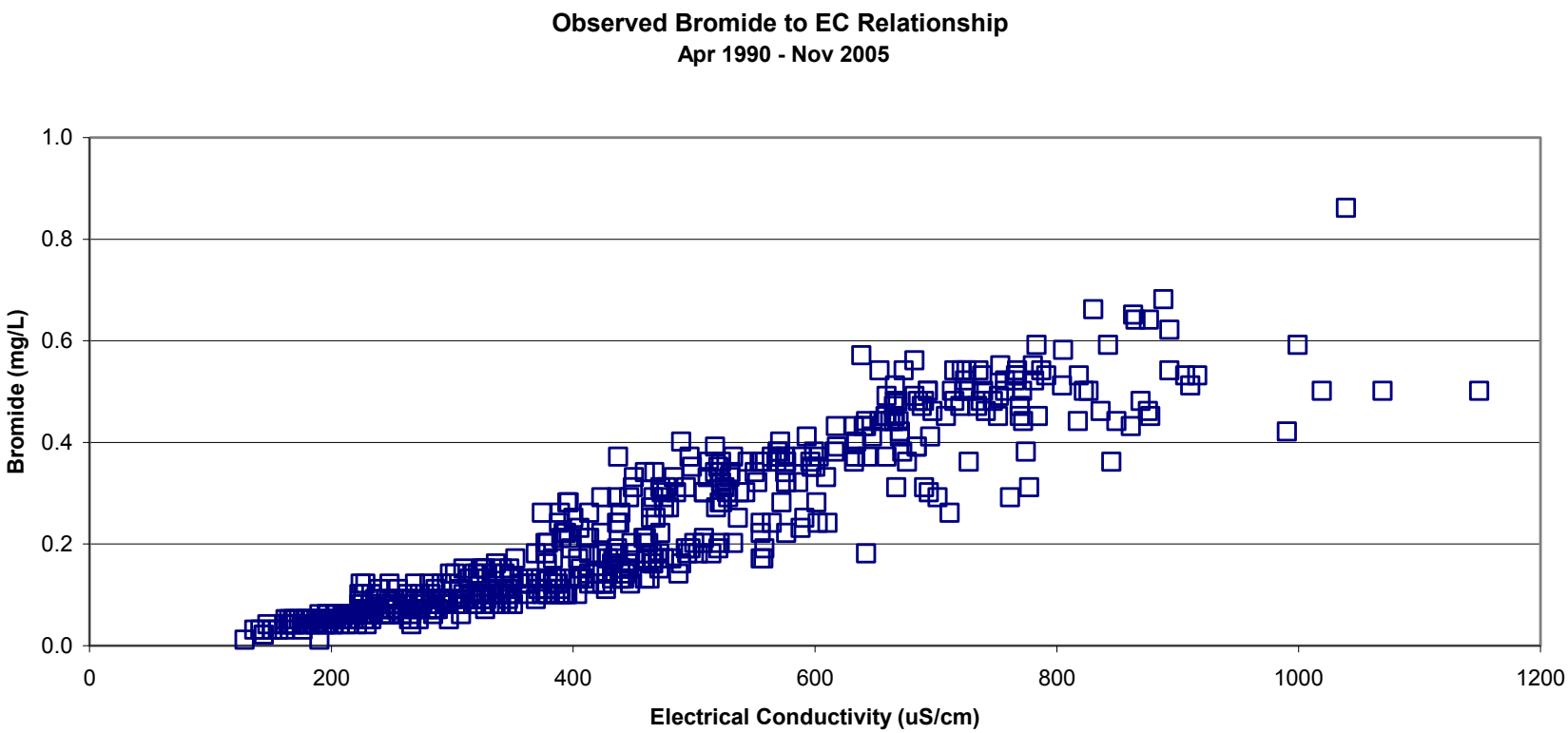
- Observed relationships between mineral concentrations and electrical conductivity correspond to modeled seawater influence. Anion data provide the most obvious fingerprints of seawater influence.
- Observed relationships between sulfate / bicarbonate concentrations and electrical conductivity correspond to modeled Sacramento and San Joaquin River influences.
- Mineral data provide an indirect means to validate DSM2 volumetric fingerprints.

Recommendations

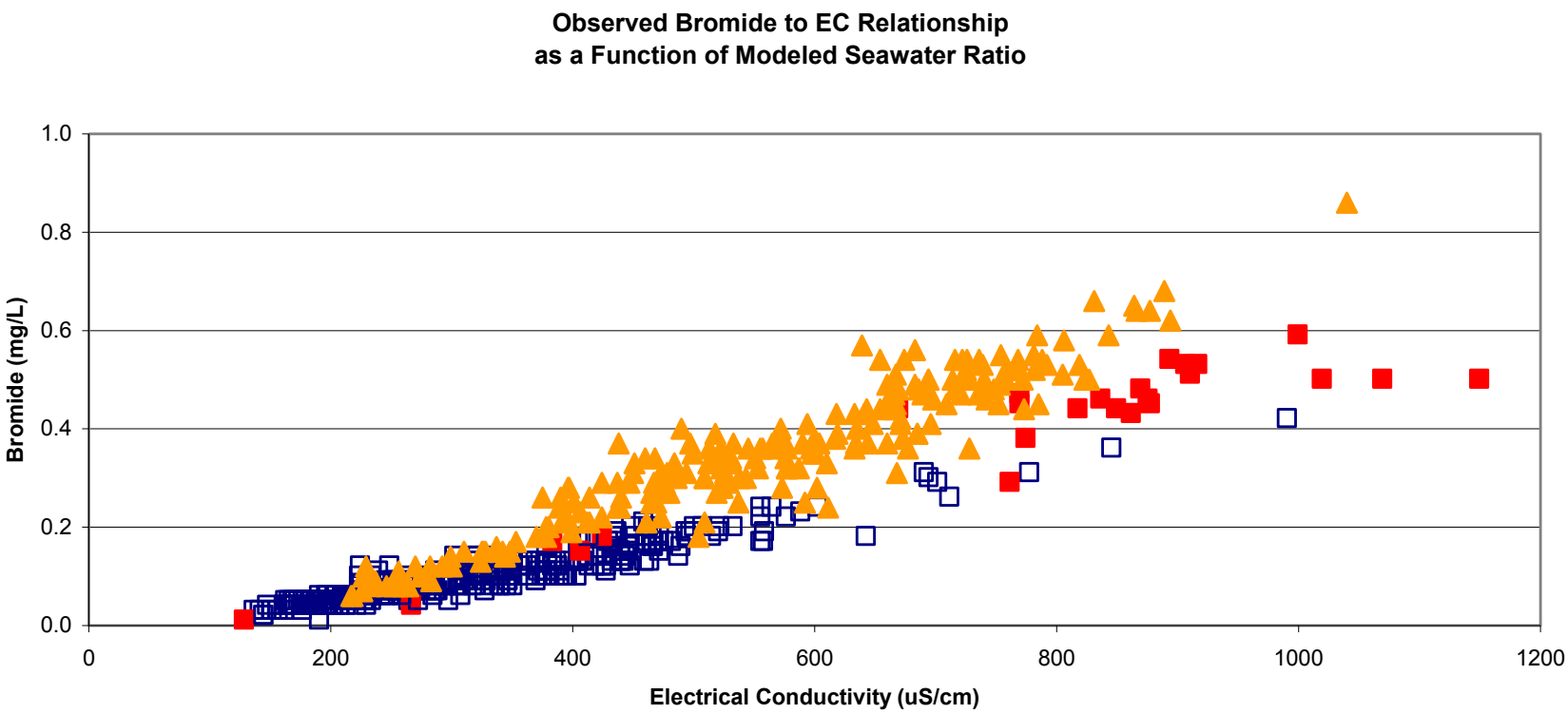
- Refine regression relationships between electrical conductivity and mineral concentrations at various Delta locations.
  - Potential use in water quality forecasts and planning studies
  - Potential use in DSM2 validation
- Investigate outlier data (Tracy 1990-92)
- Collect more mineral data in the Delta. Anion data is particularly valuable.

