

# **Distributional Patterns of Aquatic Macrophytes in the San Marcos and Comal Rivers from 2000 to 2015**

**Jeffrey Hutchinson and Julie Foote**

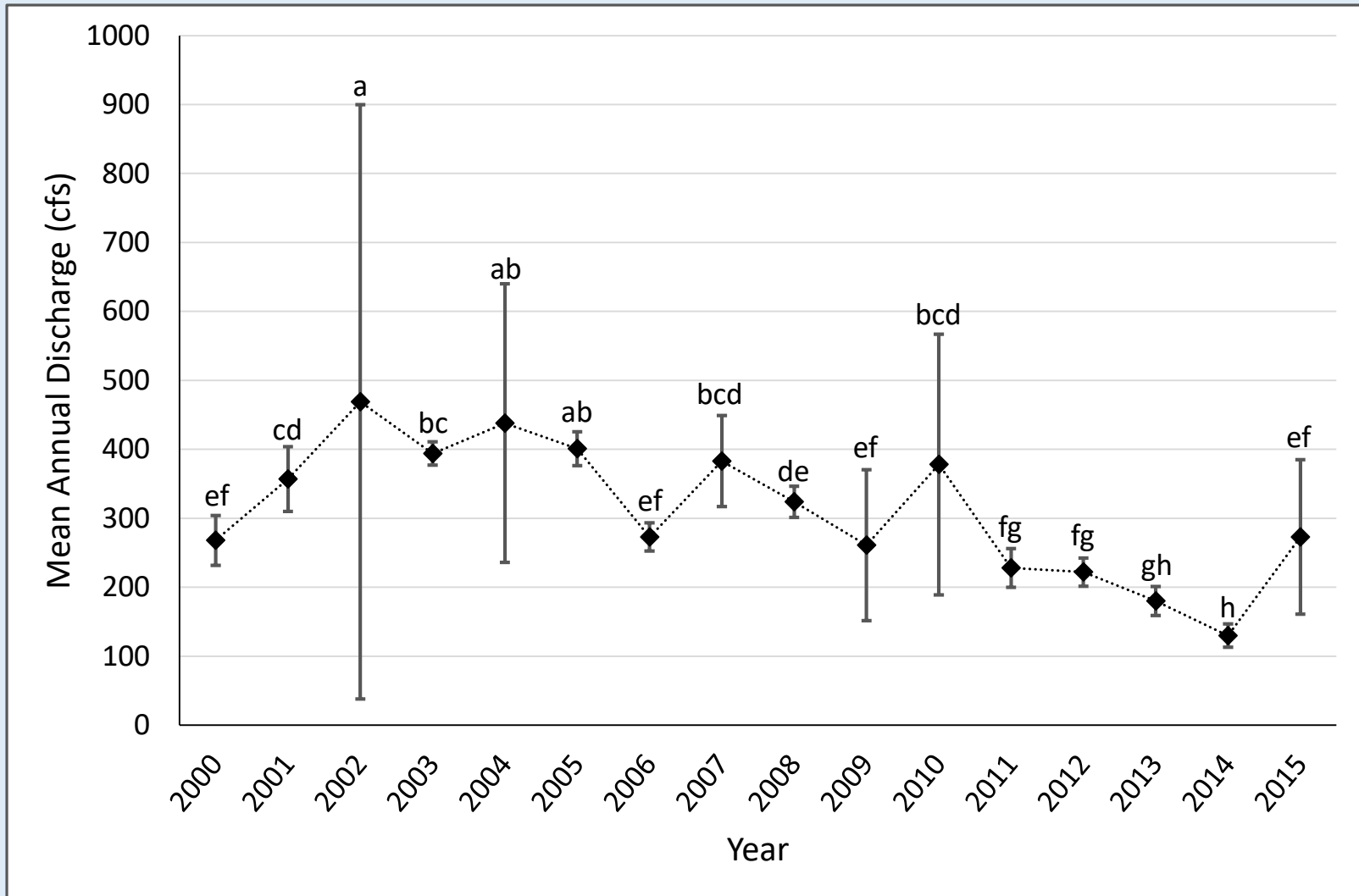


# Analysis

- Discharge patterns
- Macrophyte coverage and discharge
  - Total and Species
- Seasonal macrophyte coverage
- Richness, evenness, and diversity
- Native and non-native coverage