Extra Slides

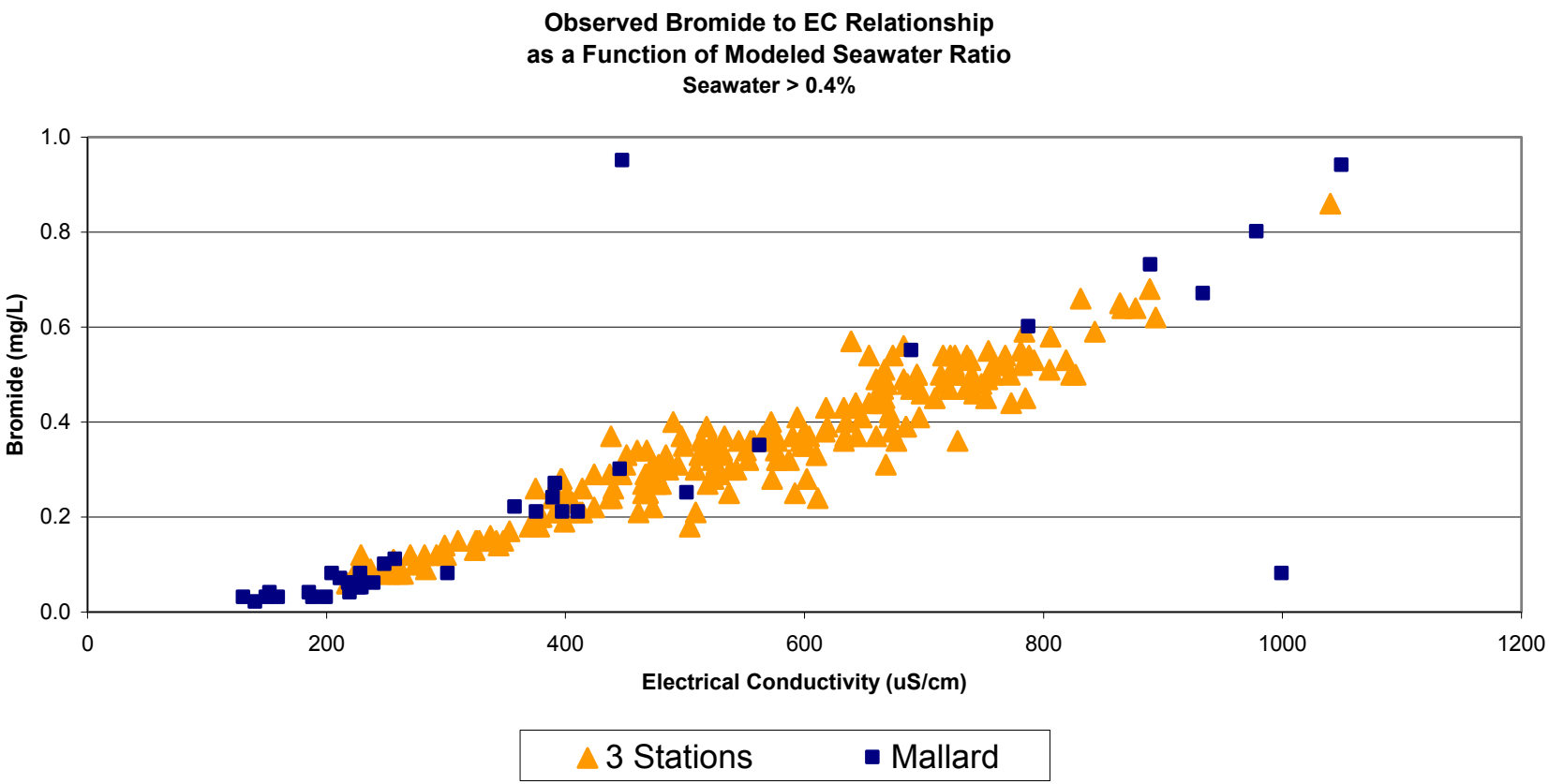
Seawater Fingerprint
Bromide



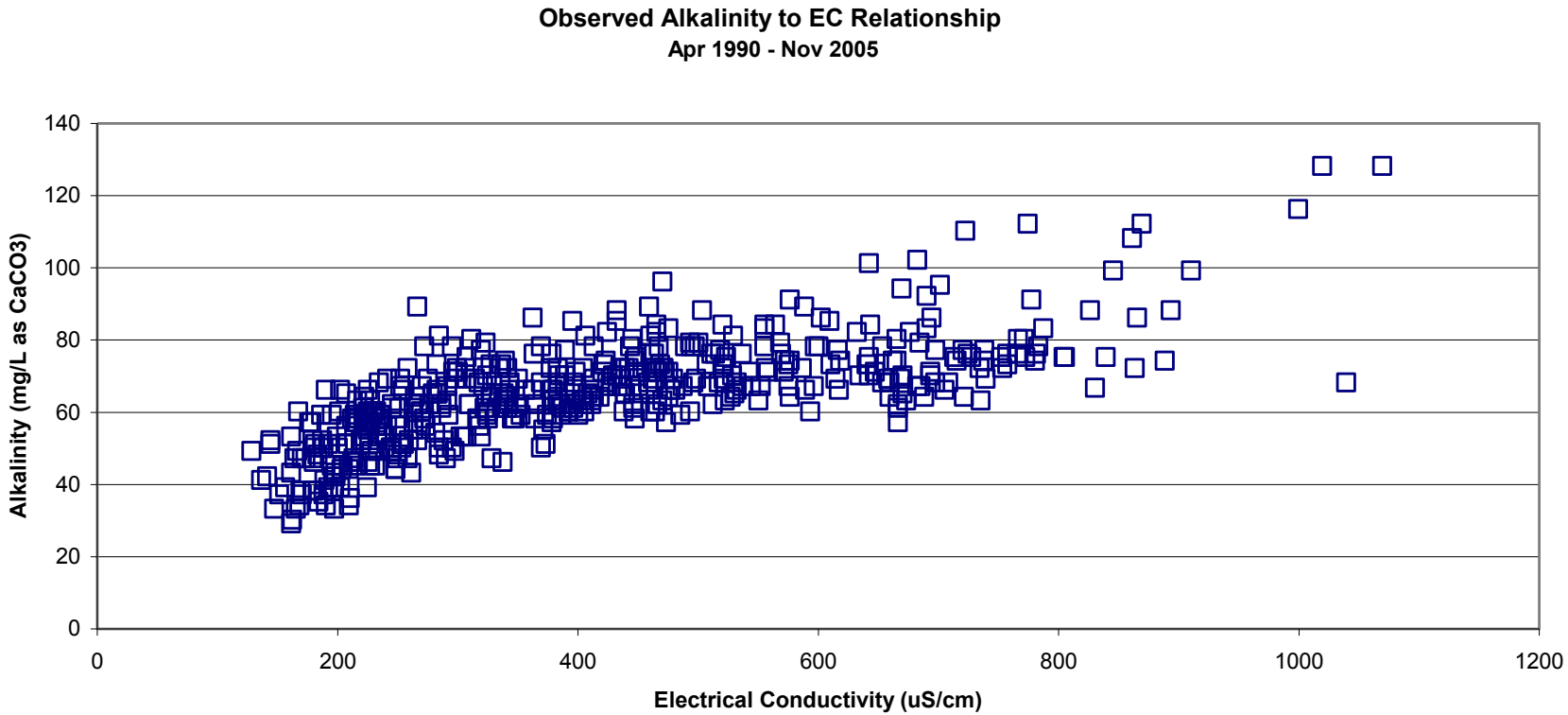
Seawater Fingerprint
Bromide



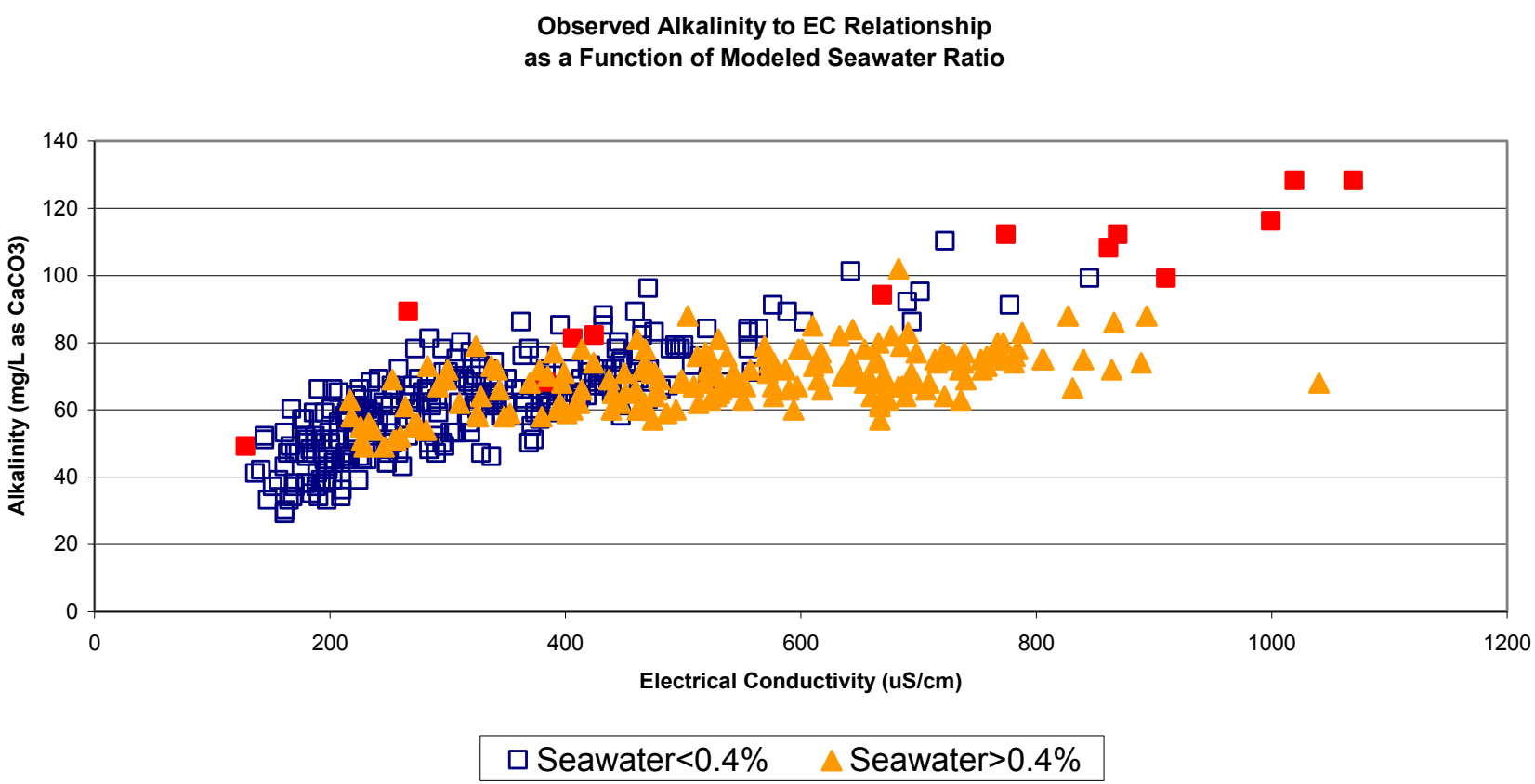