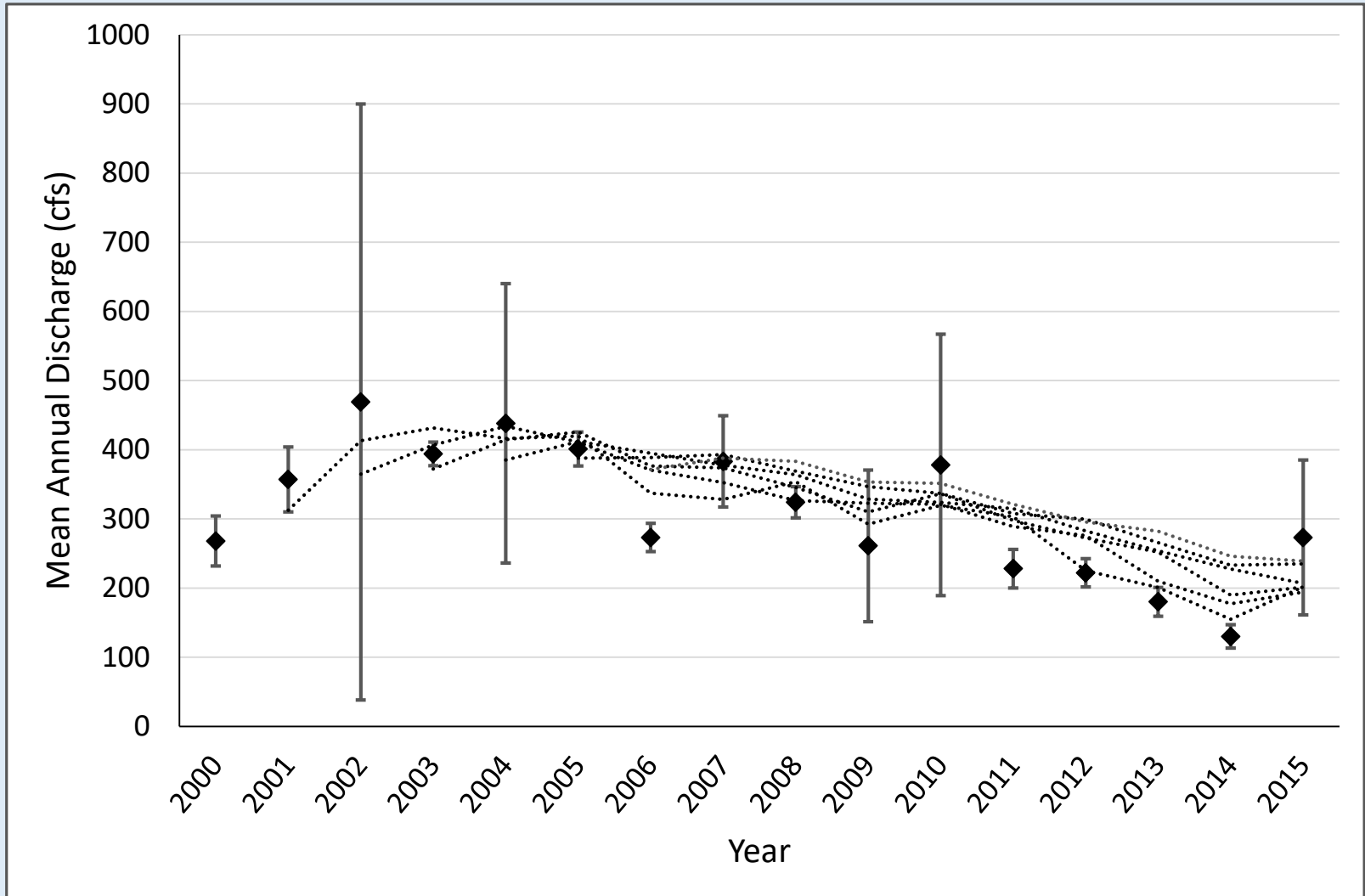
# Discharge Patterns

# Comal River Discharge

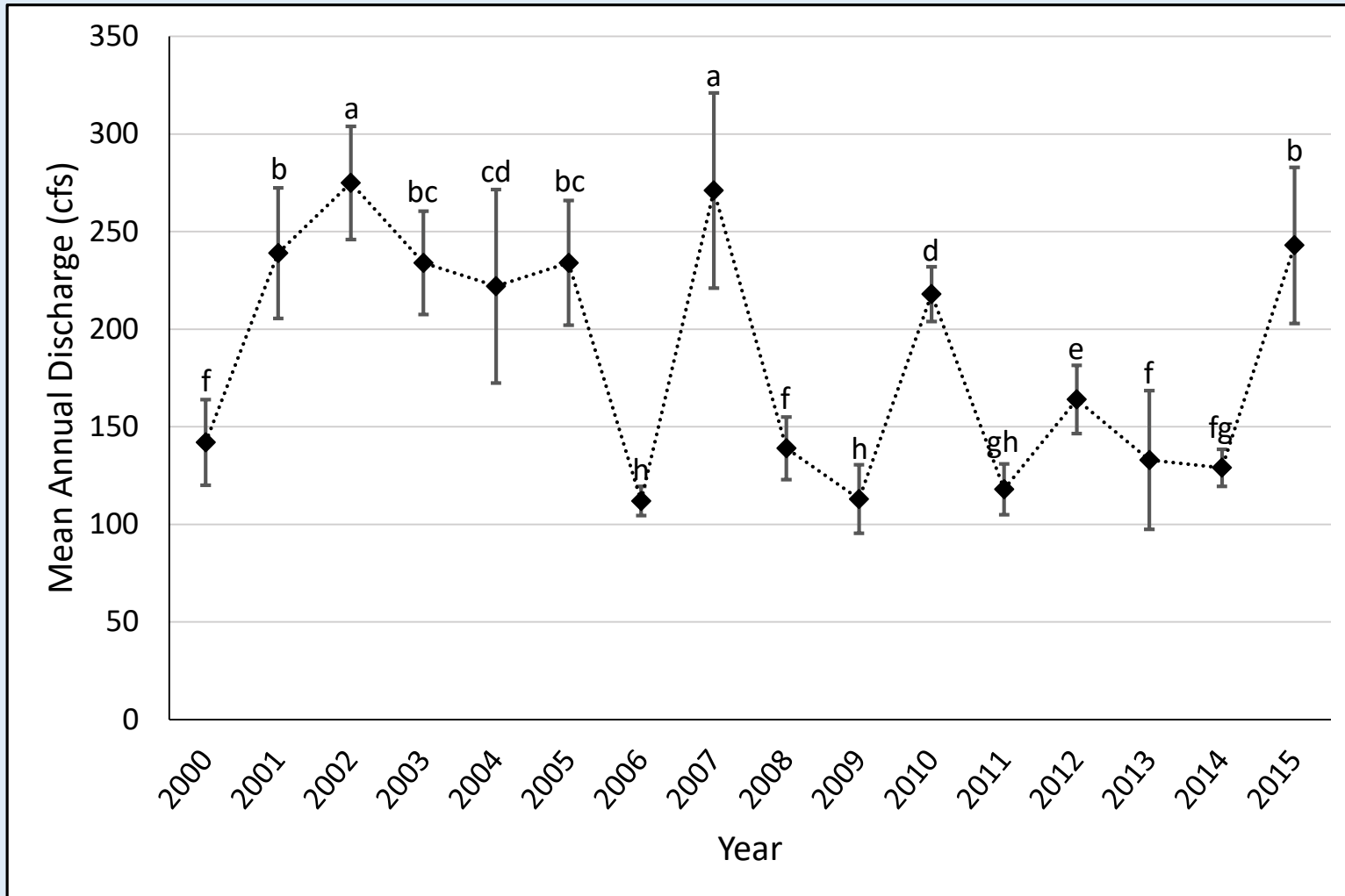


Different letters for years represent differences at  $P < 0.05$

# Comal River Discharge

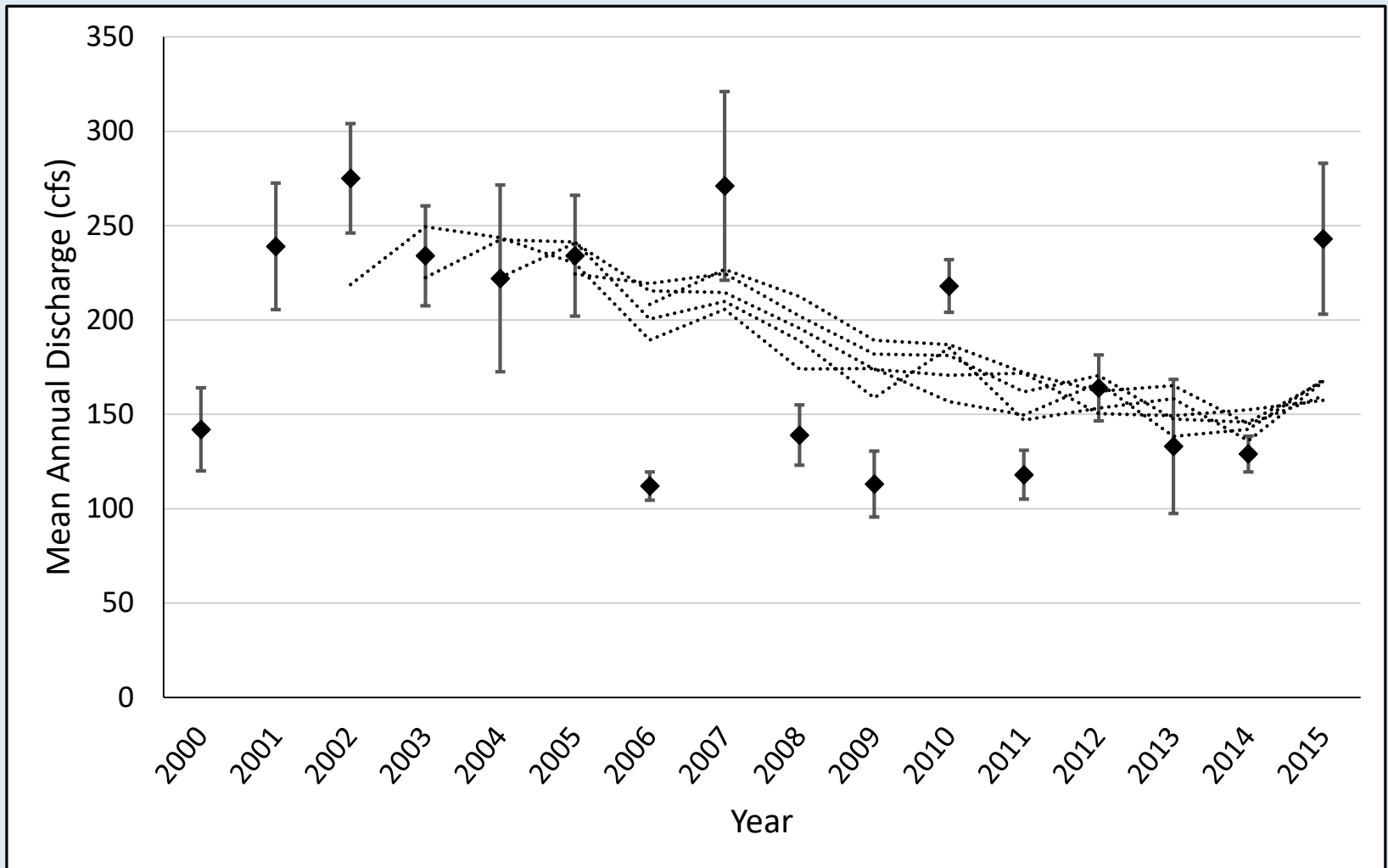


# San Marcos River Discharge



Different letters for years represent differences at  $P < 0.05$

# San Marcos River Discharge

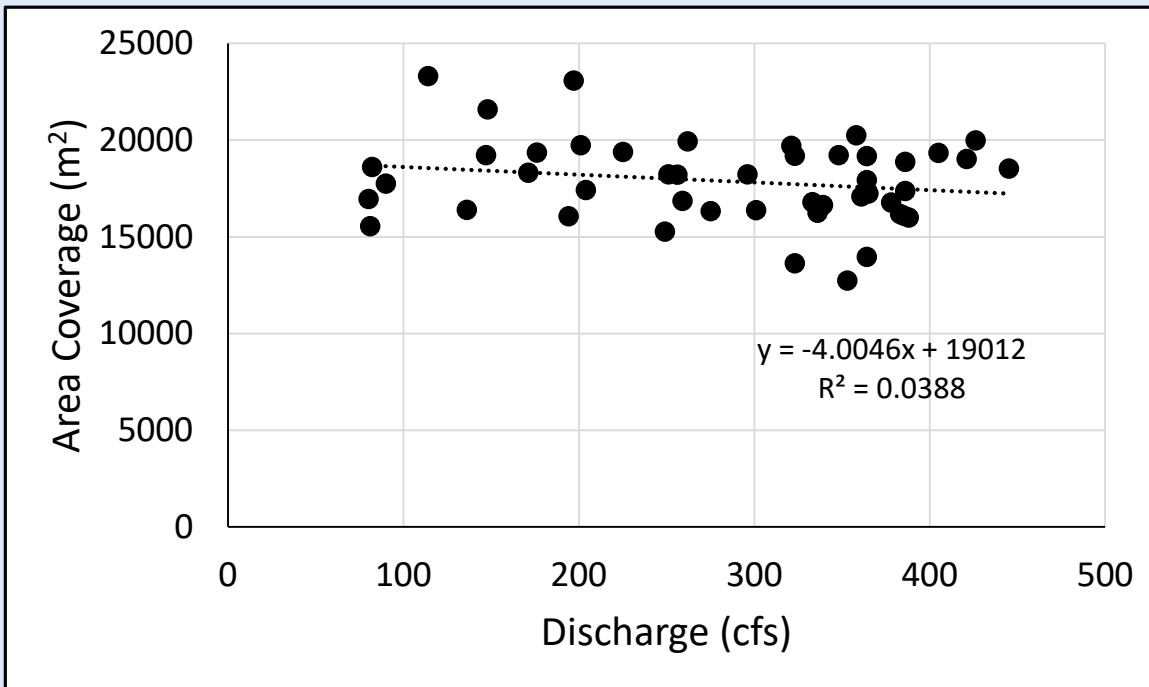


# **Total Macrophyte Coverage and Discharge**

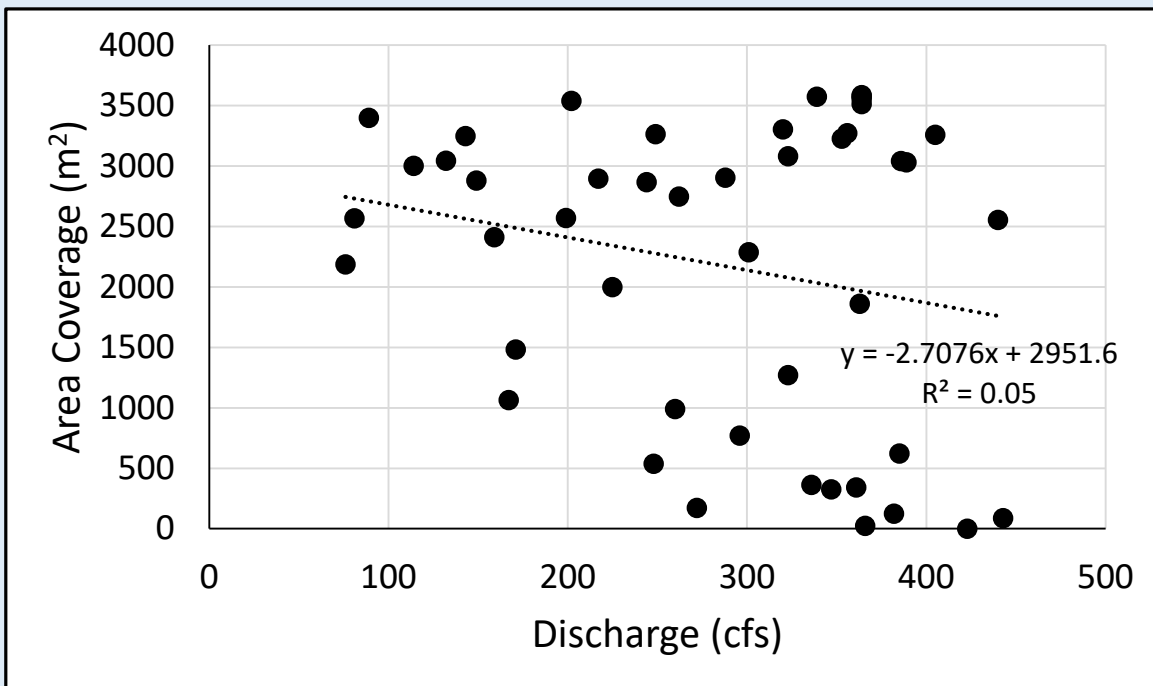


# Comal River

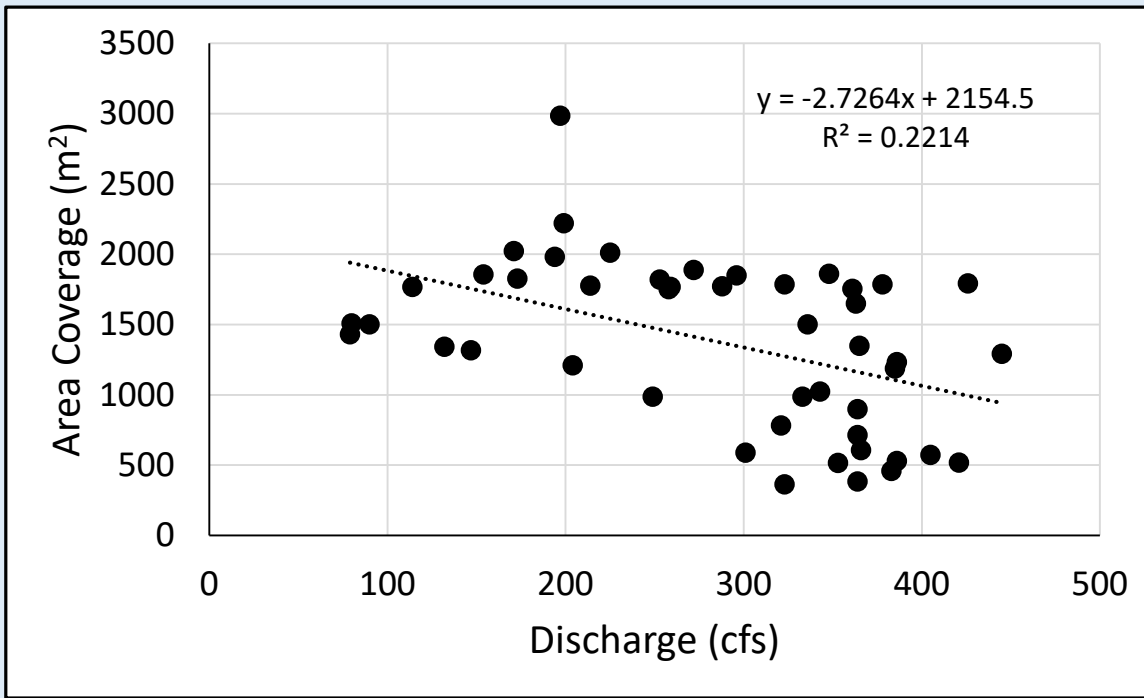
# Landa Lake



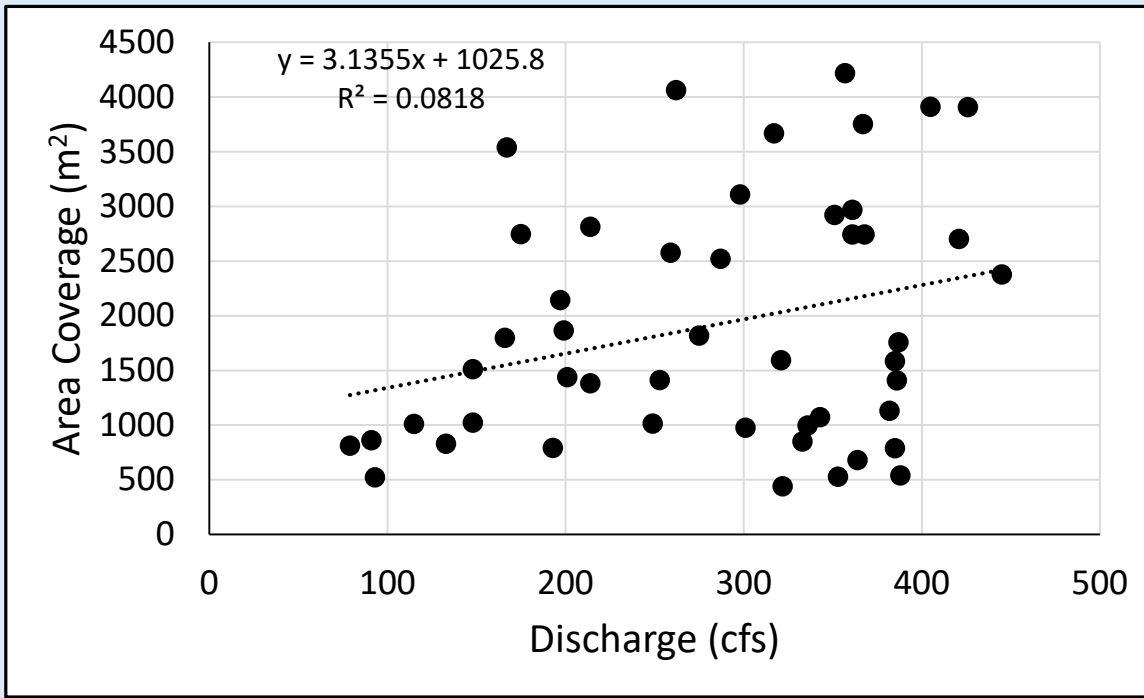
# Lower New Channel



# Old Channel

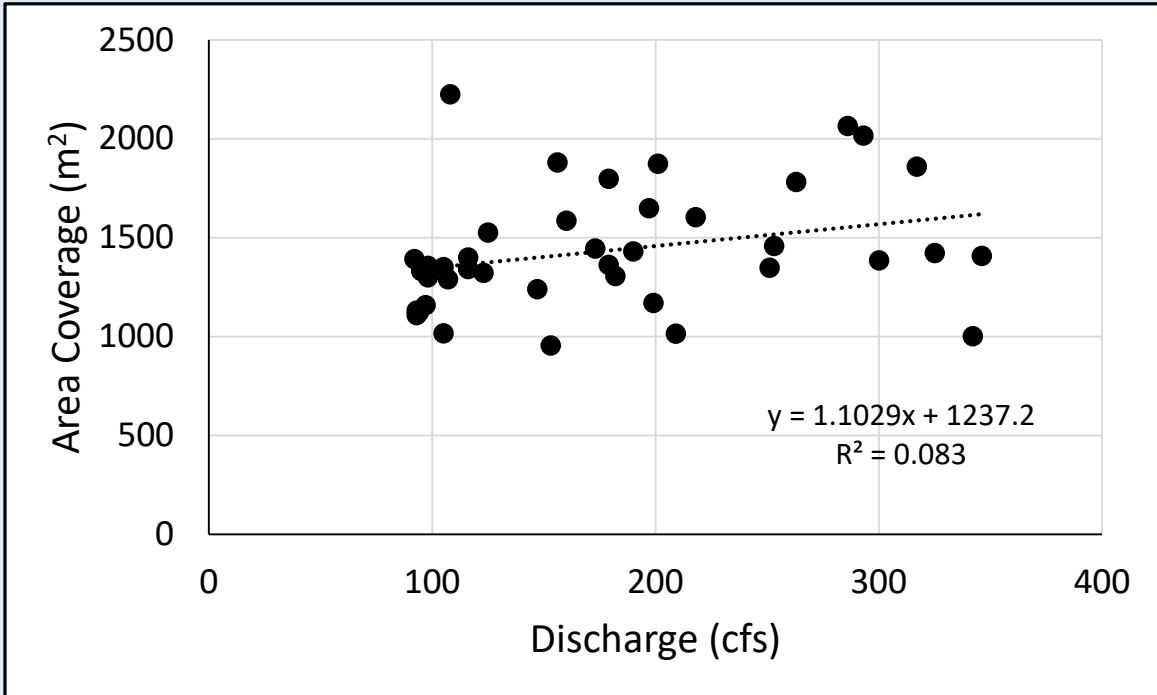


# Upper Spring Run

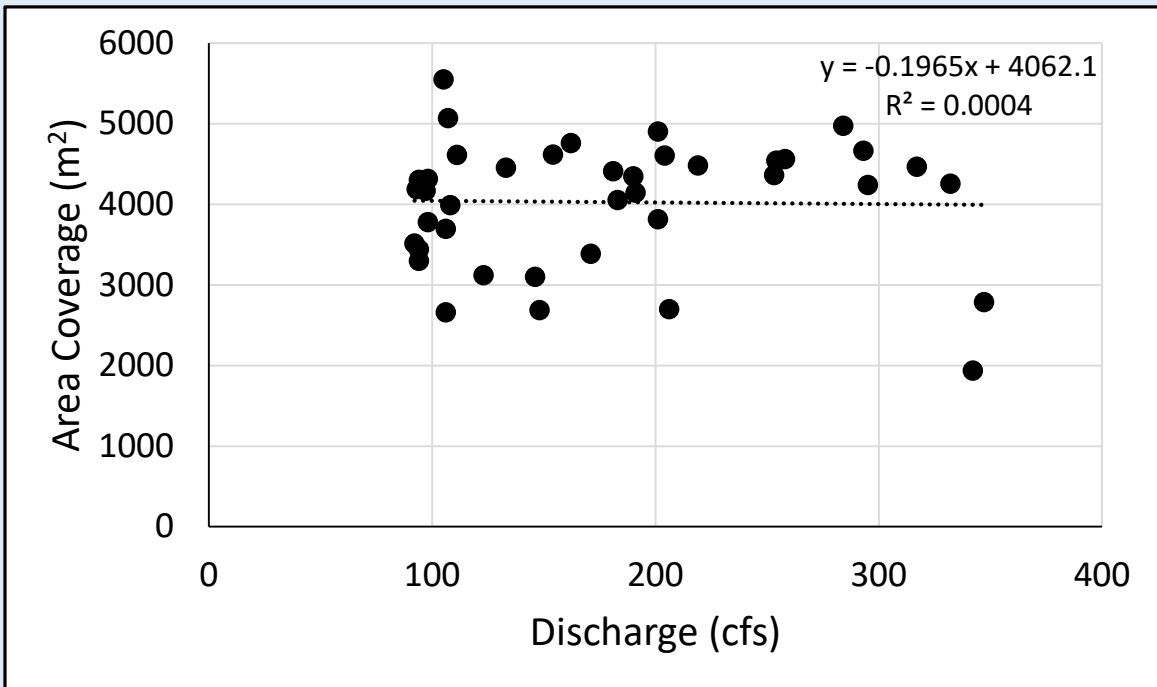


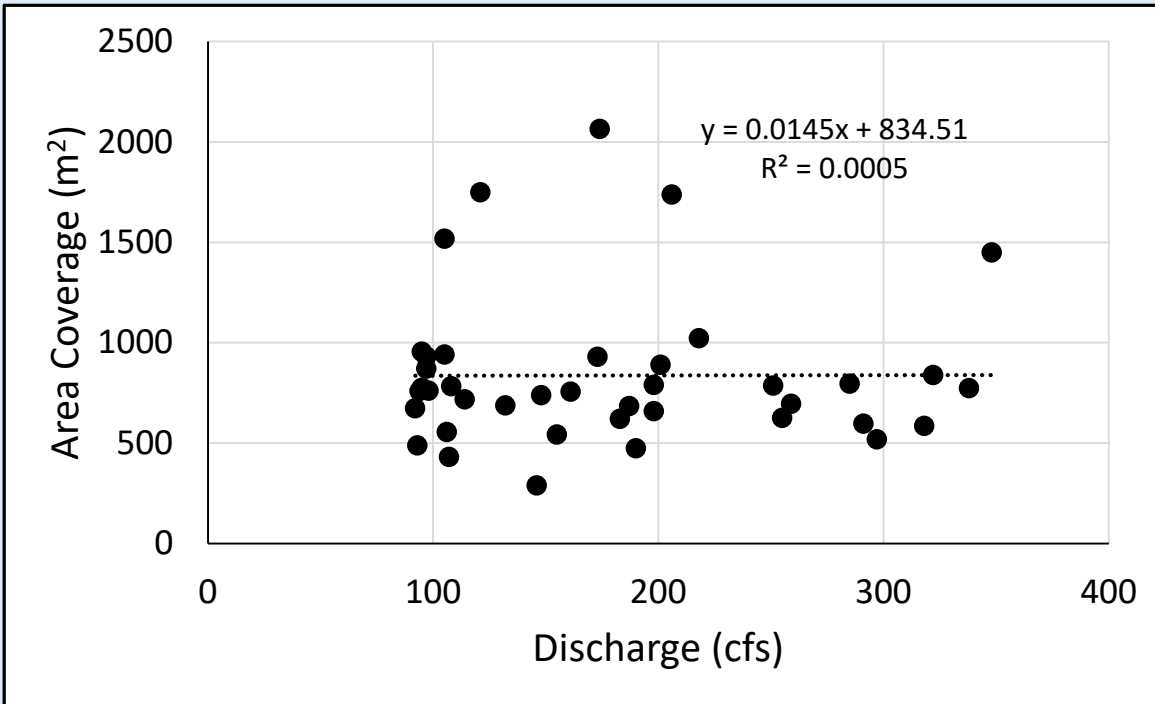
# San Marcos River

# Spring Lake Dam



# City Park



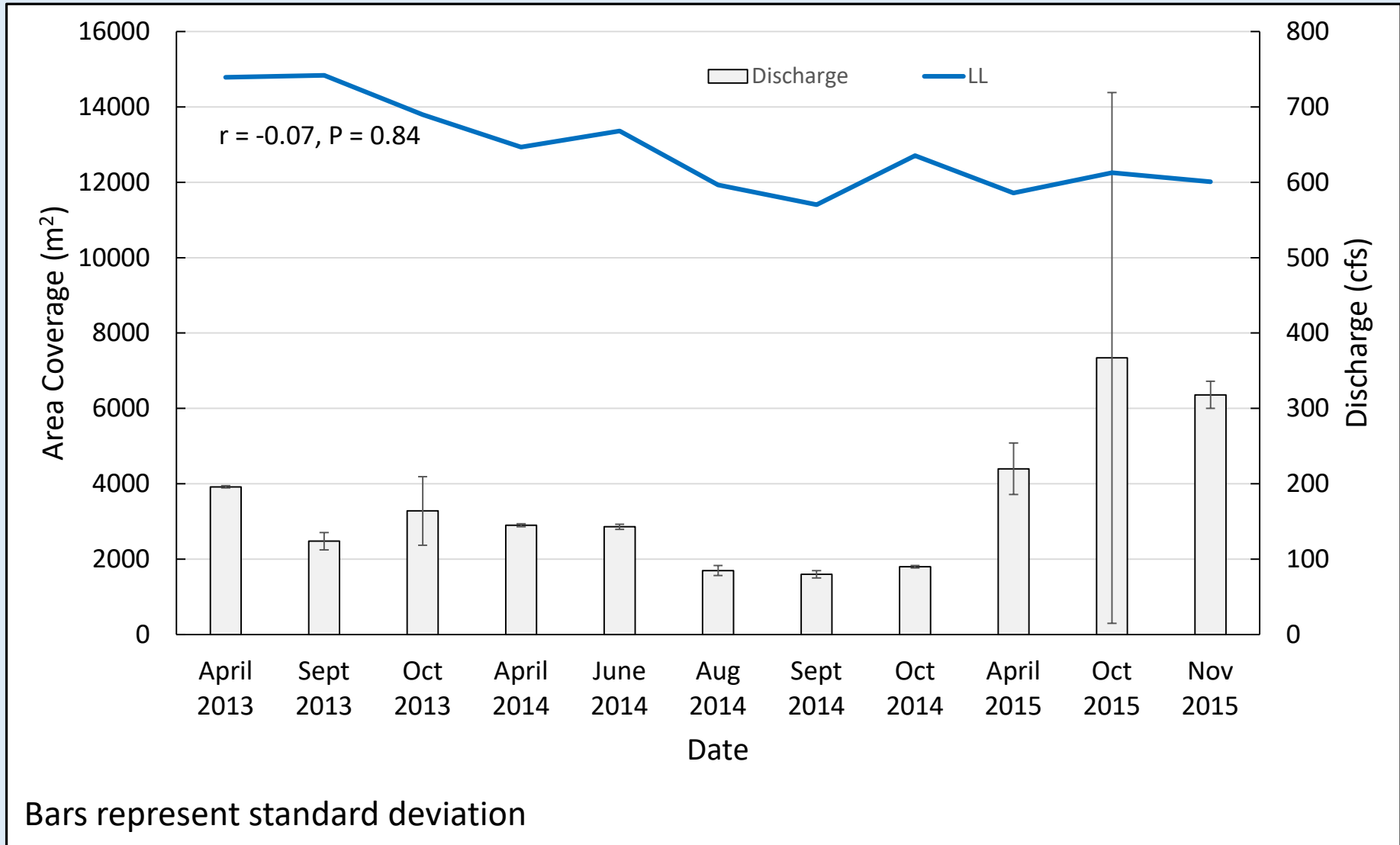


I-35

# Macrophytes Coverage By Species

# *Vallisneria* spp.

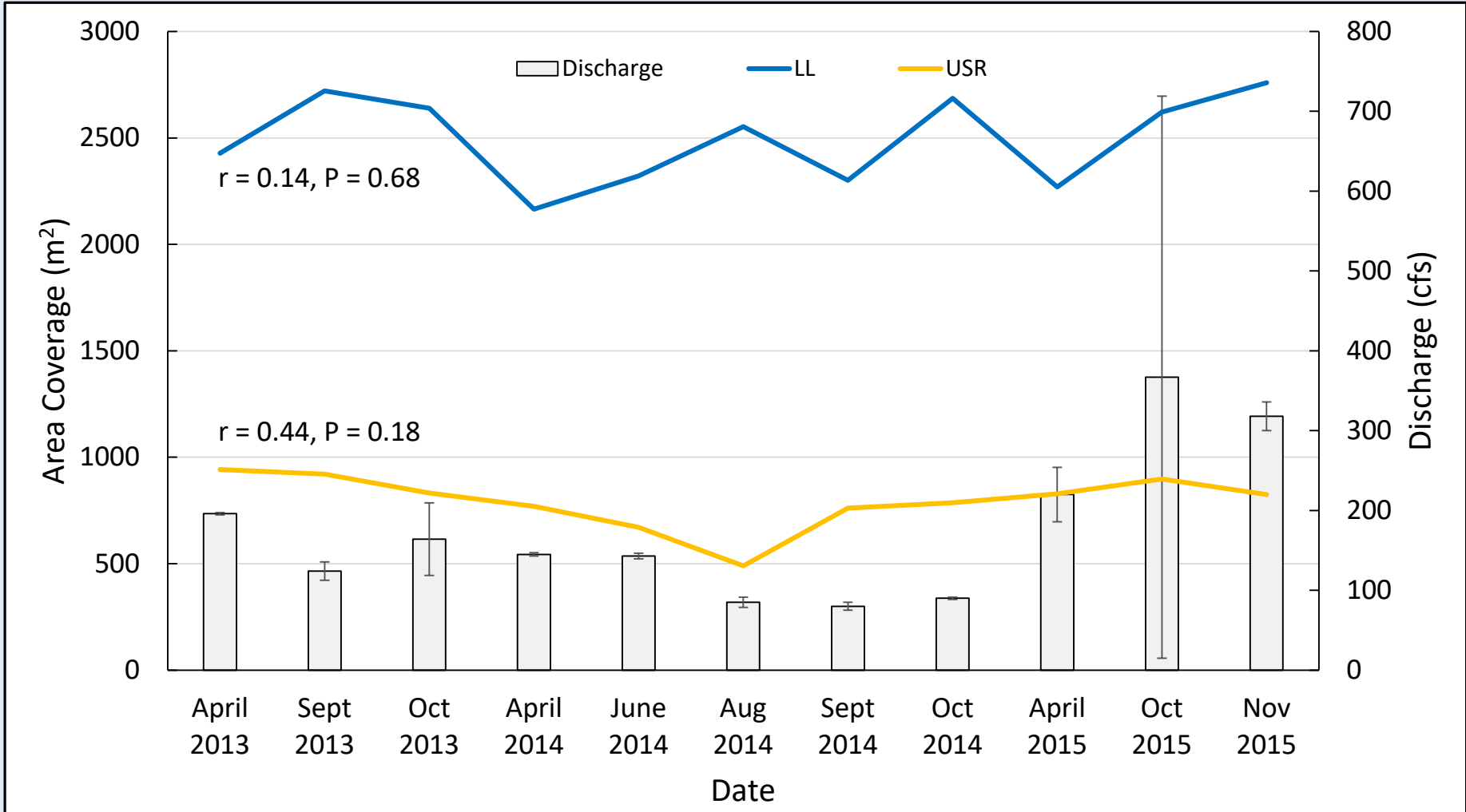
Comal River





# *Sagittaria platyphylla*

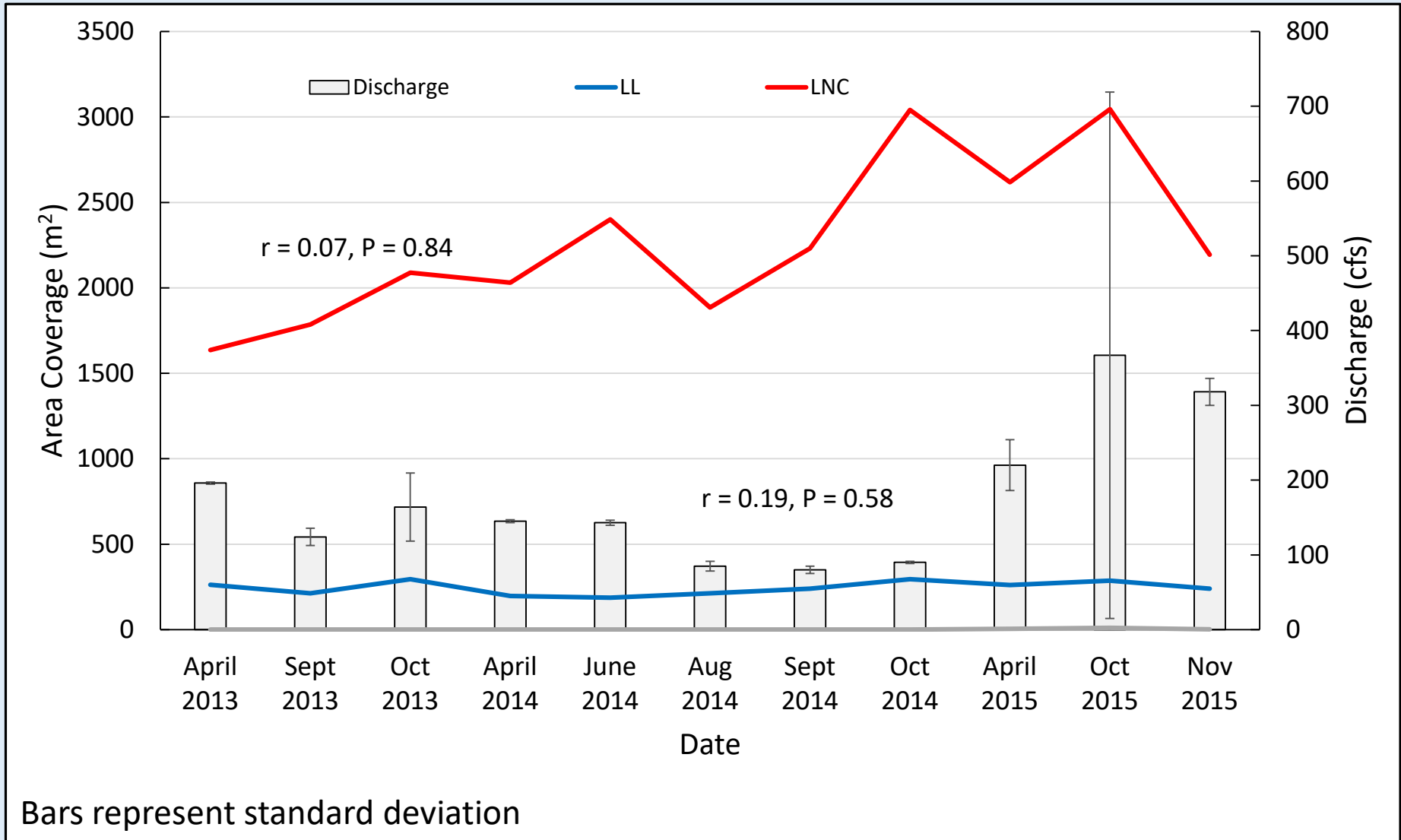
Comal River



Bars represent standard deviation

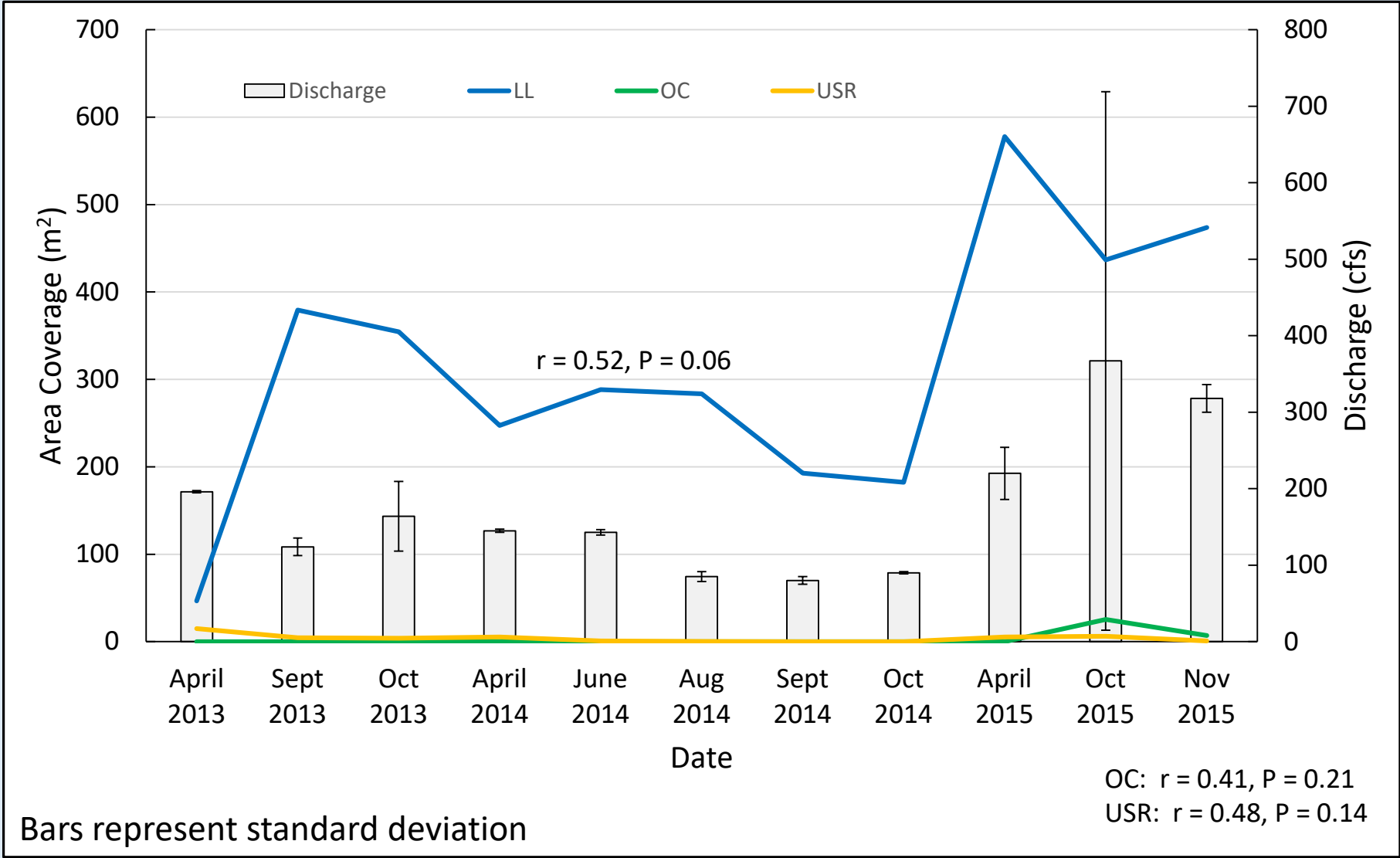
# *Cabomba caroliniana*

Comal River



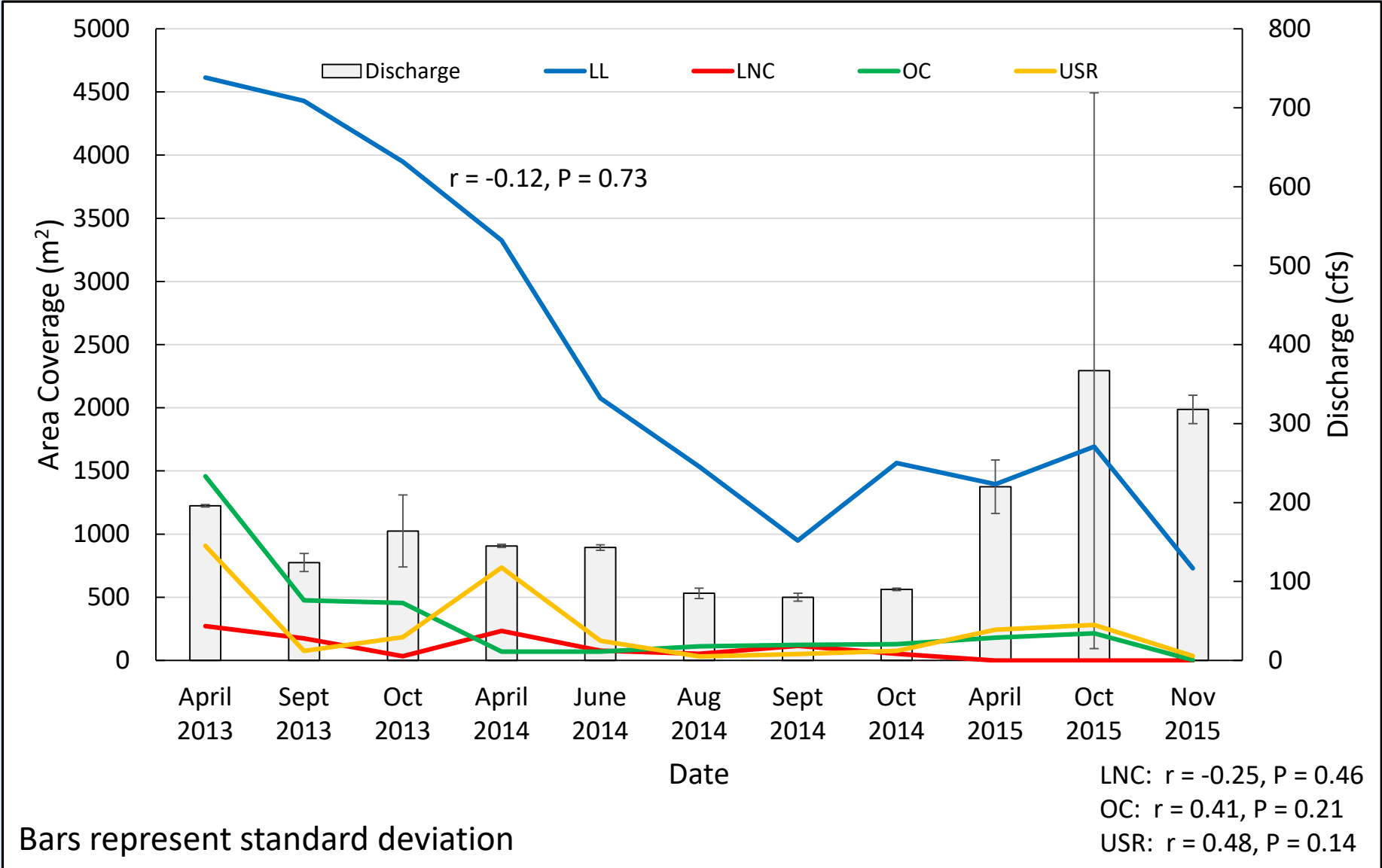
# *Ludwigia repens*

Comal River