Seawater Fingerprint
Bromide



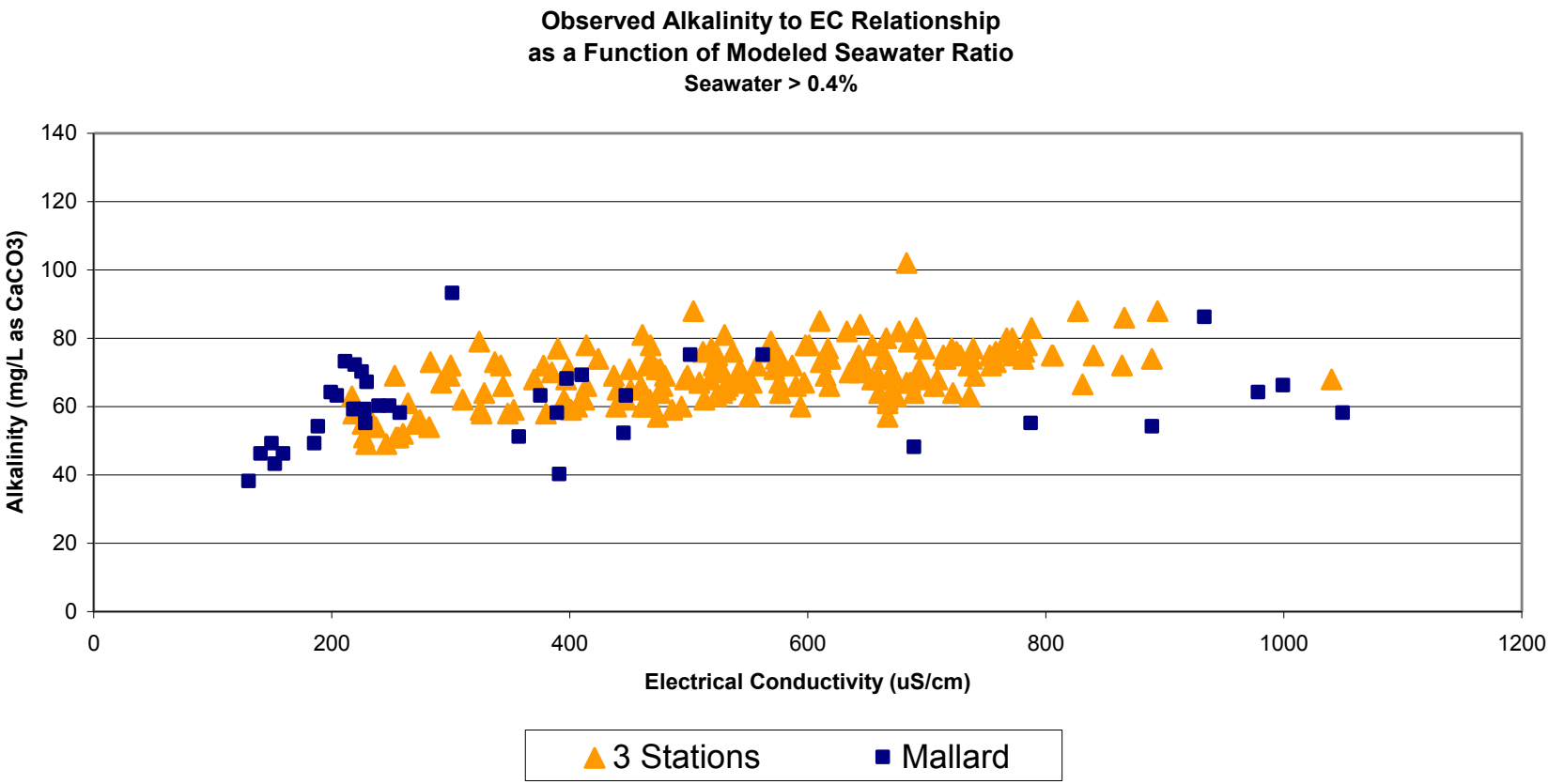
Seawater Fingerprint
Bicarbonate



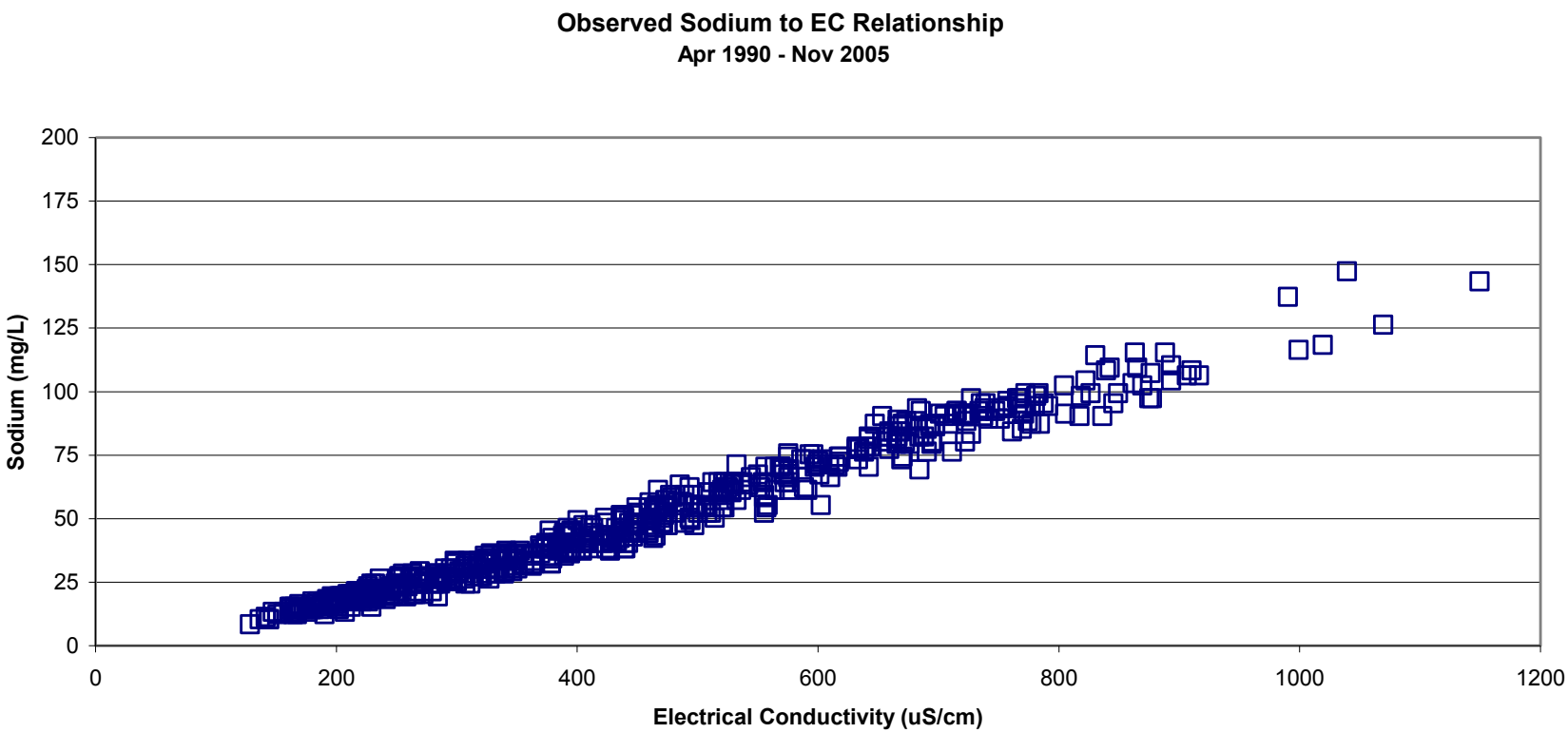
Seawater Fingerprint
Bicarbonate



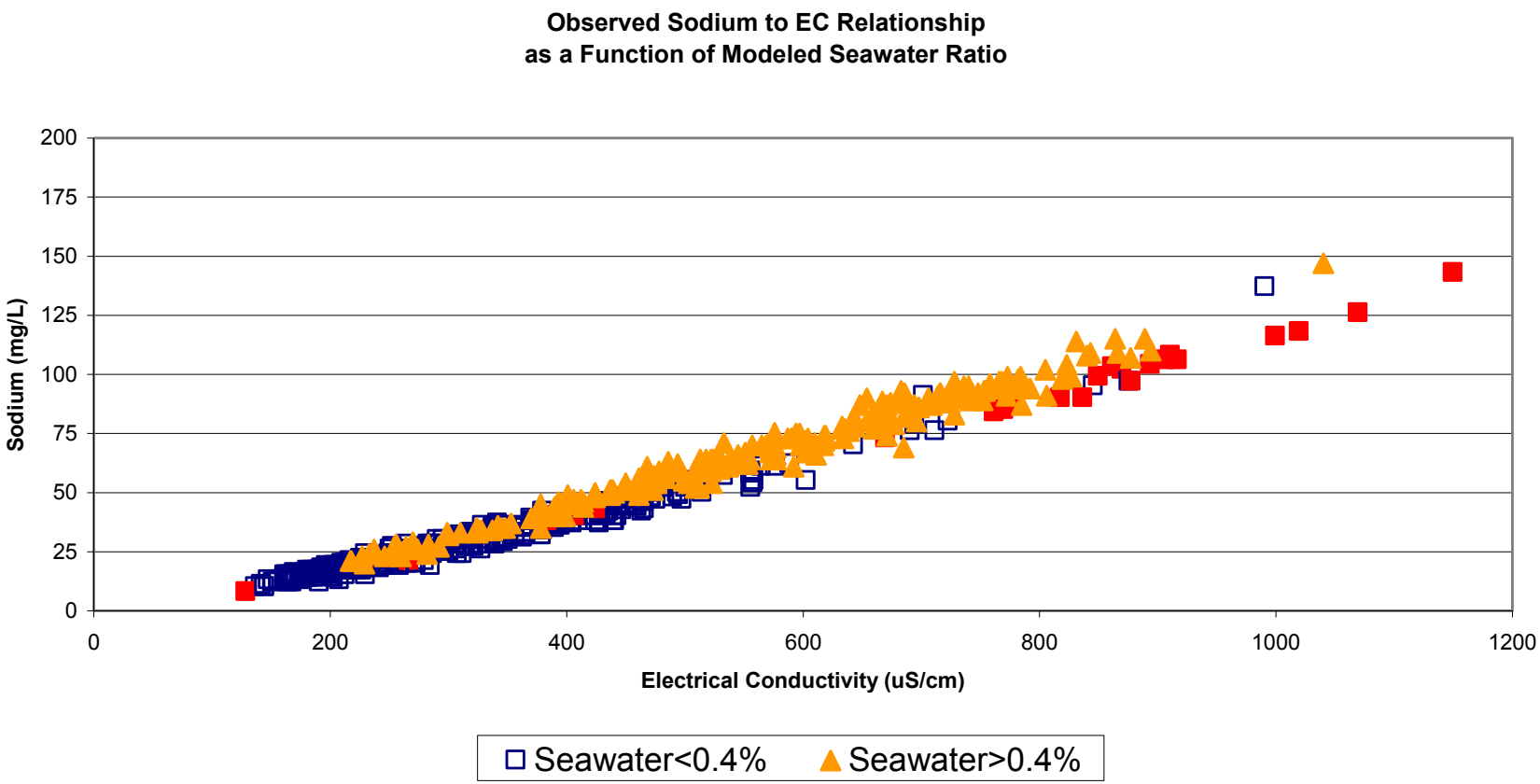
Seawater Fingerprint
Bicarbonate



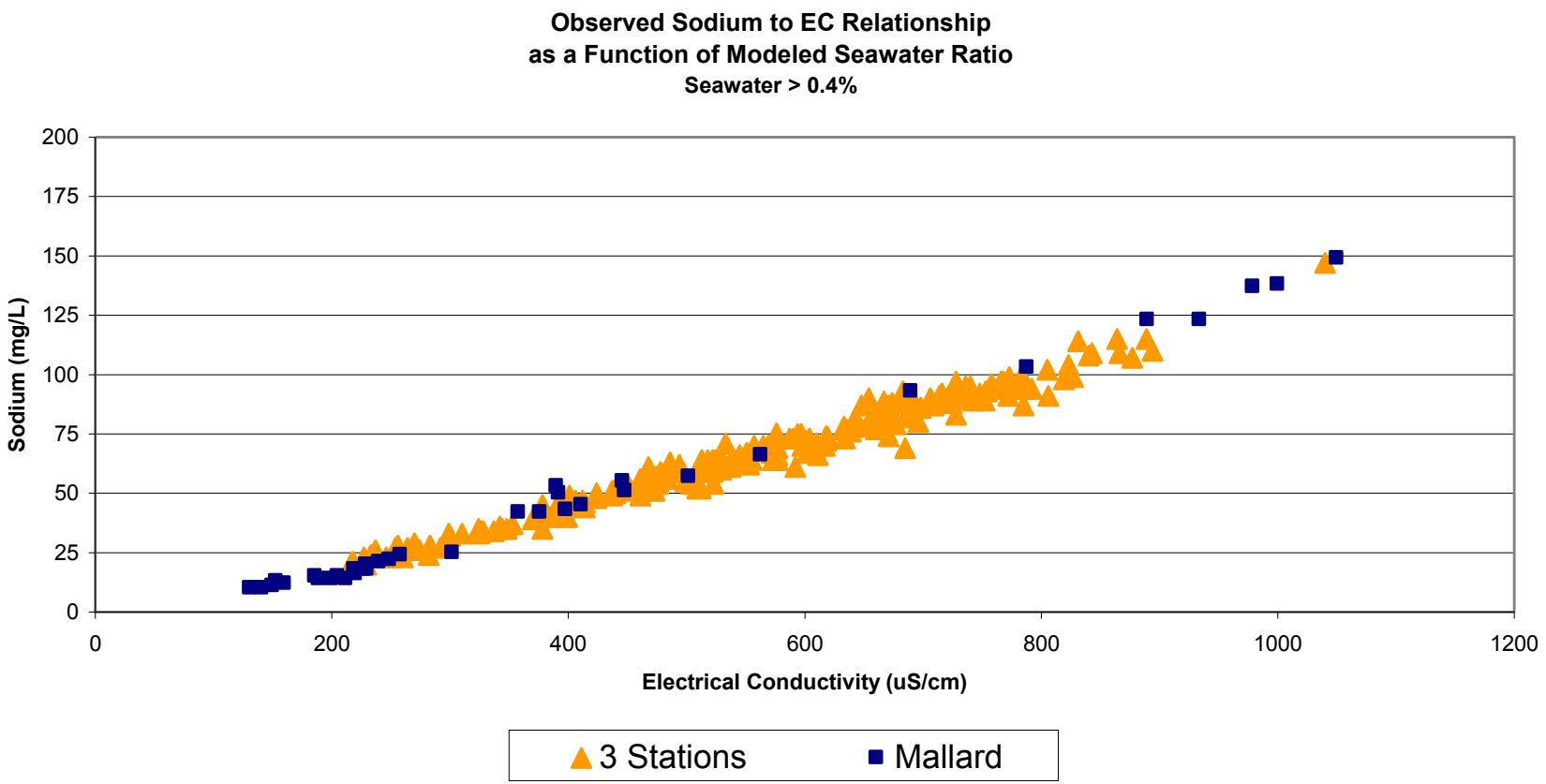
Seawater Fingerprint
Sodium