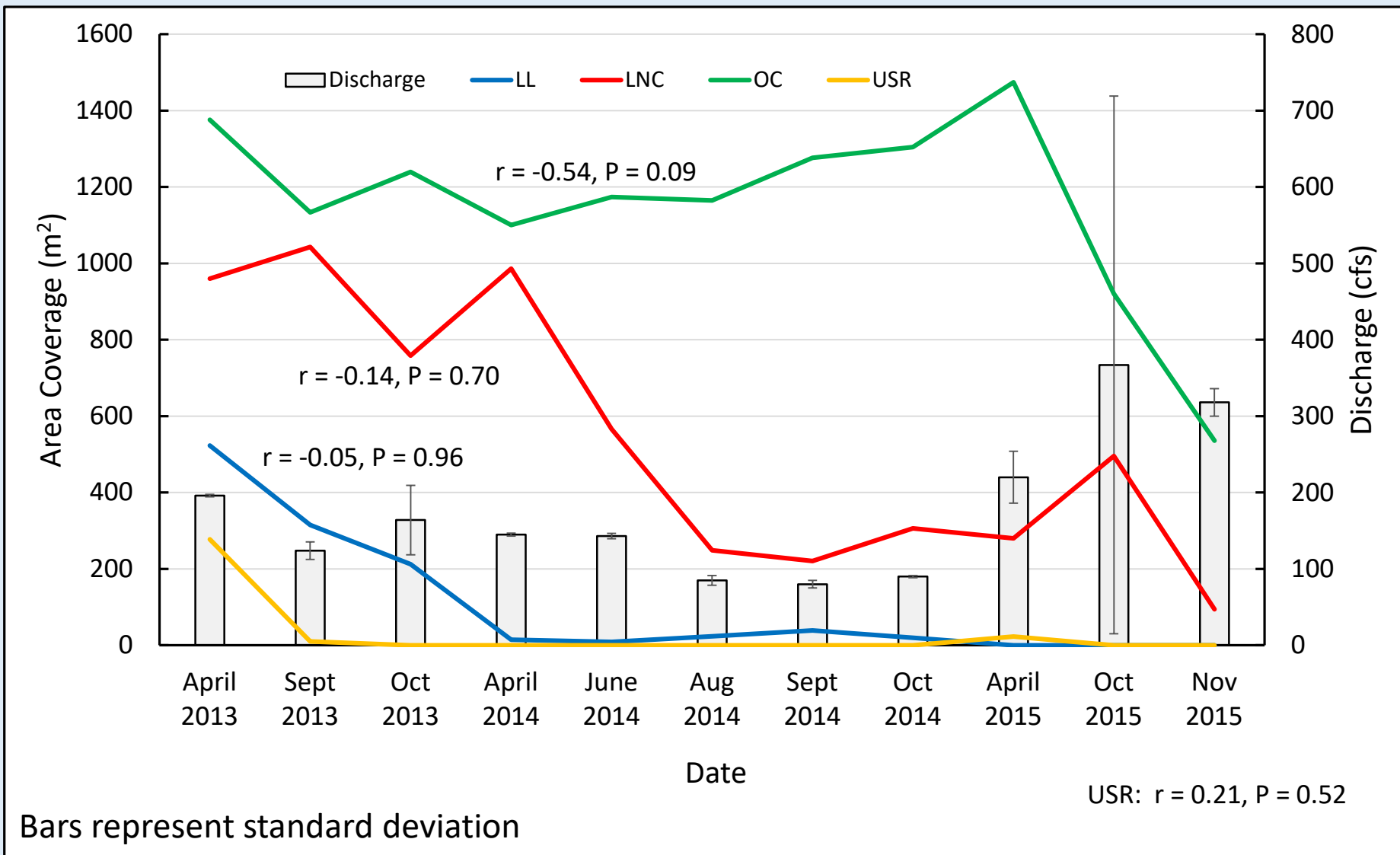
# Bryophytes

Comal River



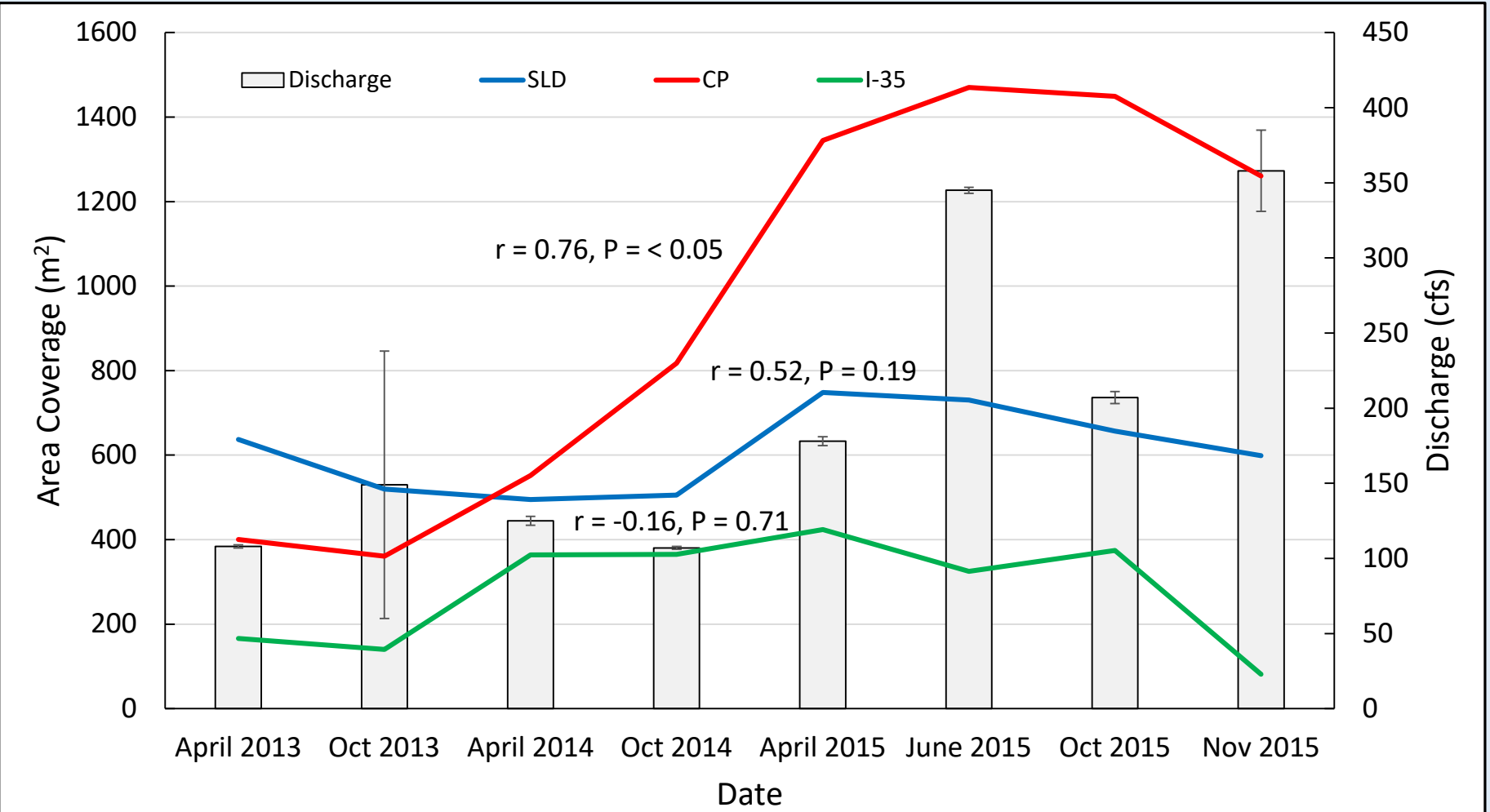
# *Hygrophila polysperma*

Comal River



# Zizania texana

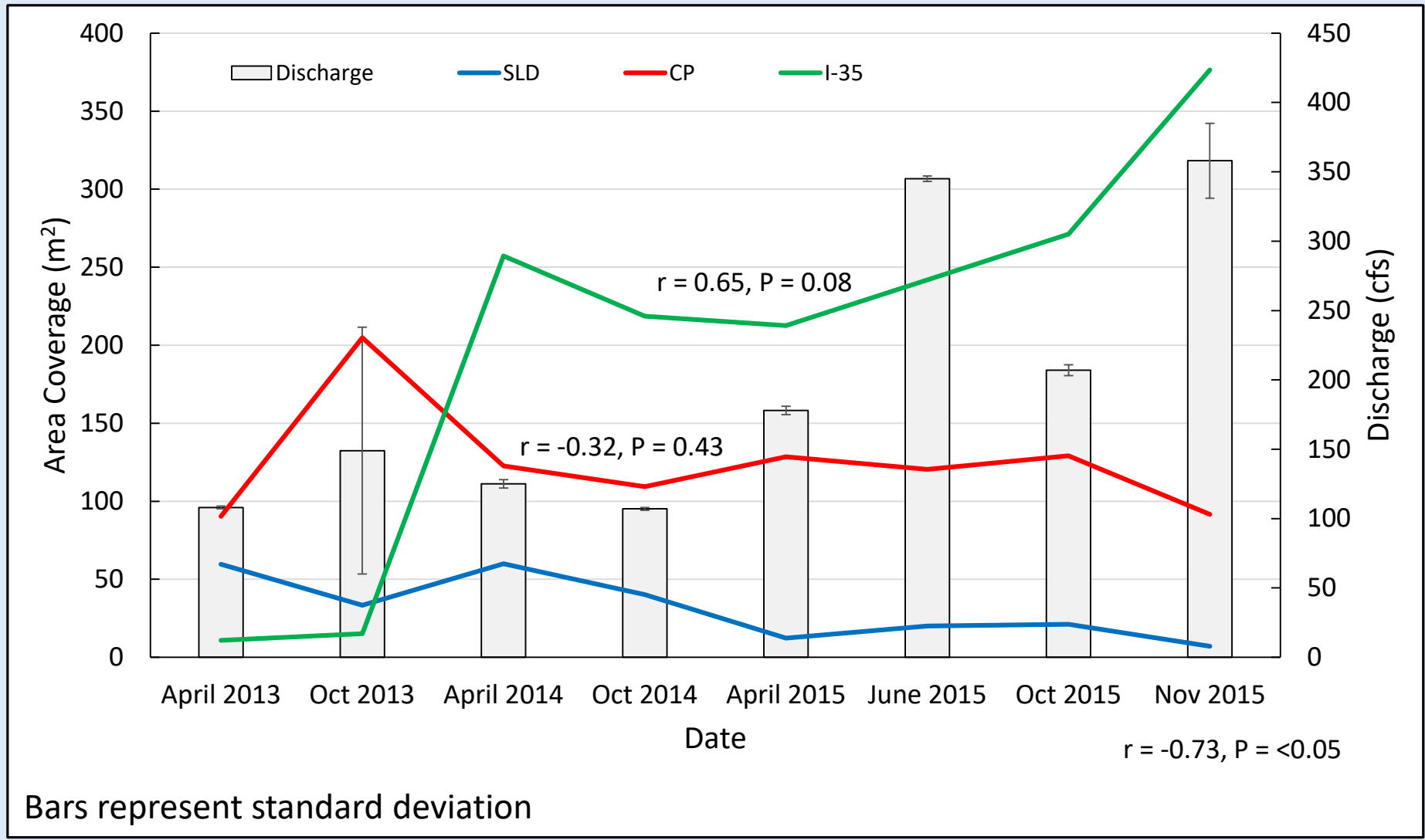
San Marcos River



Bars represent standard deviation

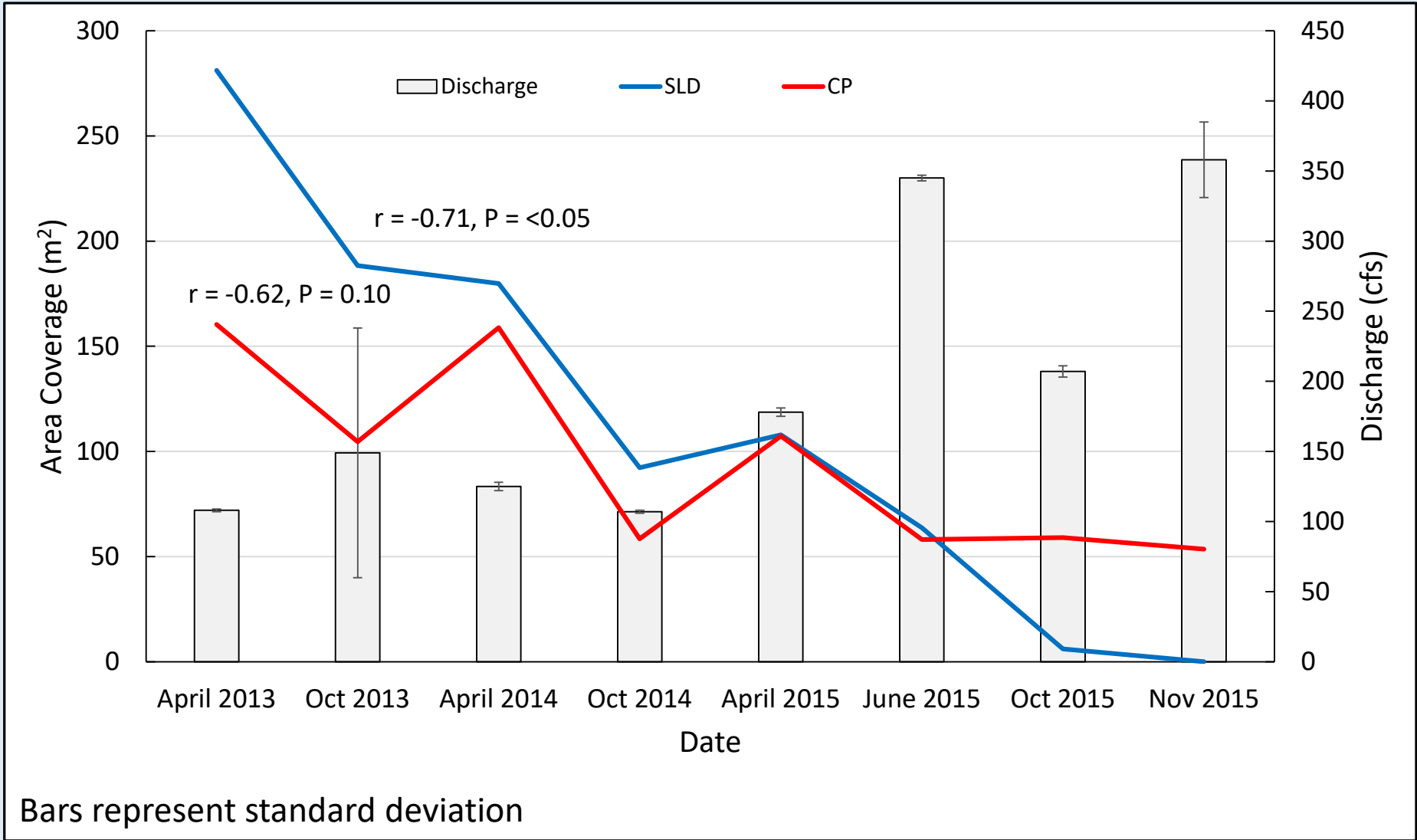
# *Sagittaria platyphylla*

San Marcos River



# *Potamogeton illinoensis*

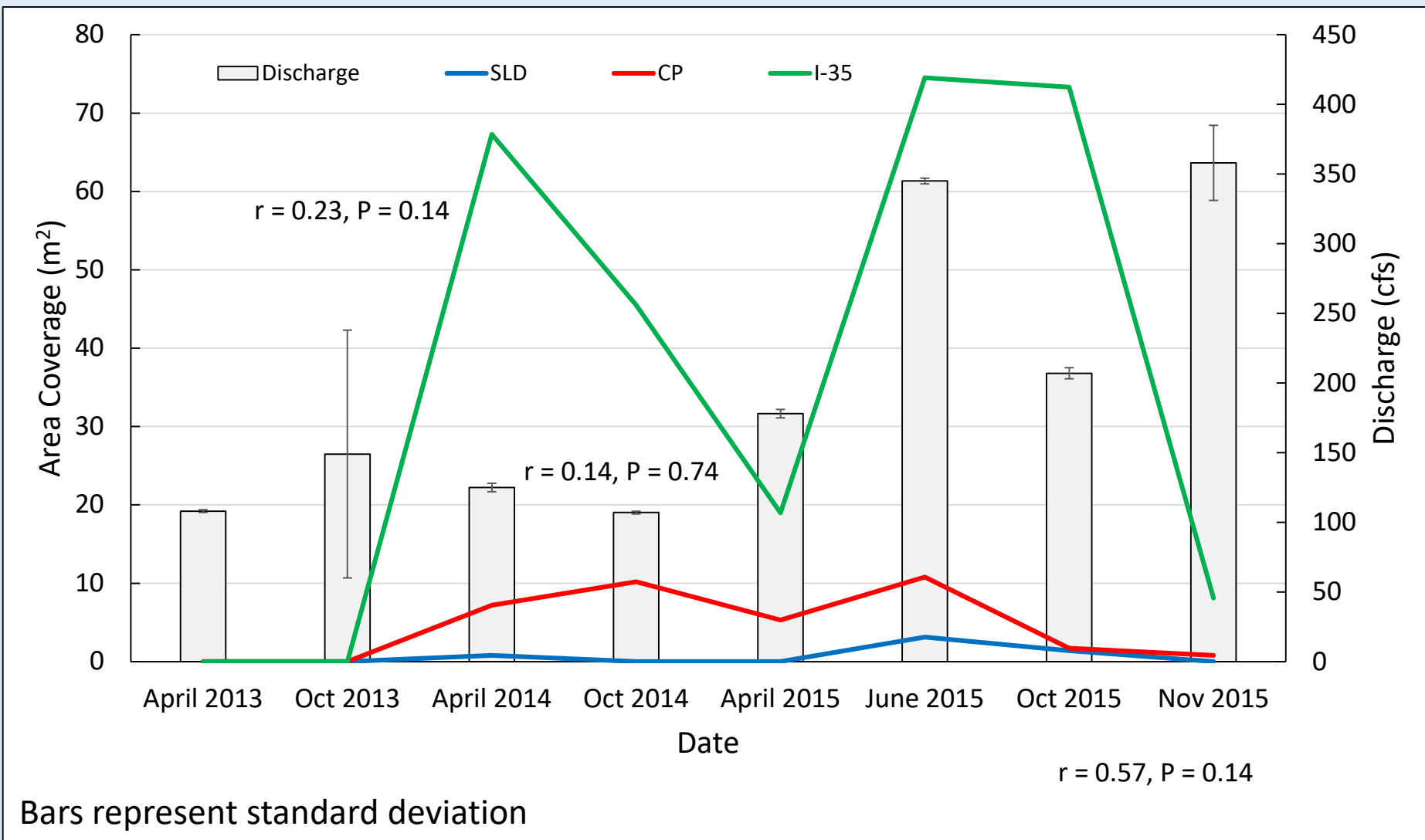
San Marcos River





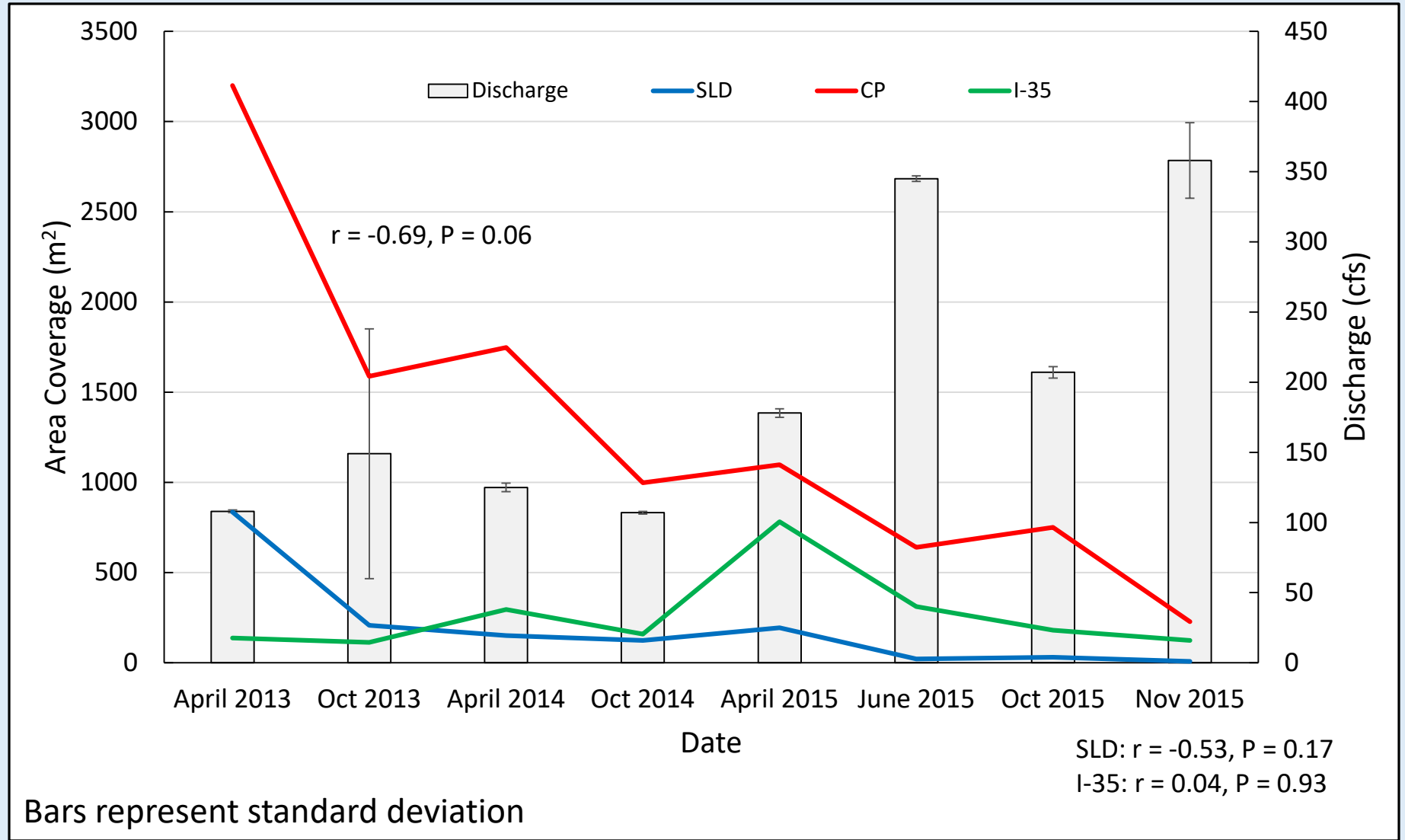
# *Ludwigia repens*

San Marcos River



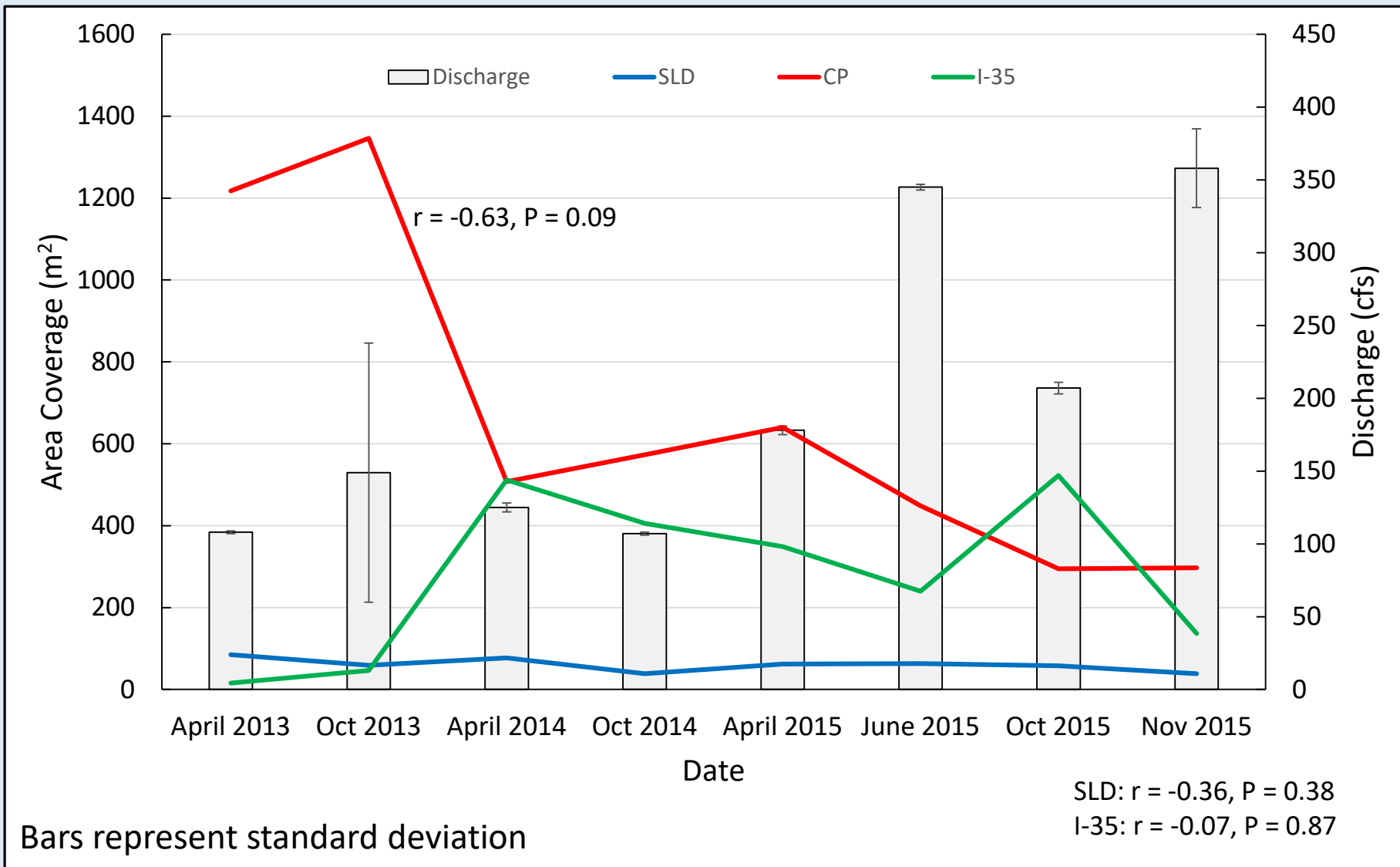
# *Hydrilla verticillata*

San Marcos River



# *Hygrophila polysperma*

San Marcos River

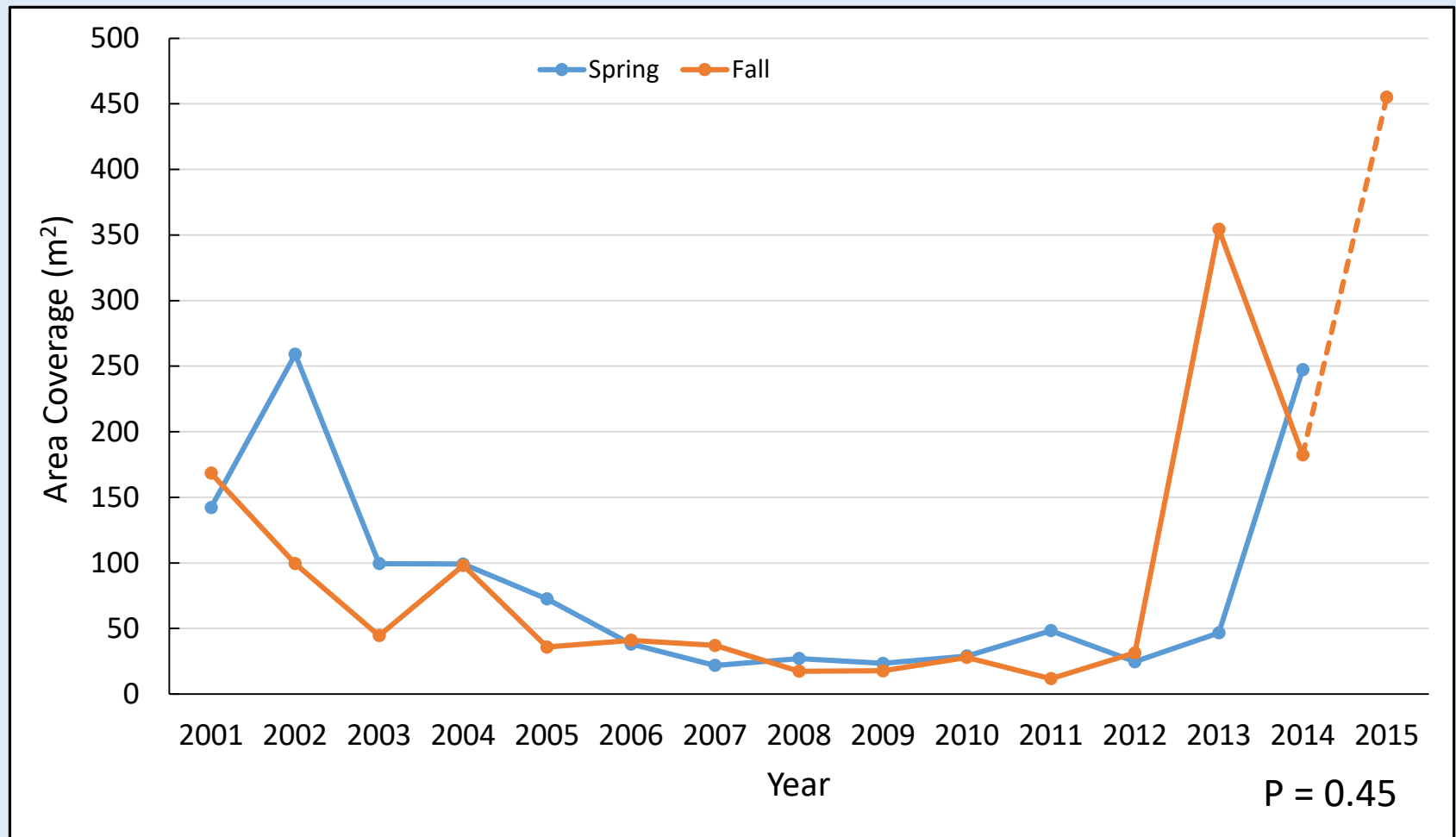


# **Seasonal Macrophyte Coverage**

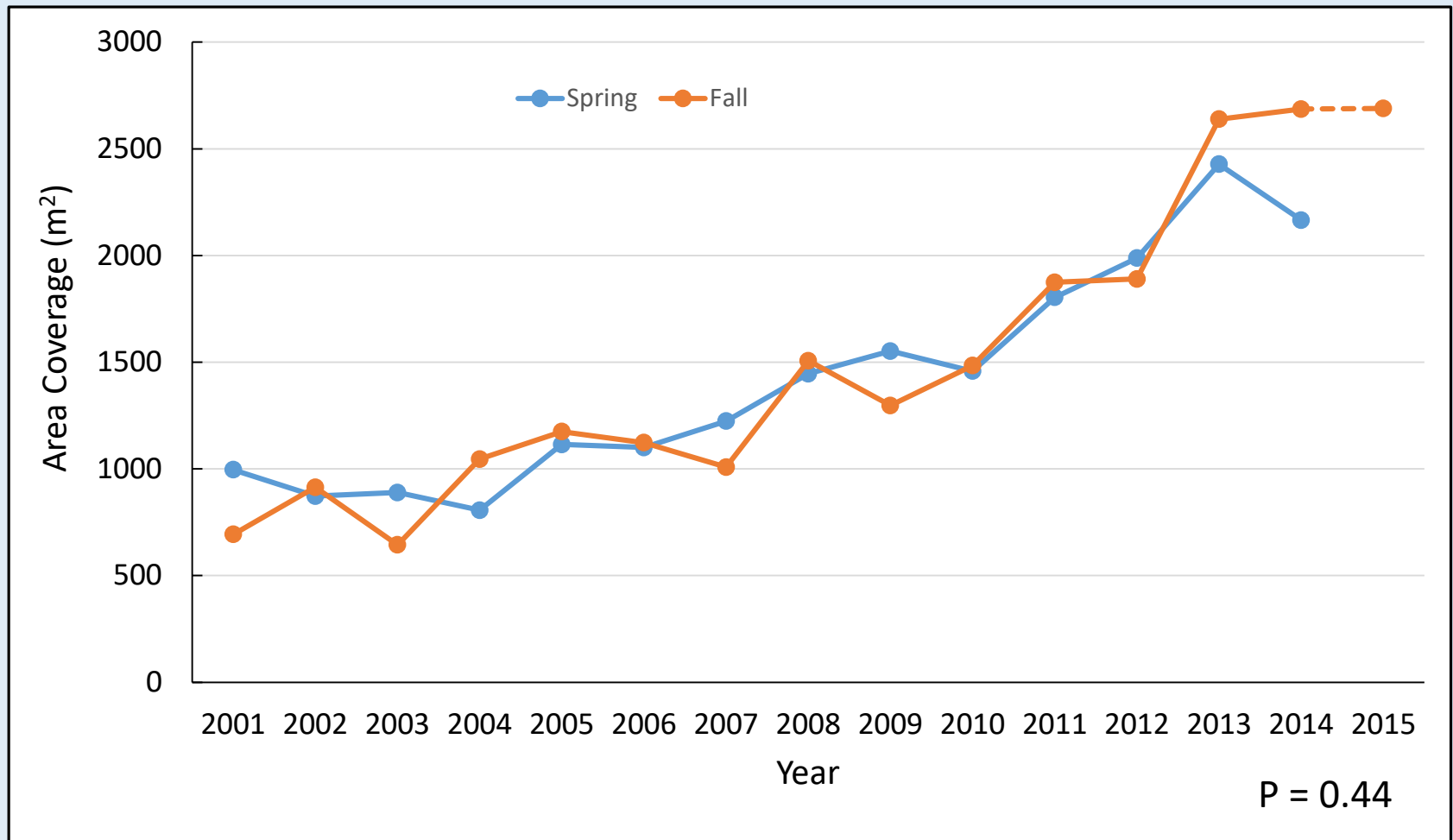
# Seasonal Trends in Total Macrophyte Coverage from 2000 to 2015

Mean Macrophyte Coverage (m <sup>2</sup> and SE)				
River	LTBG	Spring	Fall	P-value
<b>Comal</b>	LL	18975 (524)	17831 (456)	< 0.05
	LNC	2120 (336)	1865 (361)	0.21
	OC	1546 (166)	1525 (120)	0.43
	USR	2569 (285)	1924 (241)	< 0.05
<b>San Marcos</b>	SLD	1425 (78)	1119 (63)	< 0.05
	CP	4403 (149)	3698 (182)	< 0.05
	I-35	869 (125)	810 (104)	0.14

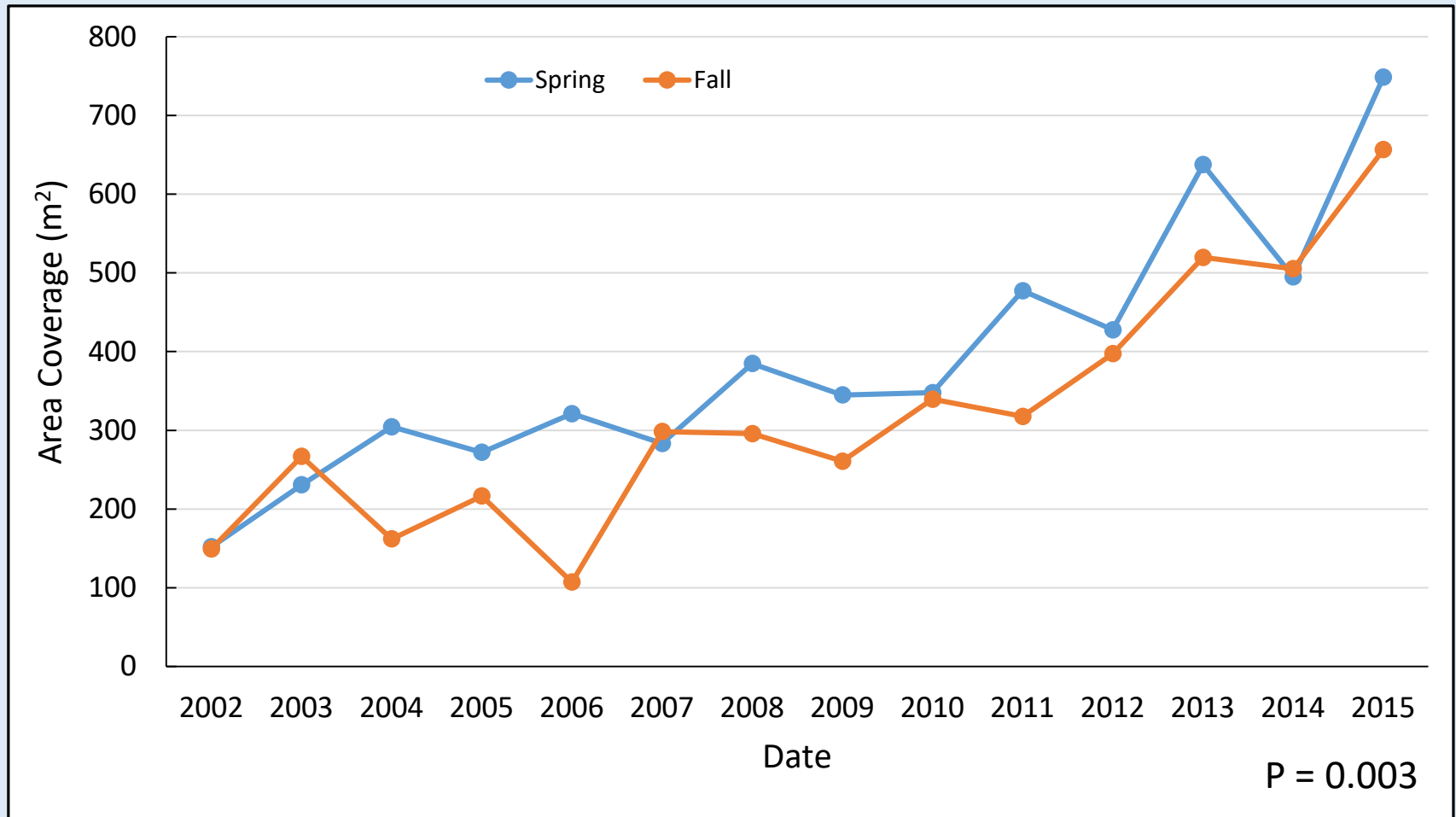
# *Ludwigia repens* - seasonal coverage in Landa Lake