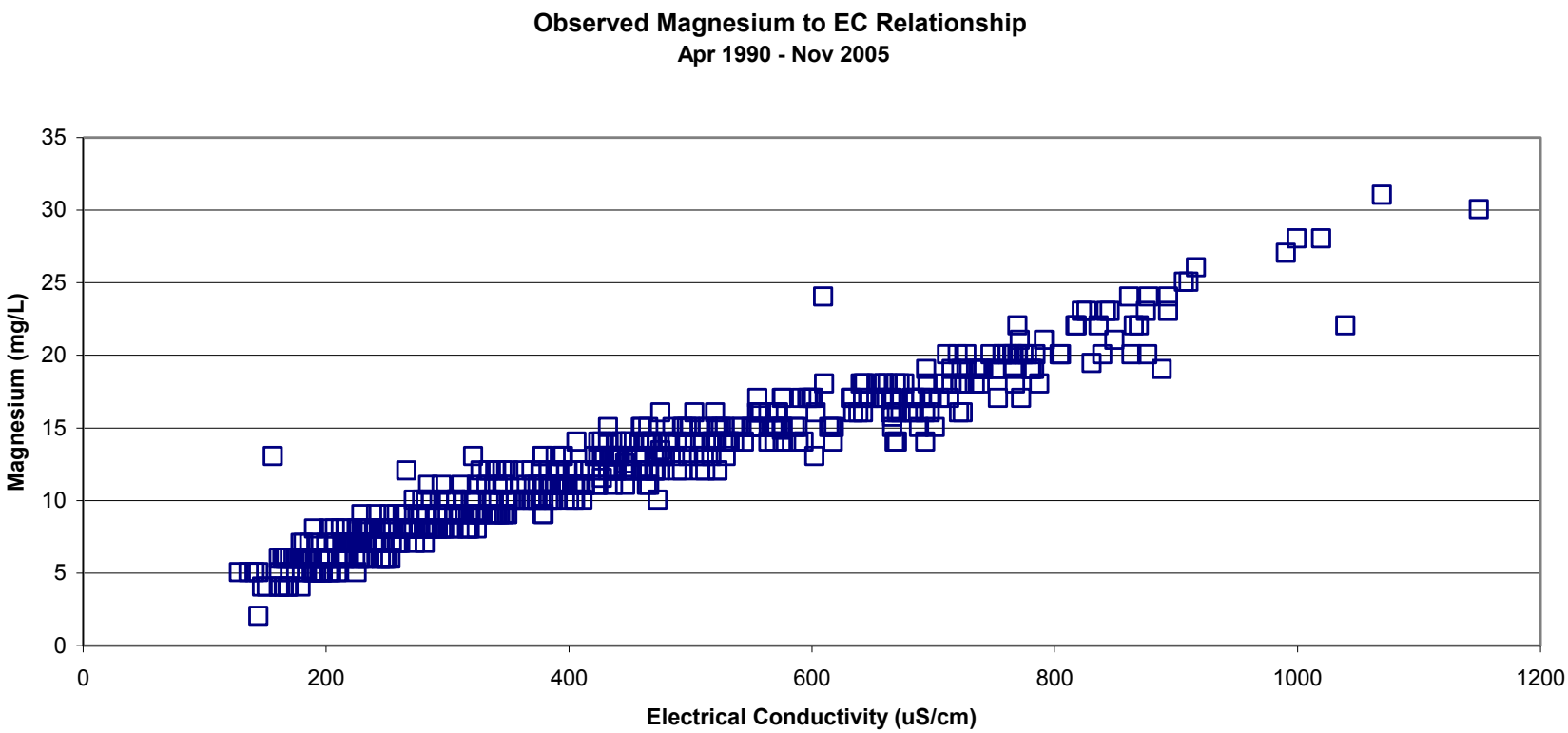
Seawater Fingerprint
Sodium



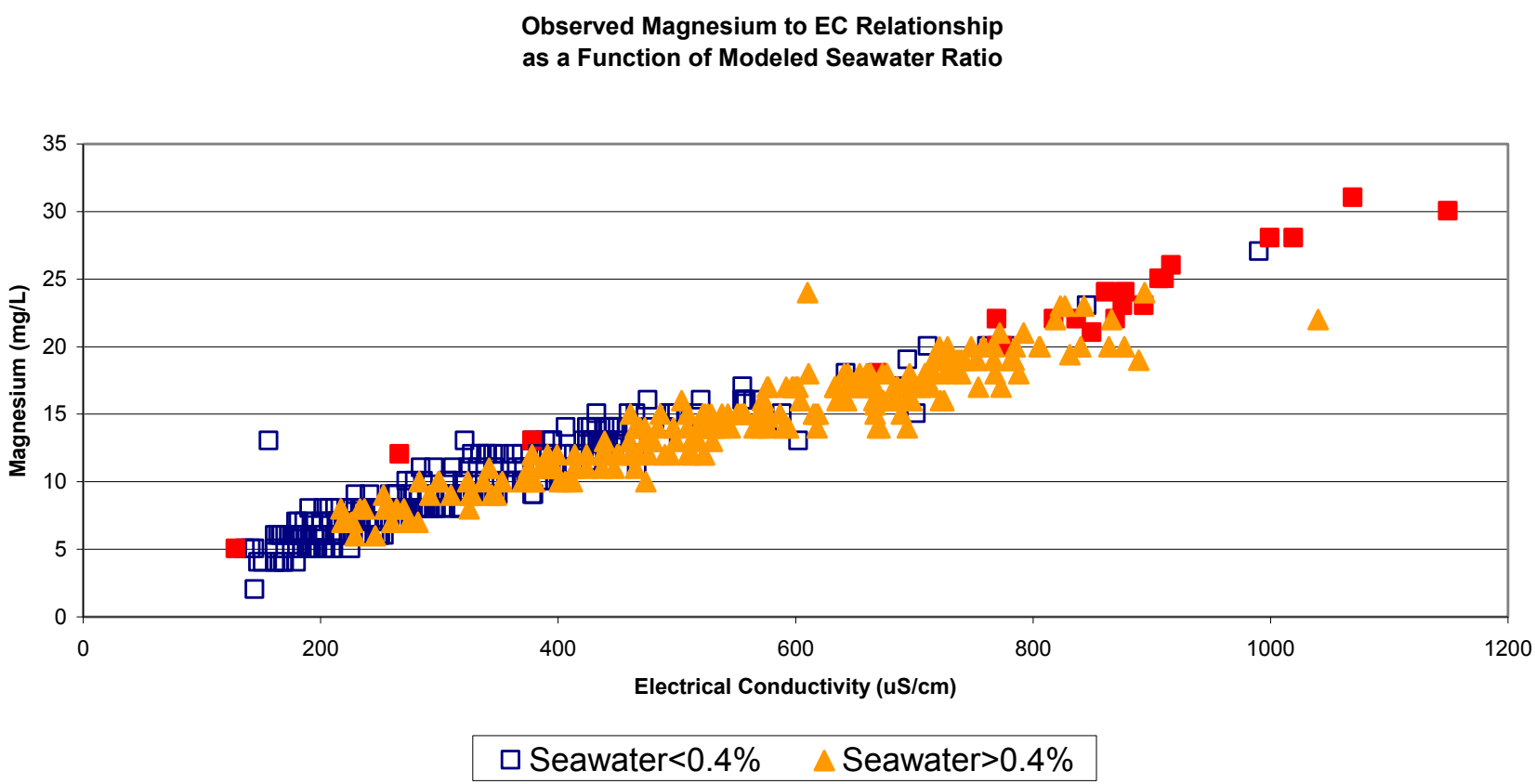
Seawater Fingerprint
Sodium



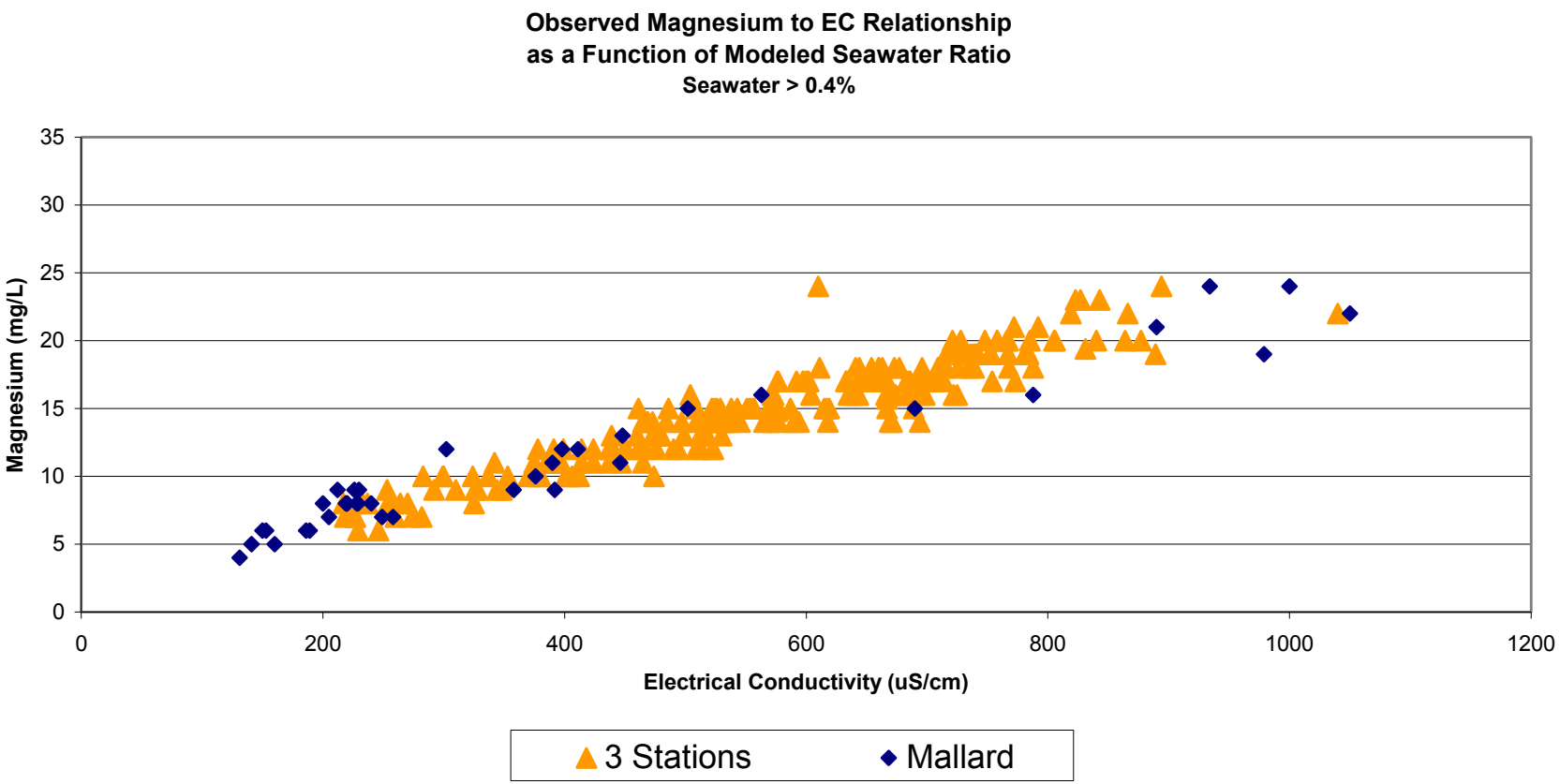