# *Sagittaria platyphylla* - seasonal coverage in Landa Lake

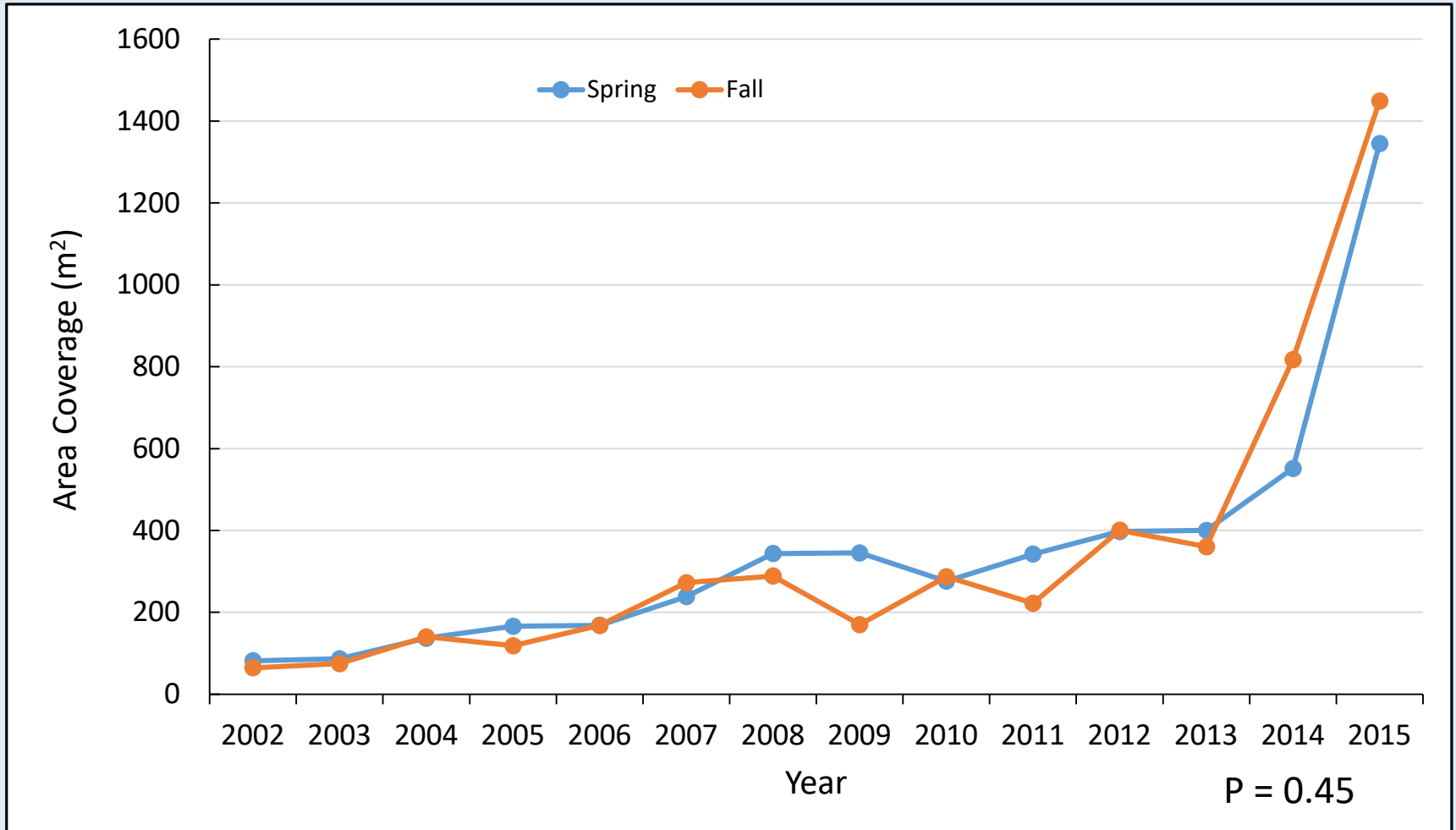


# *Zizania texana* - seasonal coverage in Spring Lake Dam



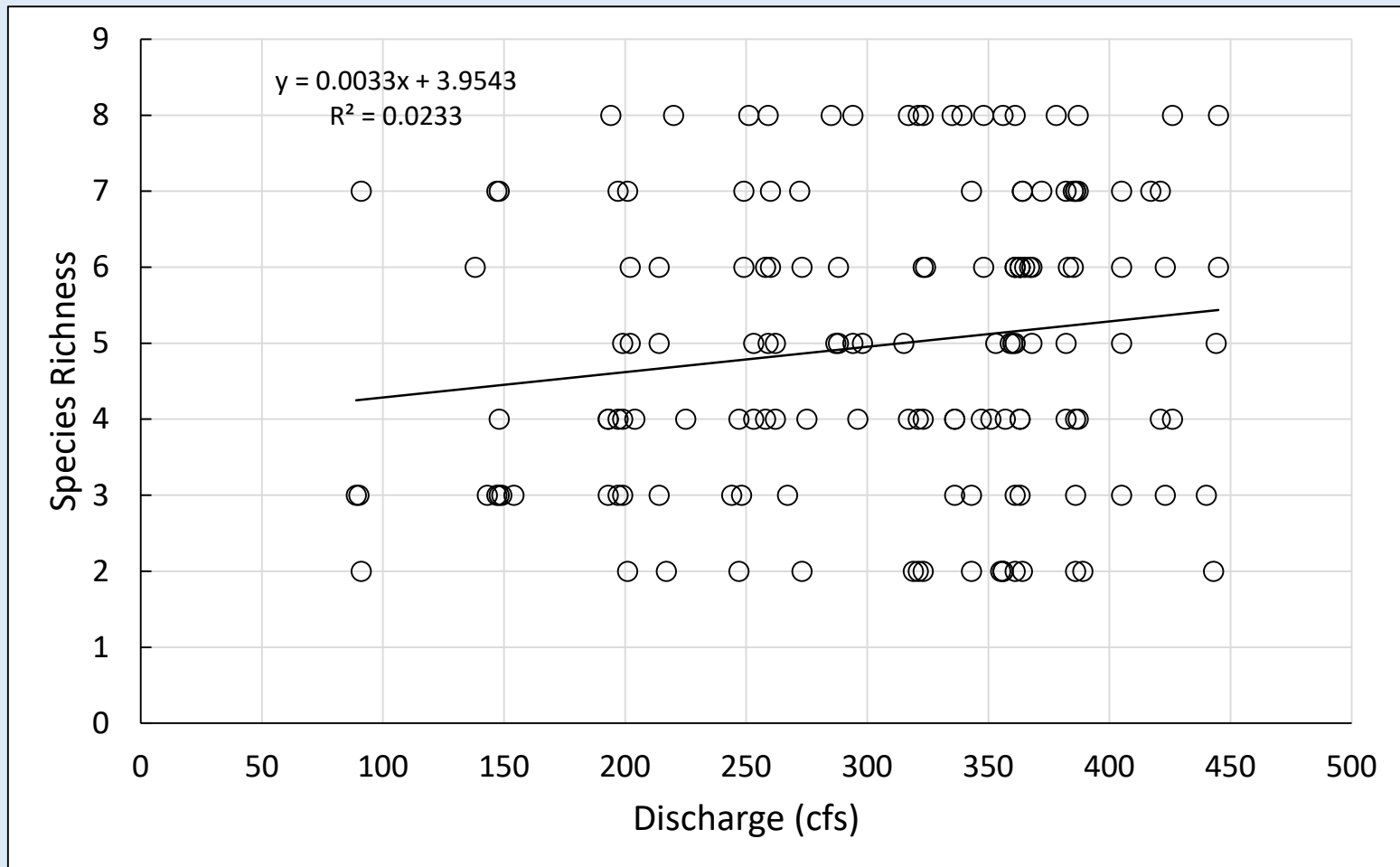


# *Zizania texana* - seasonal coverage in City Park

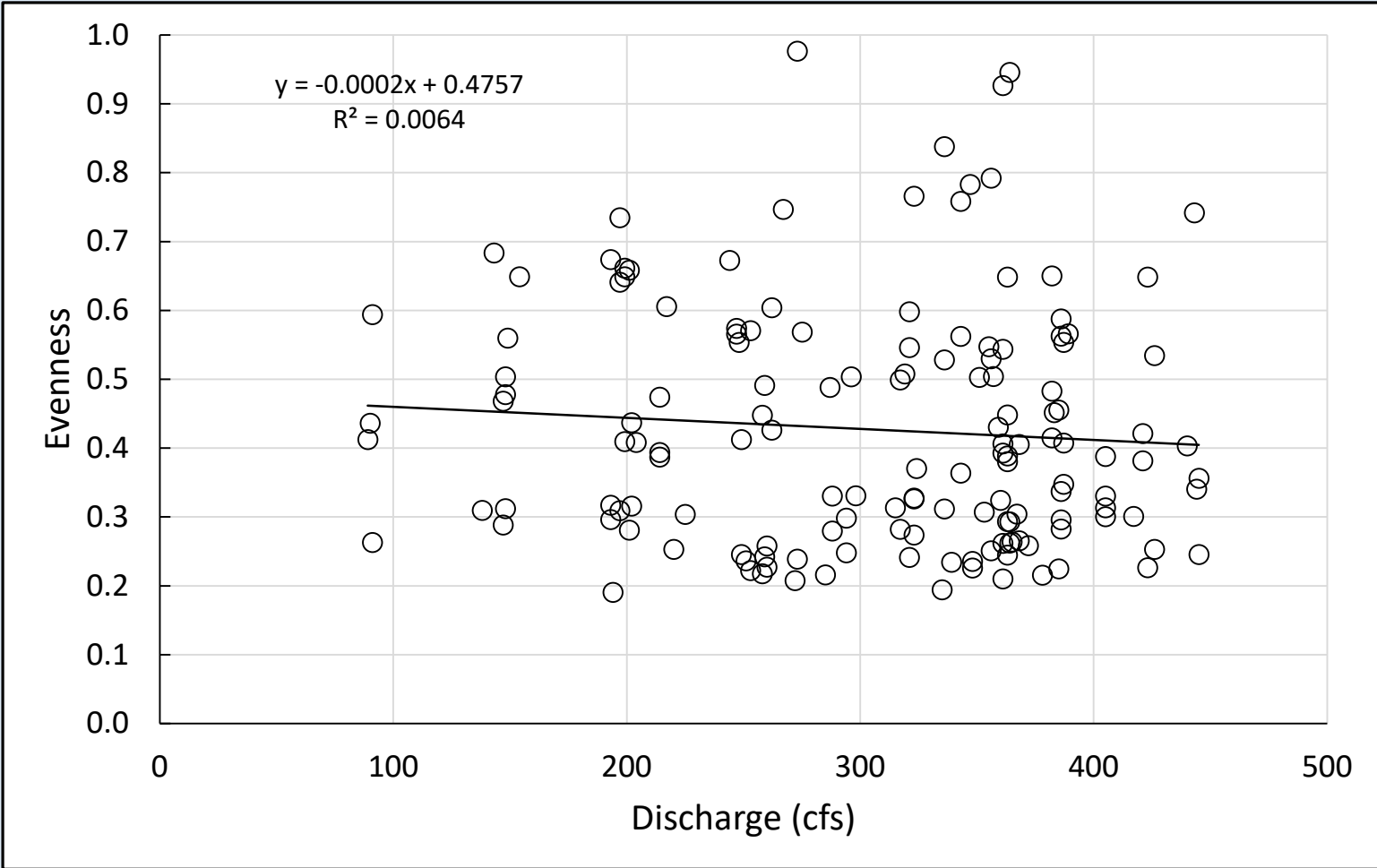


# Richness, Evenness, and Diversity

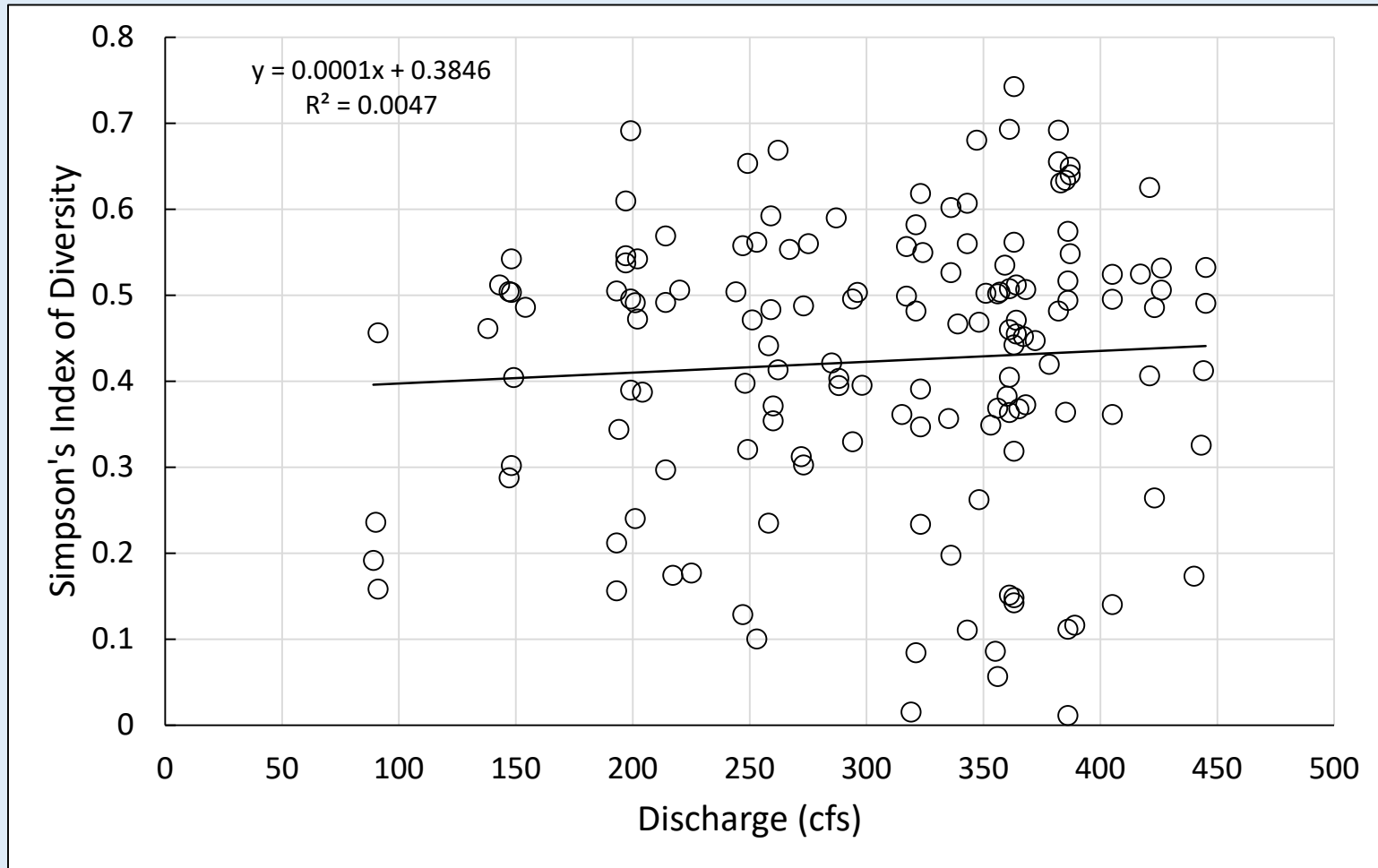
# Comal River - Species Richness



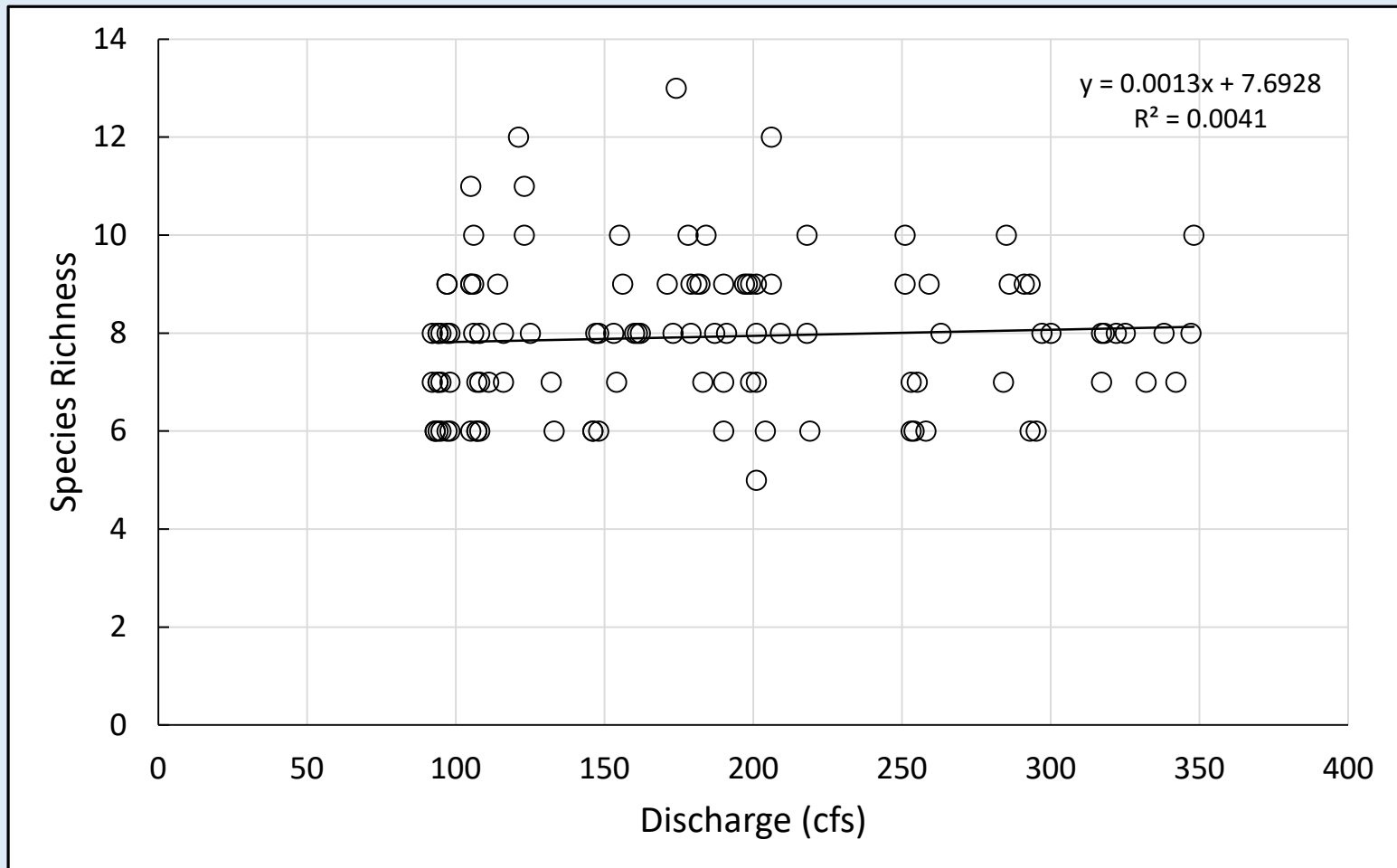
# Comal River - Evenness



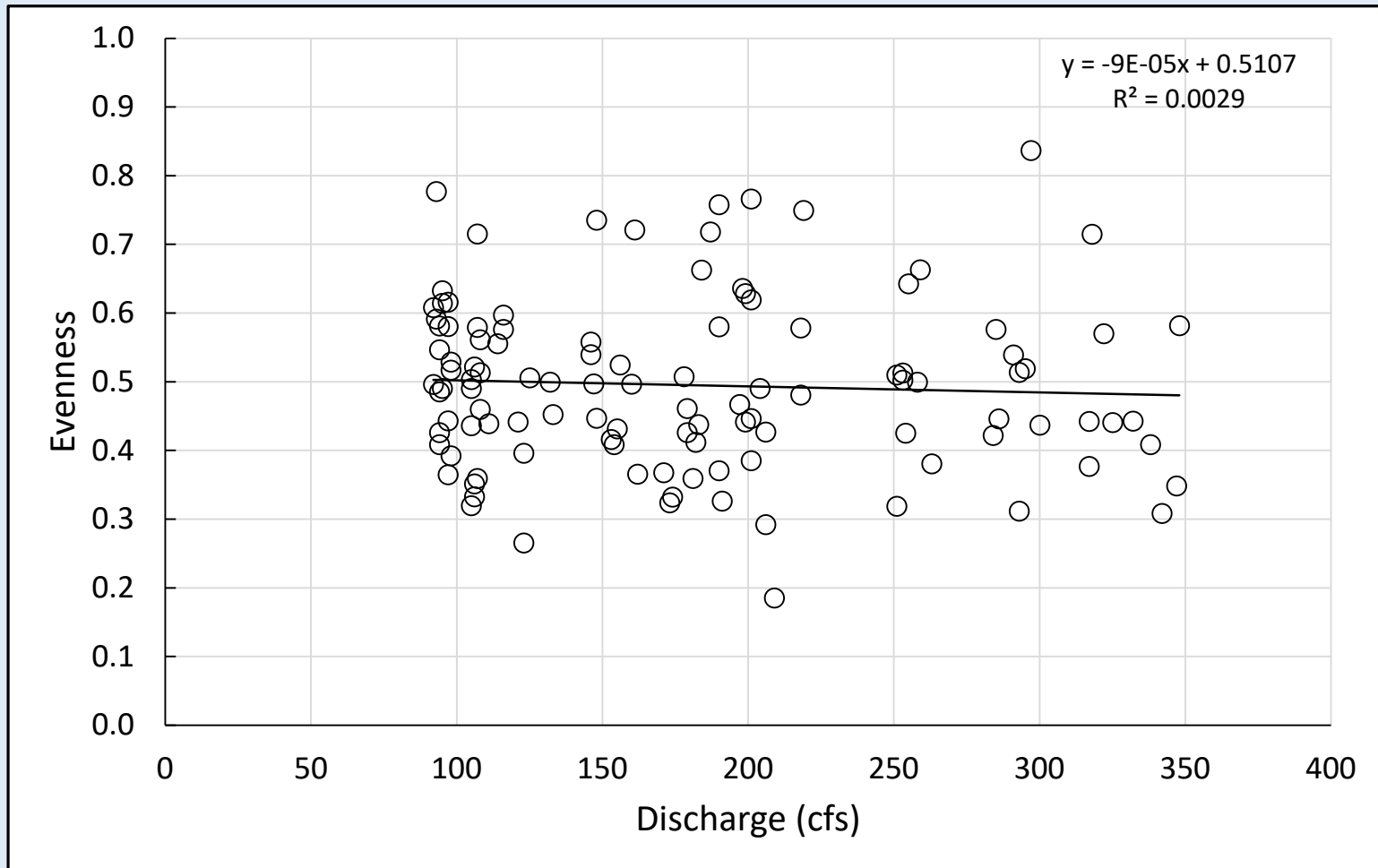
# Comal River - Simpson's Index of Diversity



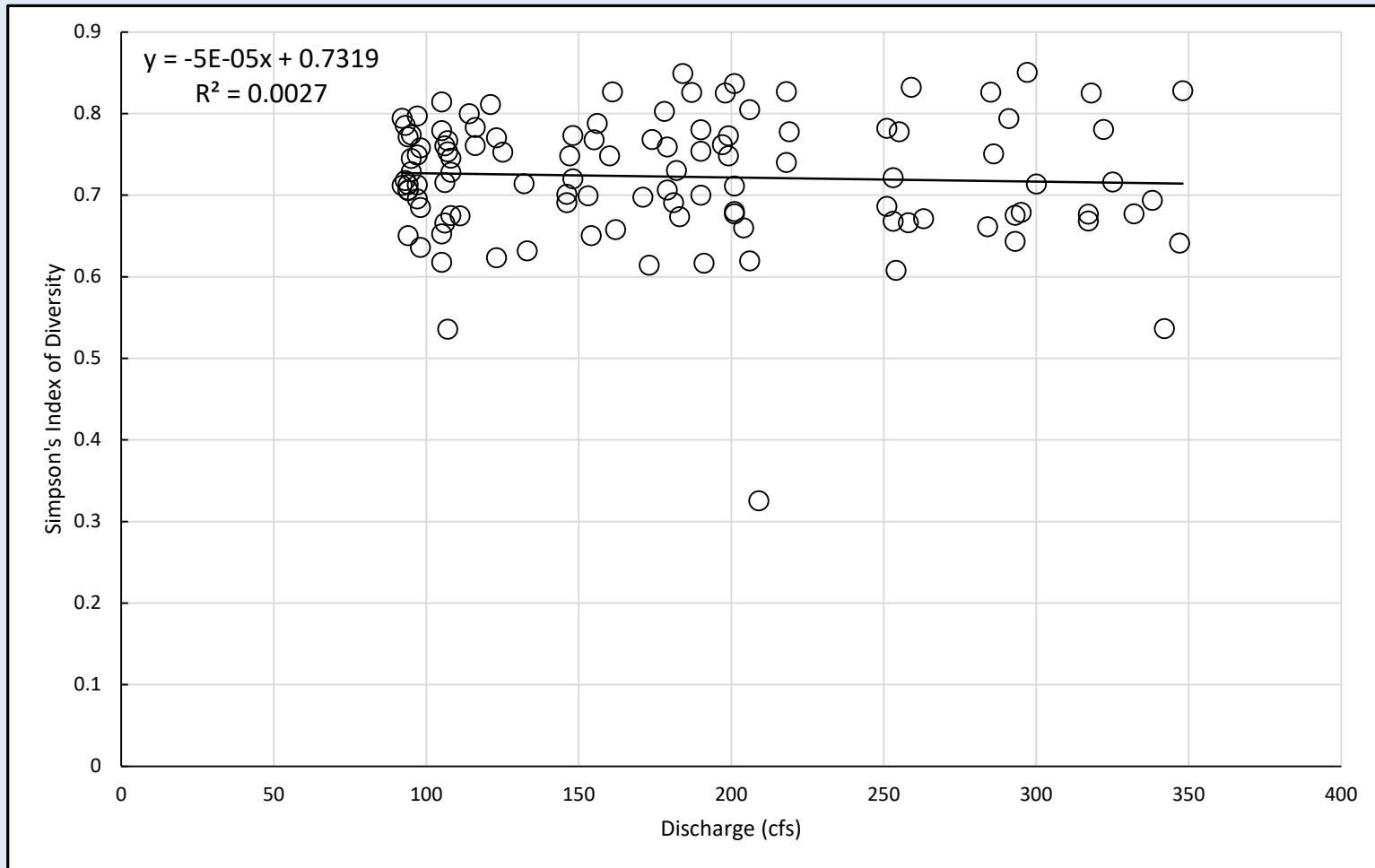
# San Marcos River - Species Richness



# San Marcos River - Evenness



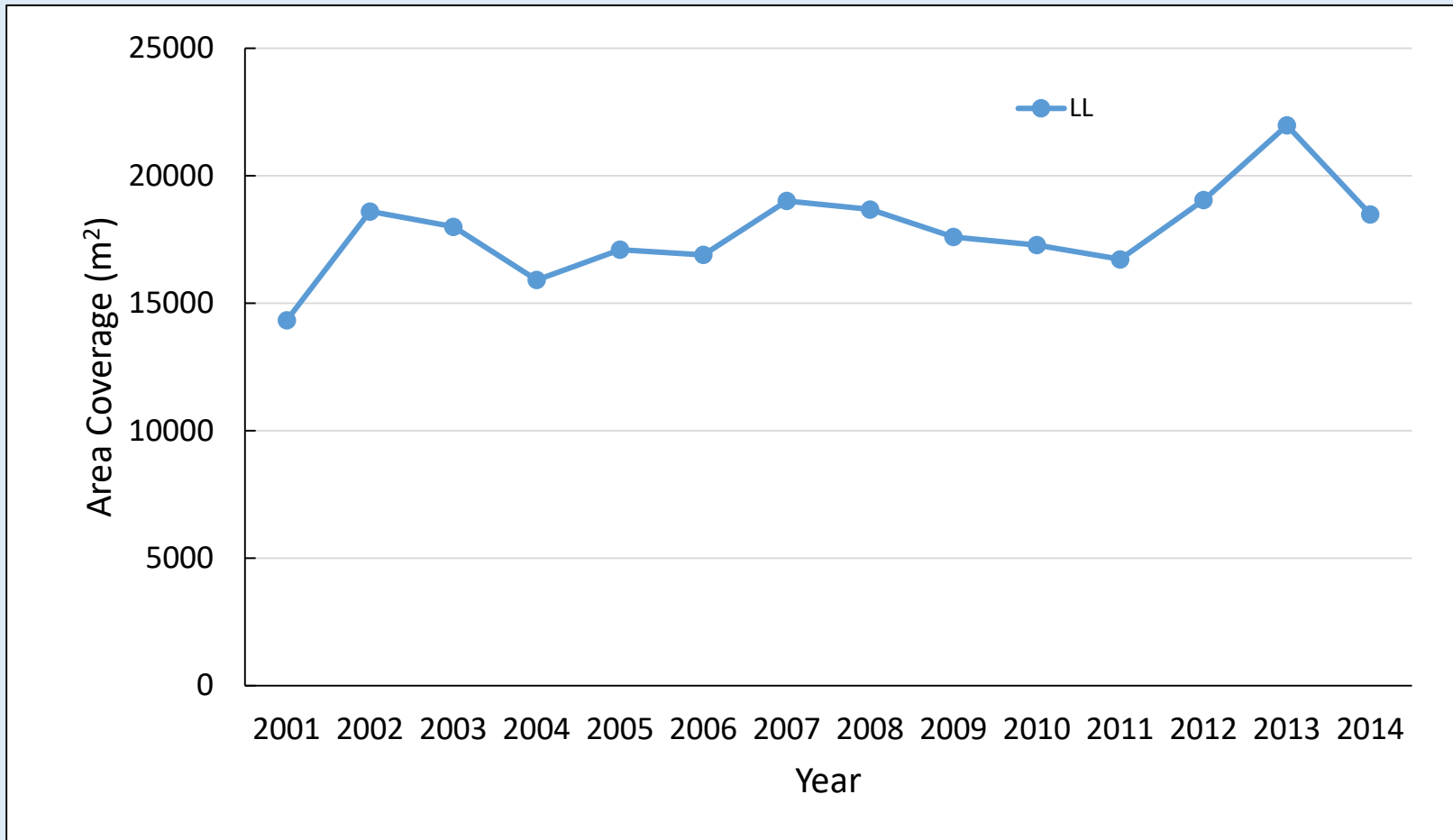
# San Marcos River - Simpson's Index of Diversity



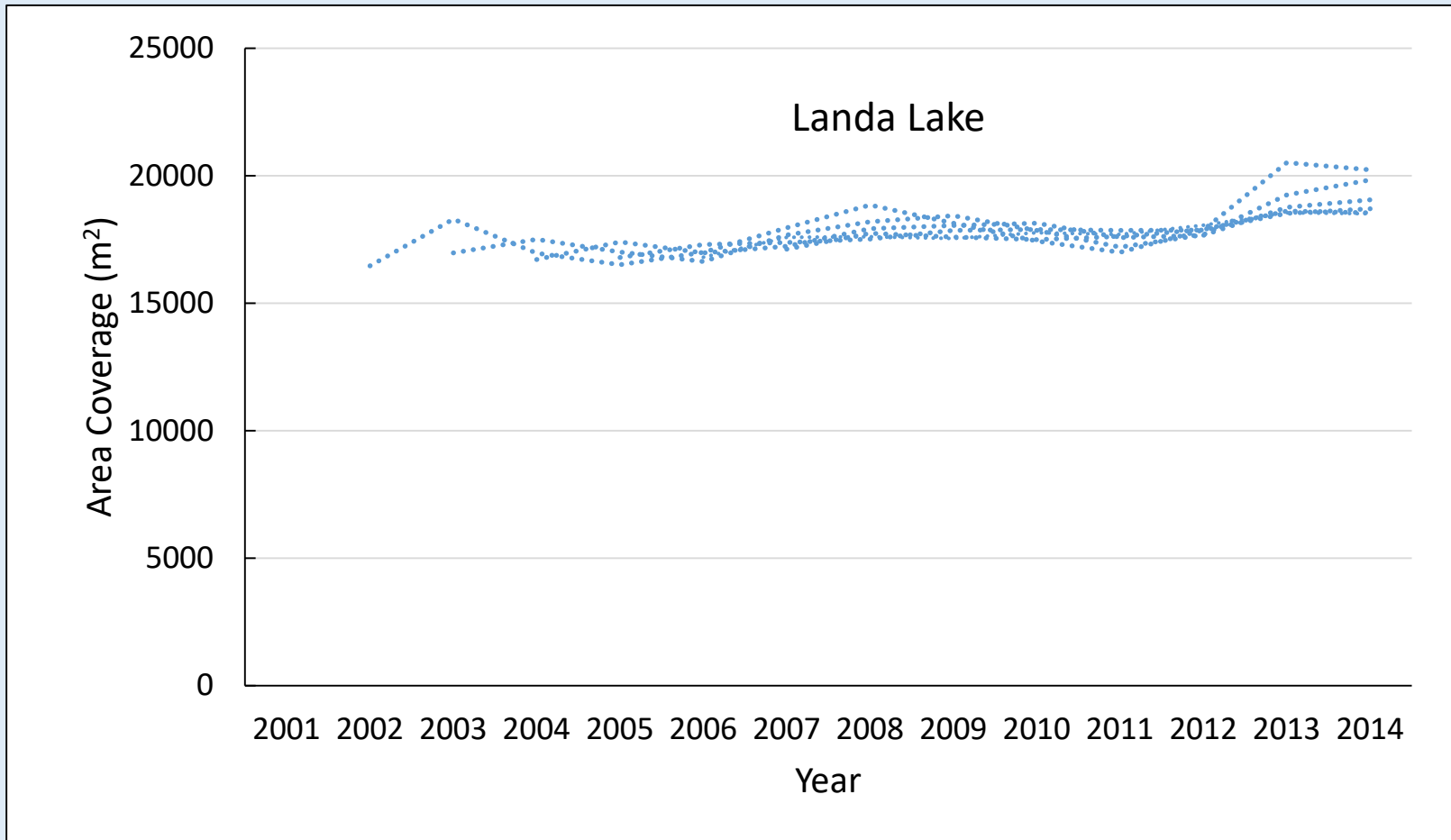


# **Native and Non-native Macrophyte Coverage**

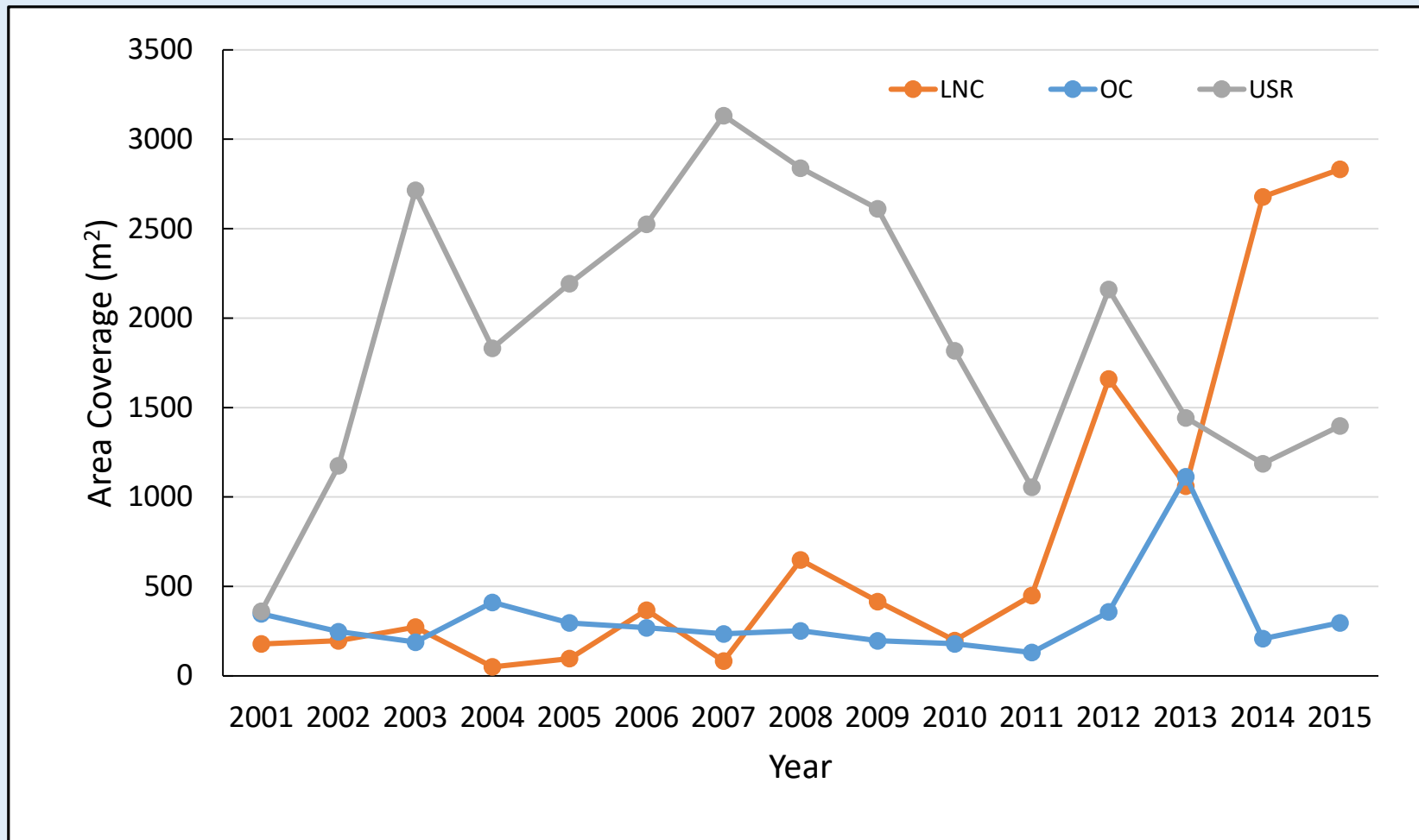
# Comal River - Native Macrophytes



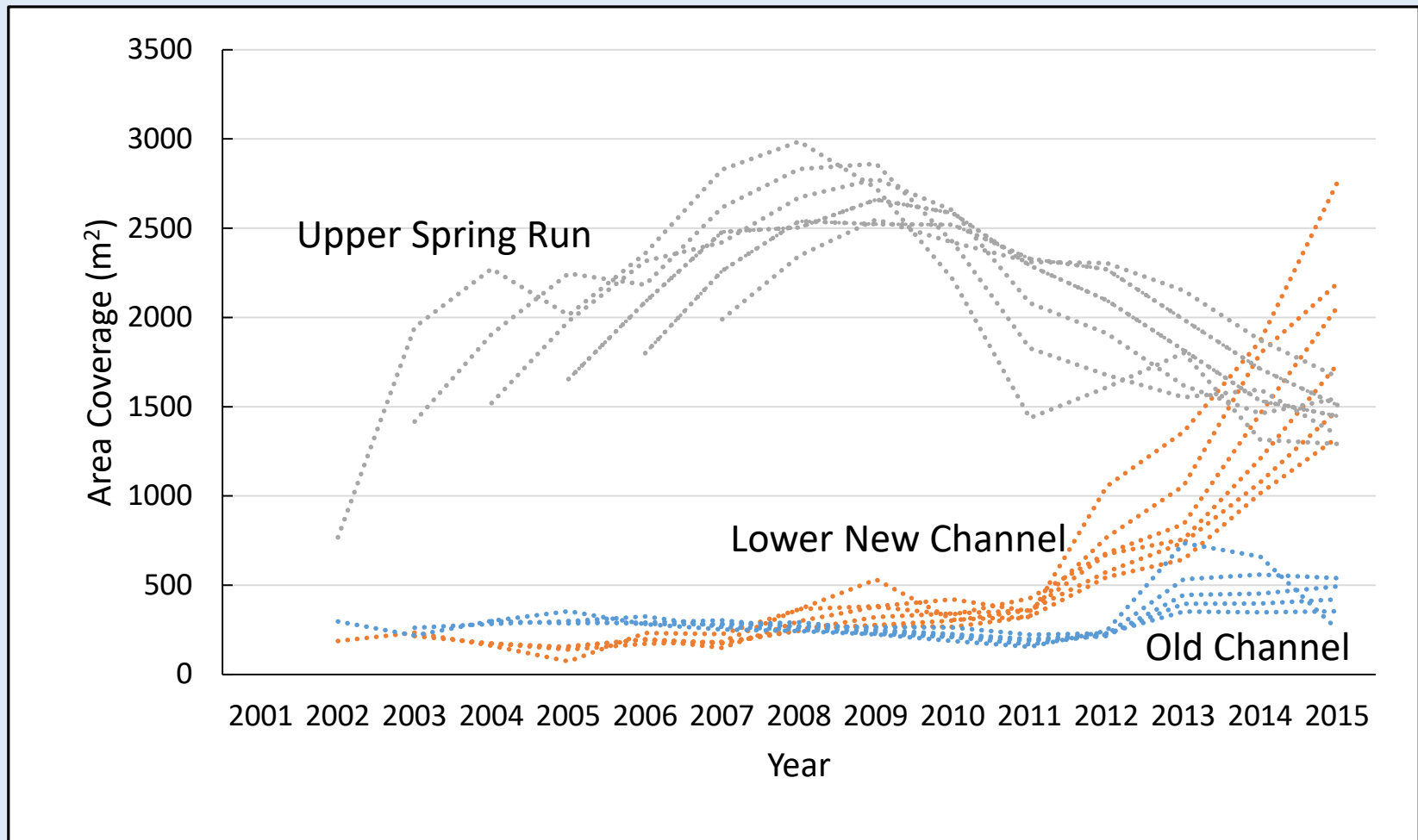
# Comal River - Native Macrophytes



# Comal River - Native Macrophytes

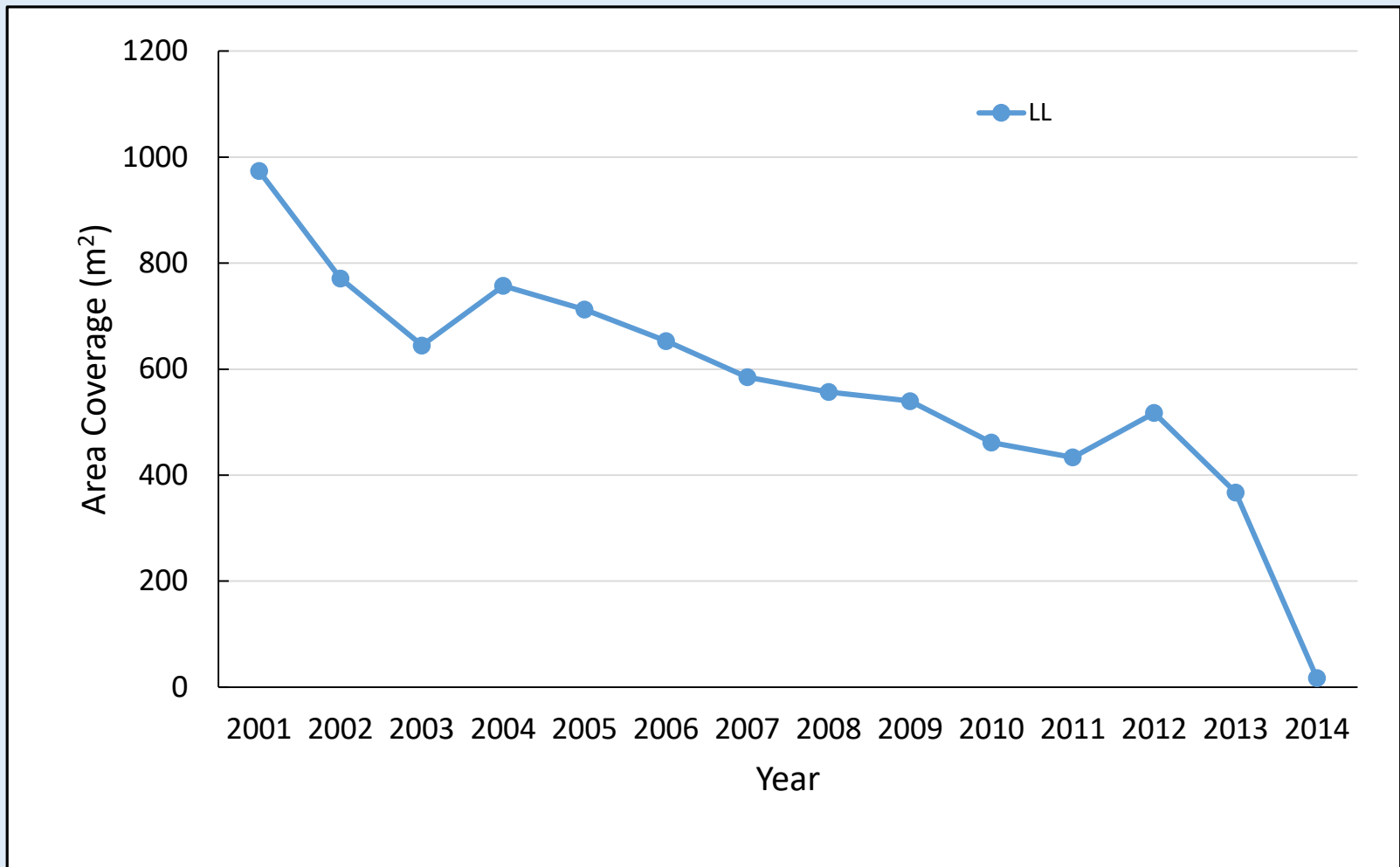


# Comal River - Native Macrophytes

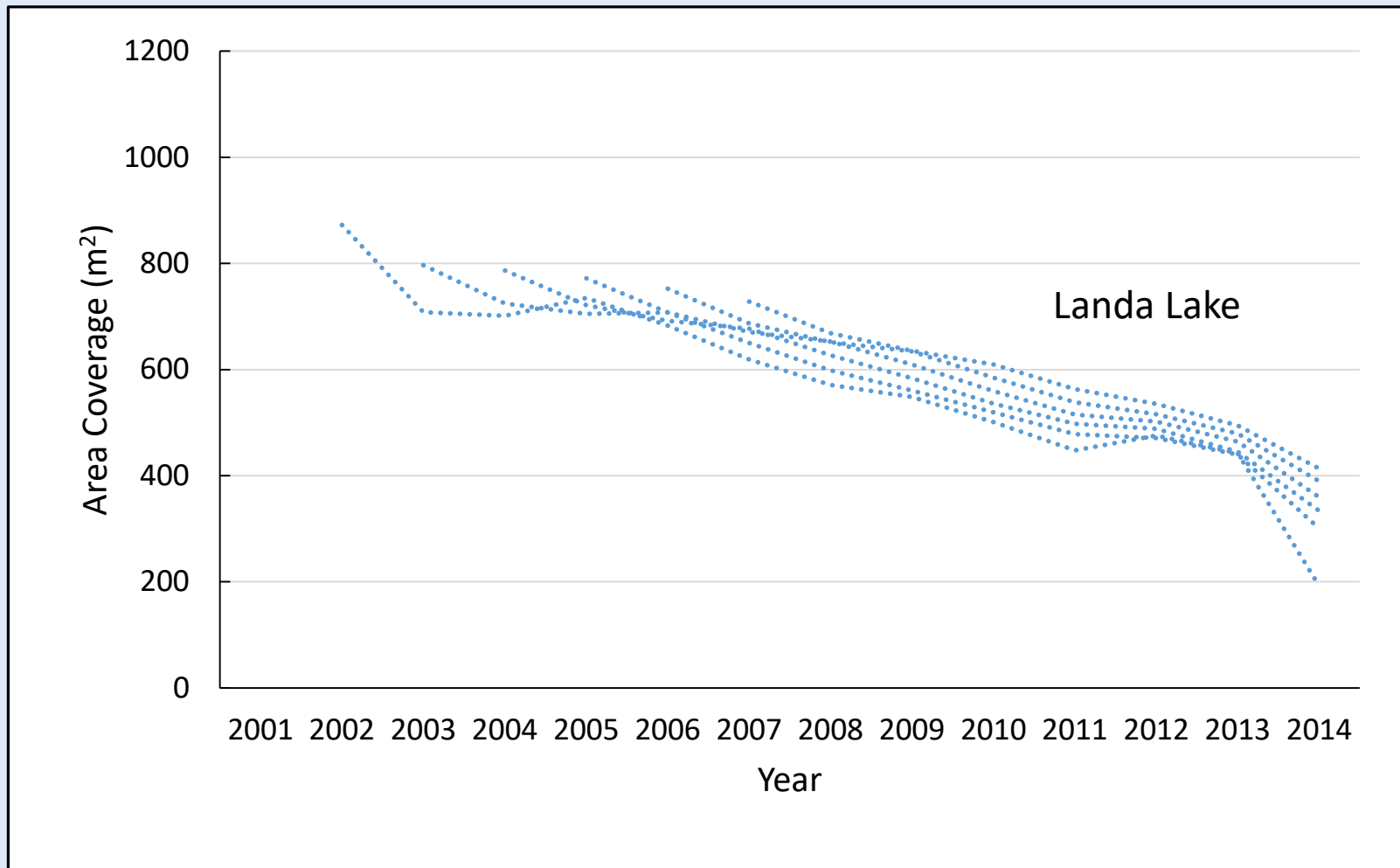