Seawater Fingerprint
Magnesium



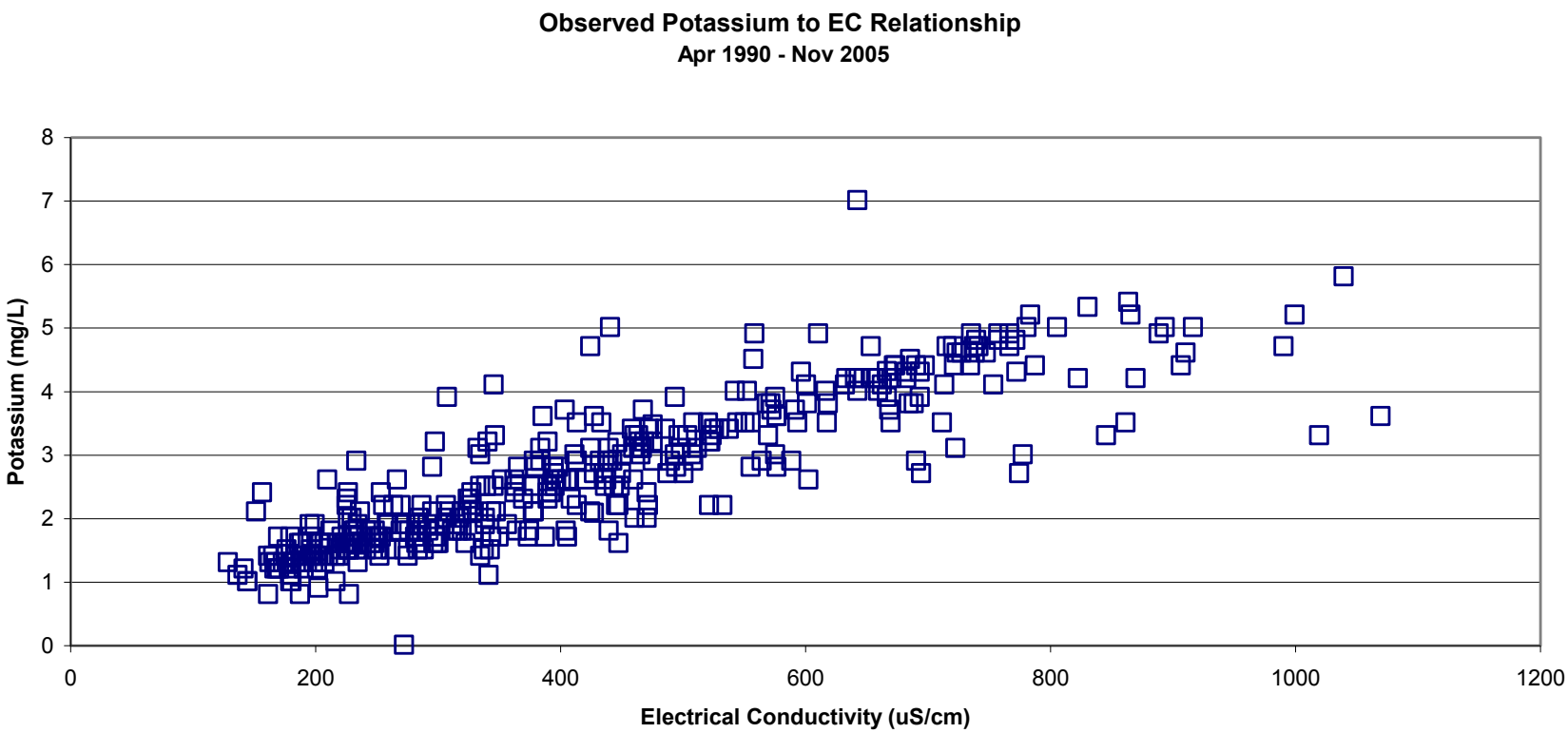
Seawater Fingerprint
Magnesium



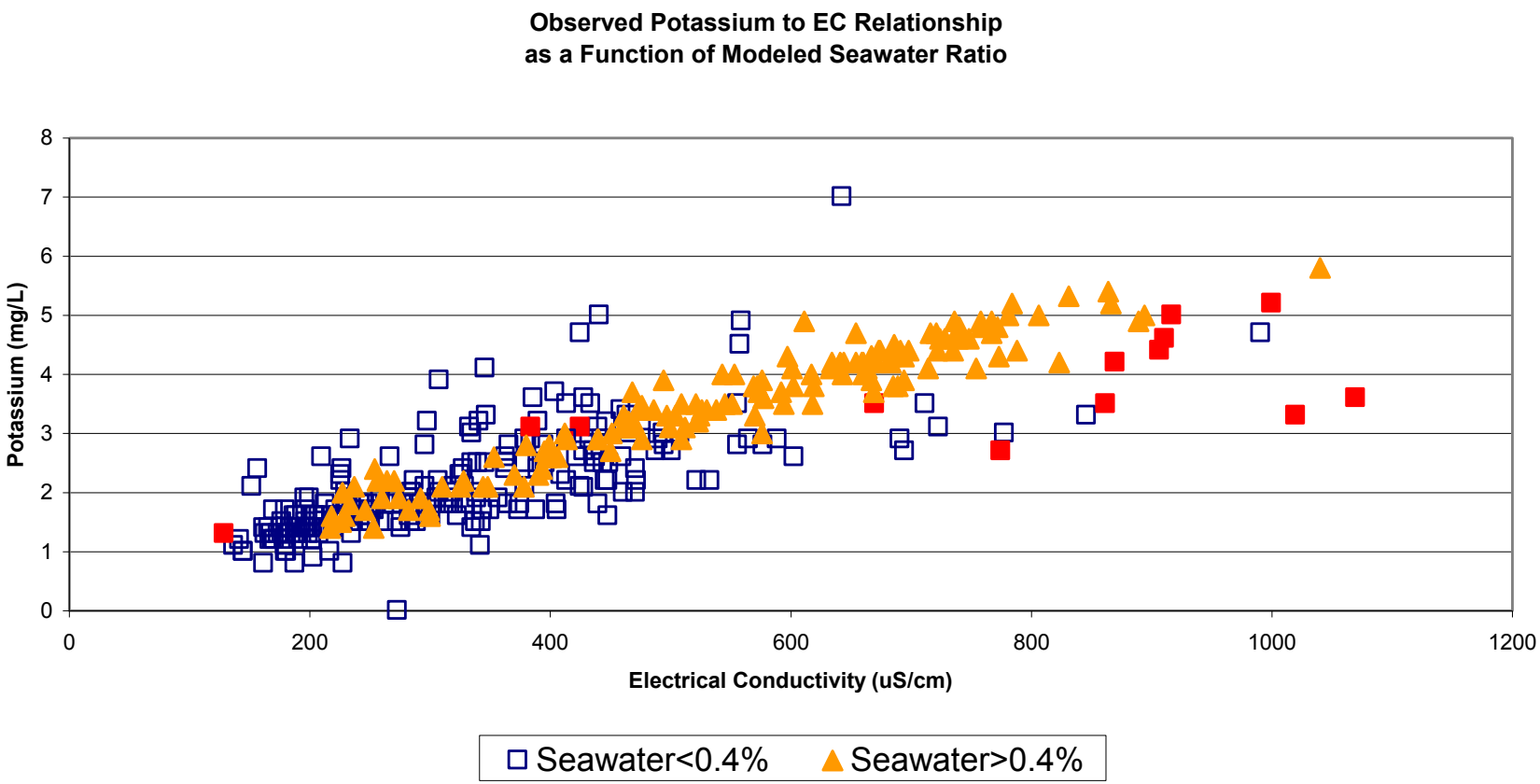
Seawater Fingerprint
Magnesium



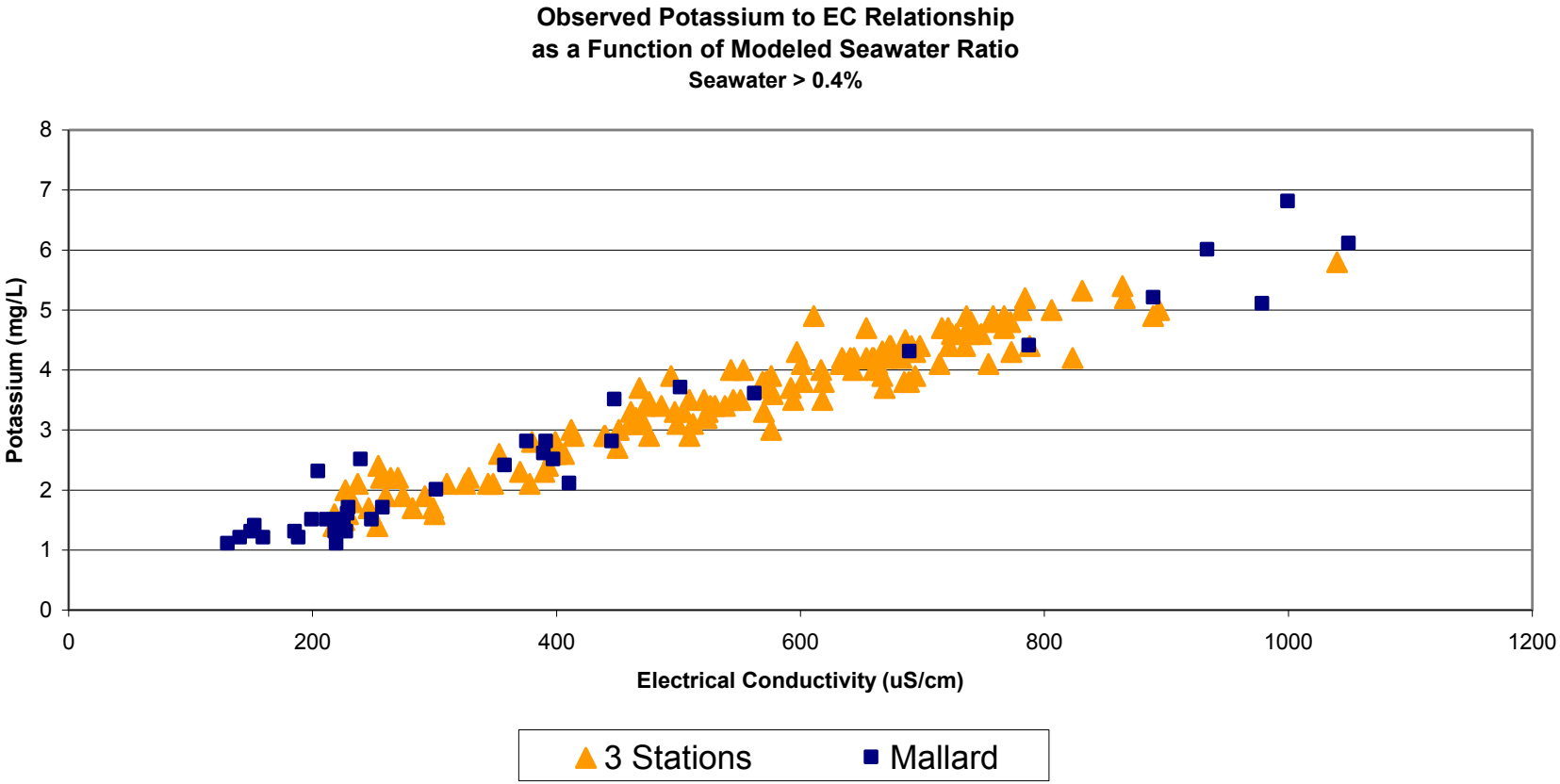
Seawater Fingerprint
Potassium



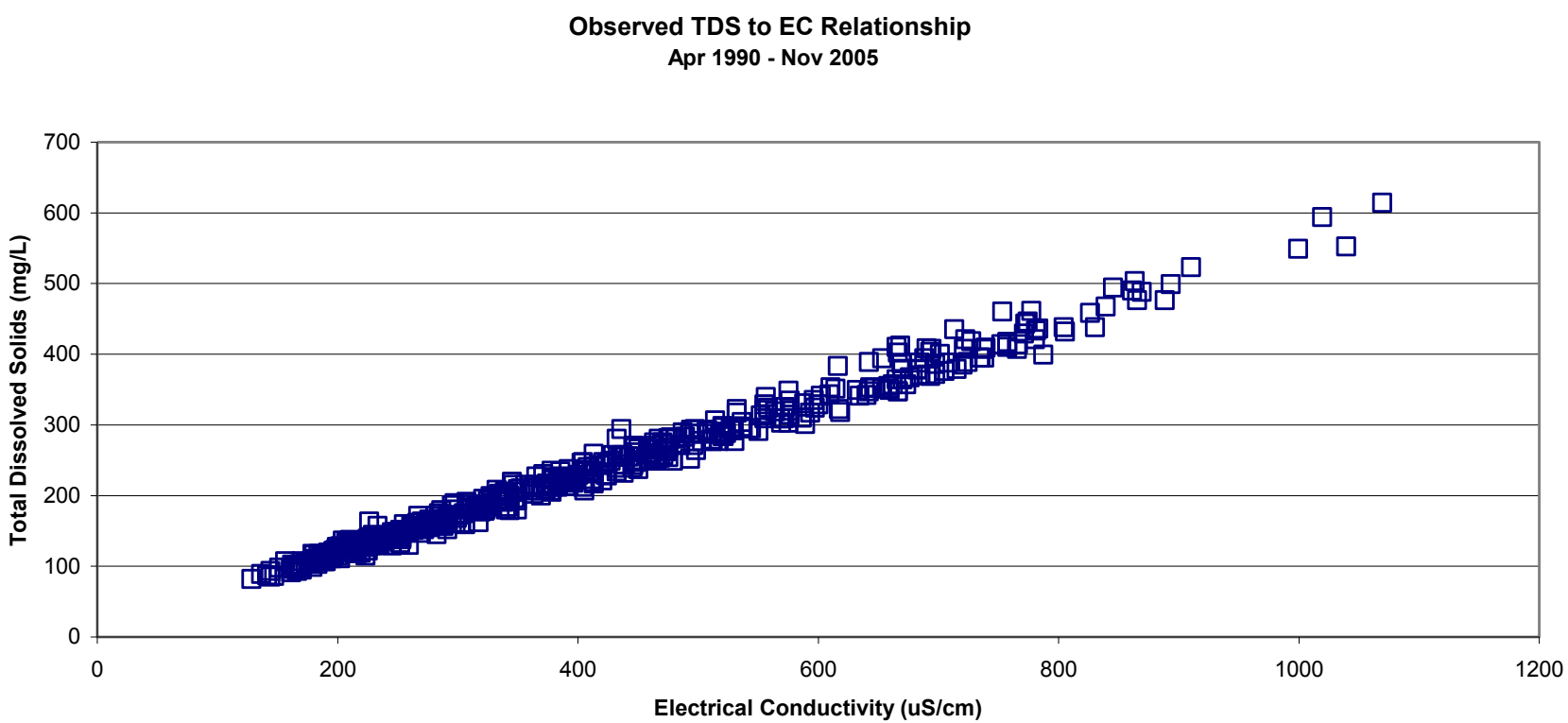
Seawater Fingerprint
Potassium



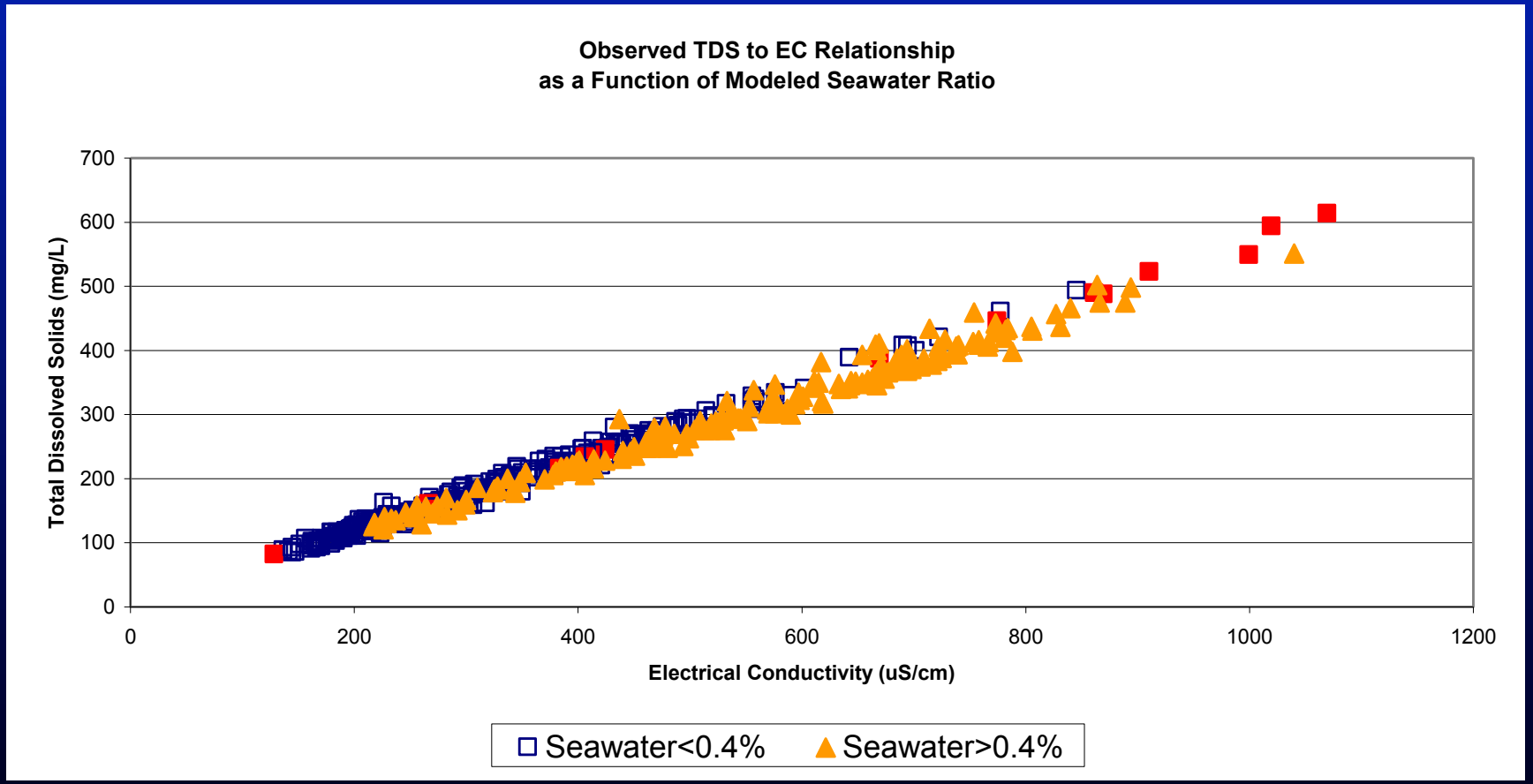
Seawater Fingerprint
Potassium



Seawater Fingerprint
Total Dissolved Solids



Seawater Fingerprint
Total Dissolved Solids



Seawater Fingerprint
Total Dissolved Solids