# Comal River

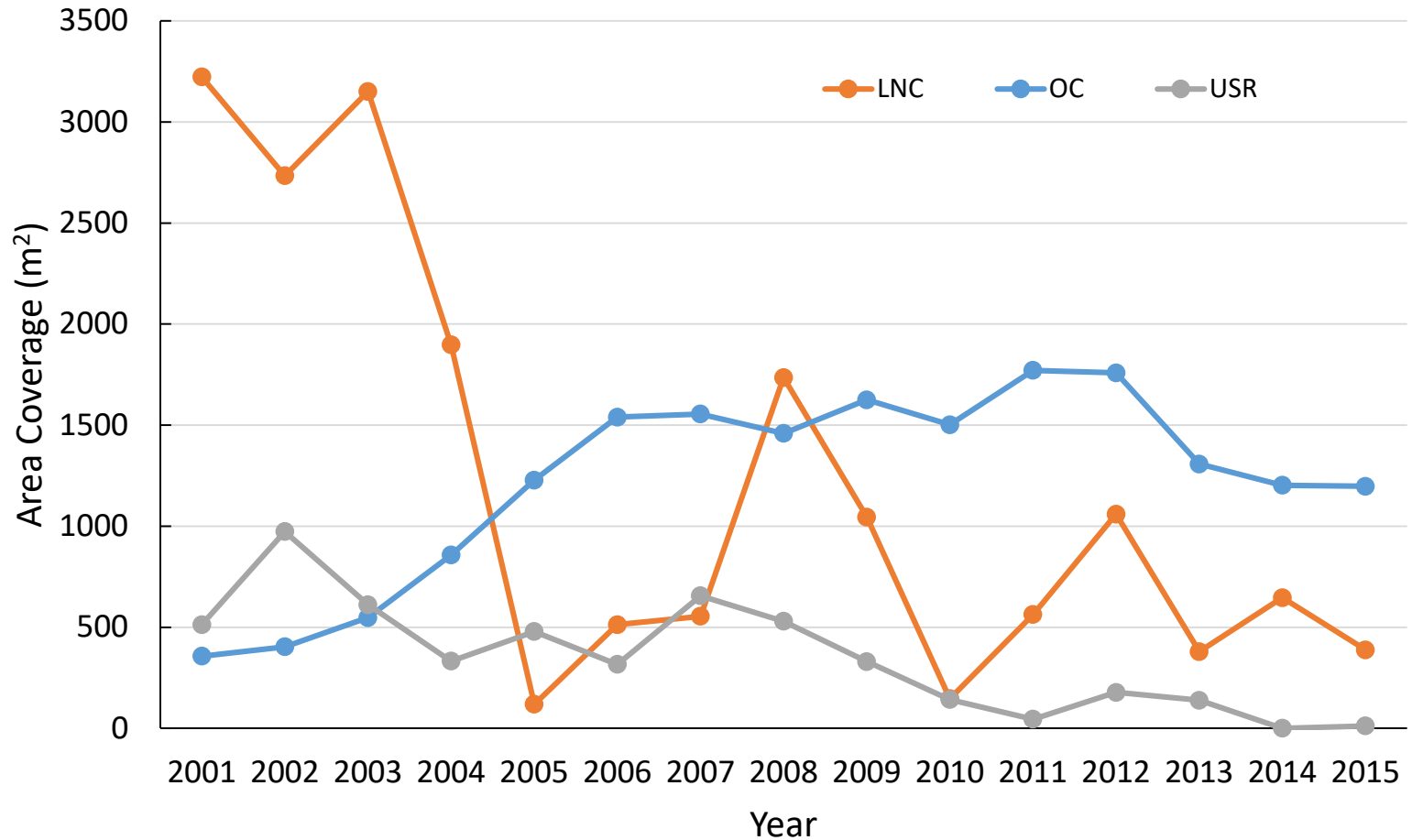
## Non-Native Macrophytes



# Comal River Non-Native Macrophytes

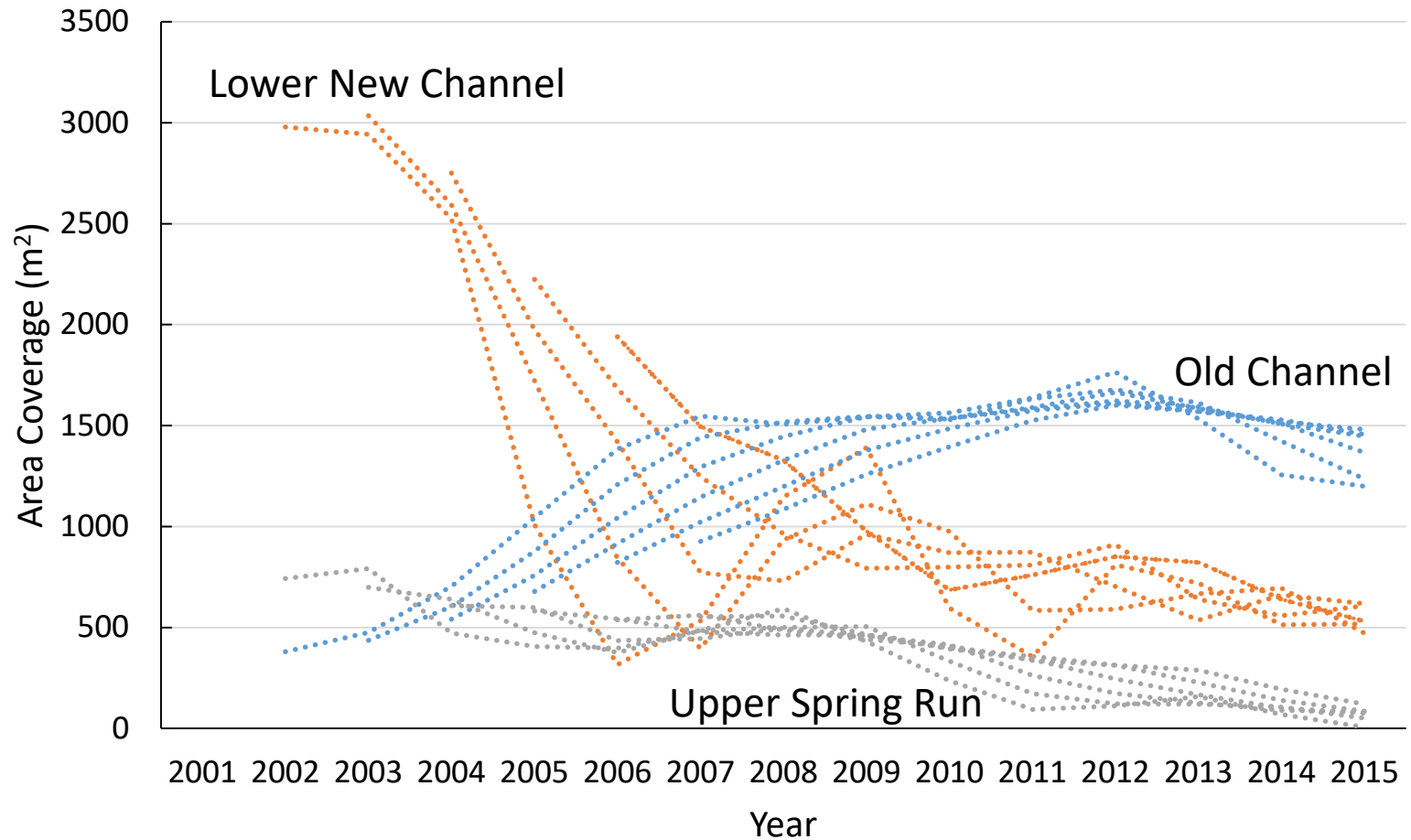


# Comal River Non-Native Macrophytes

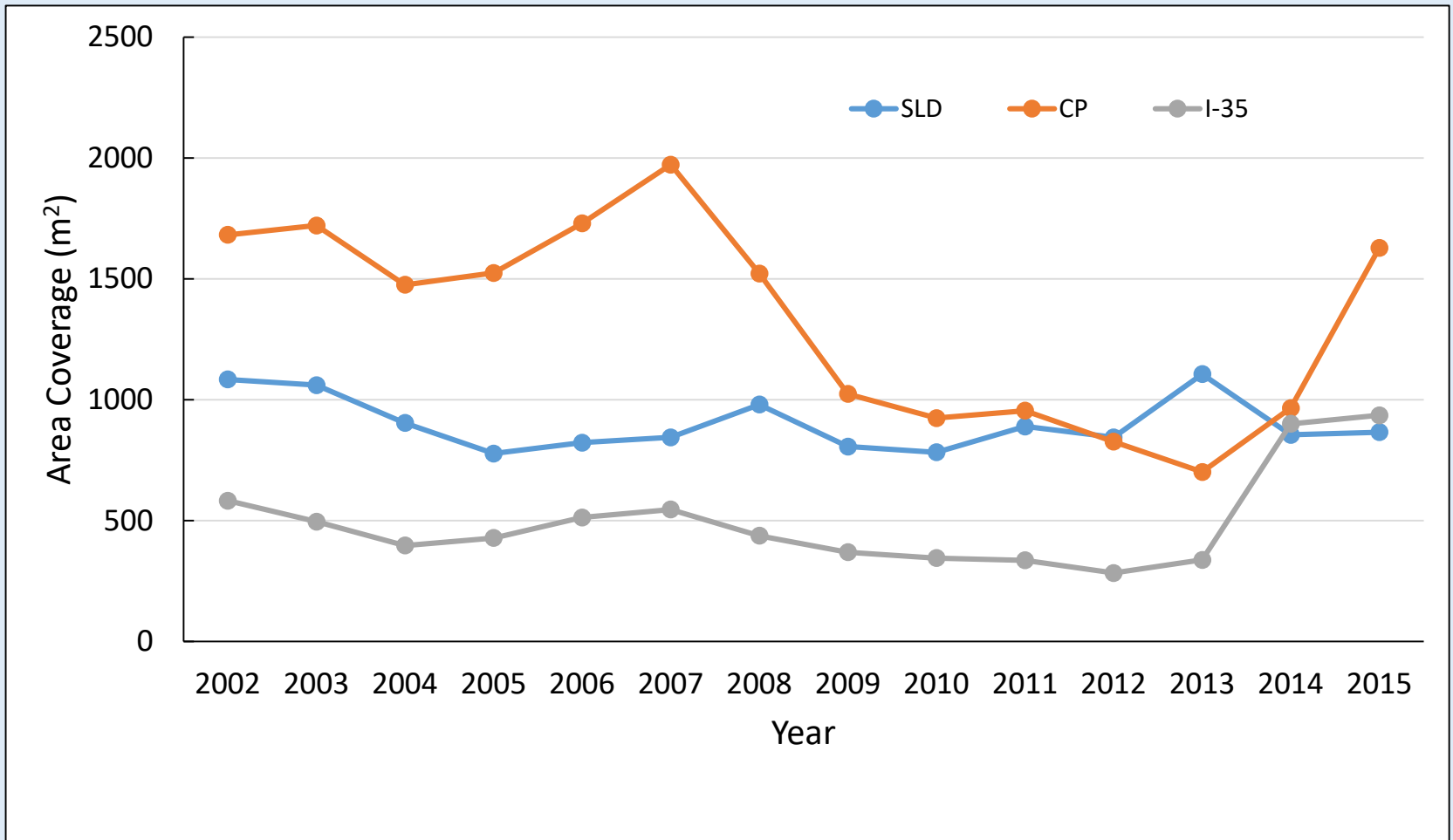




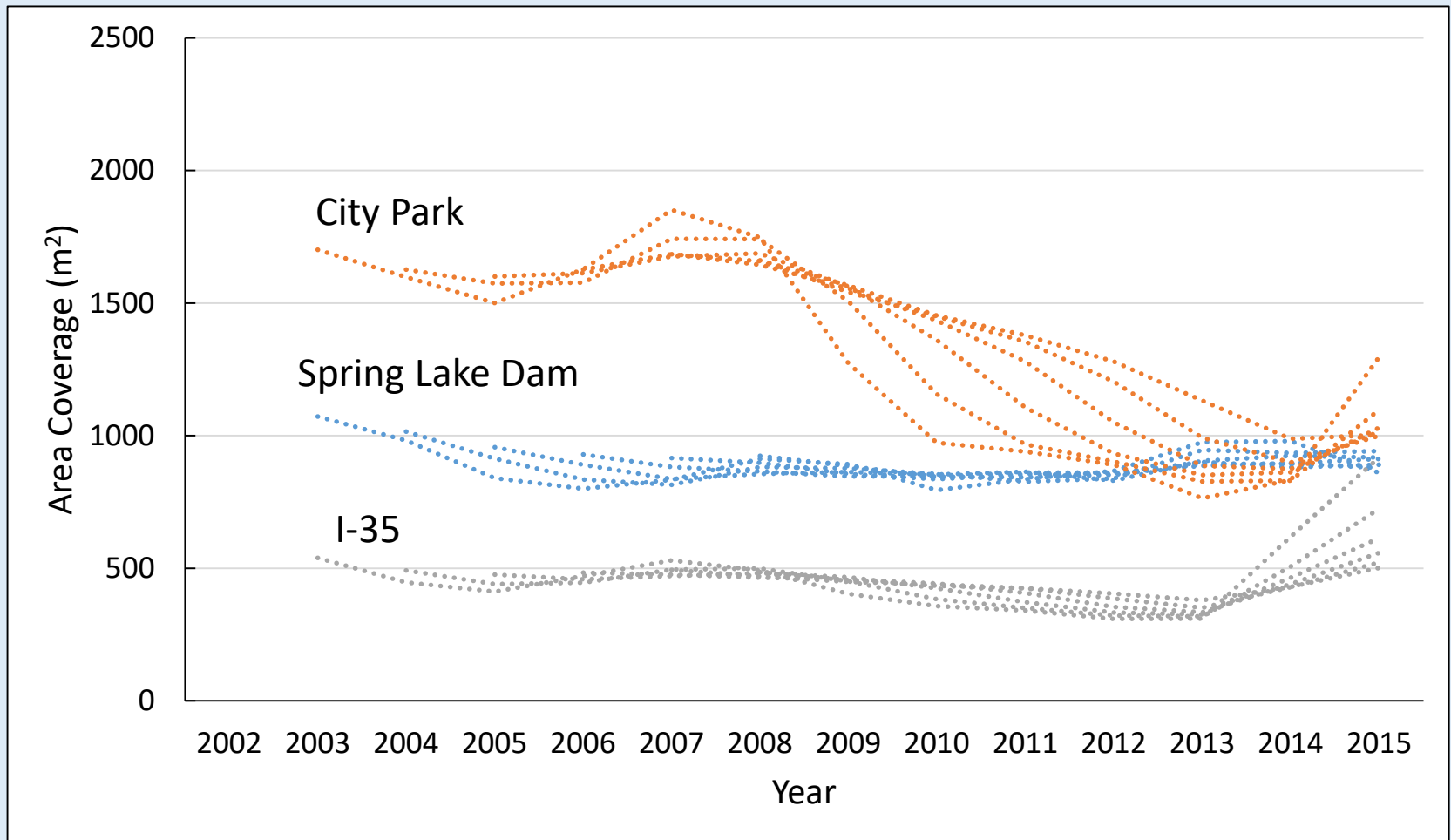
# Comal River Non-Native Macrophytes



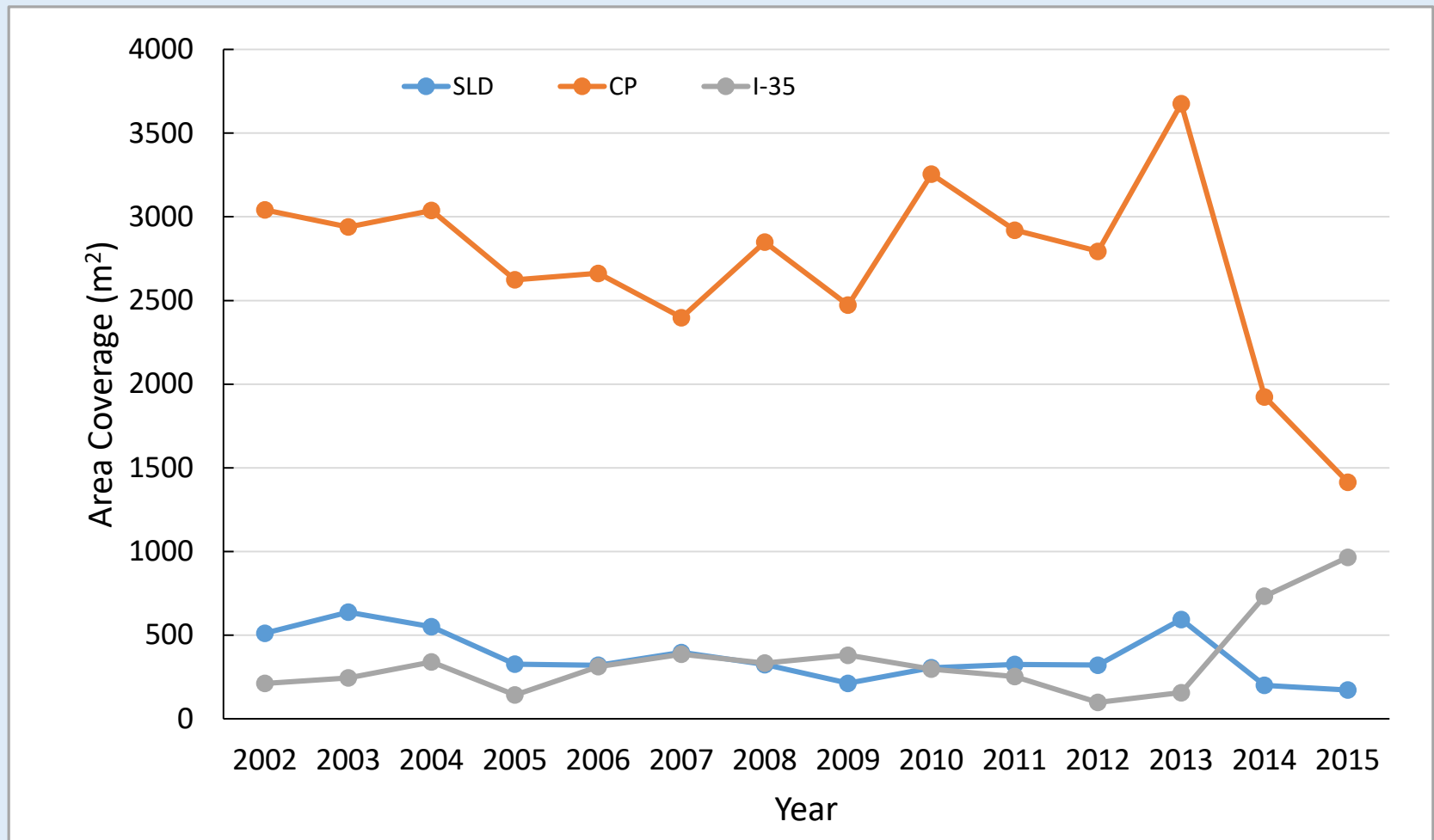
# San Marcos River Native Macrophytes



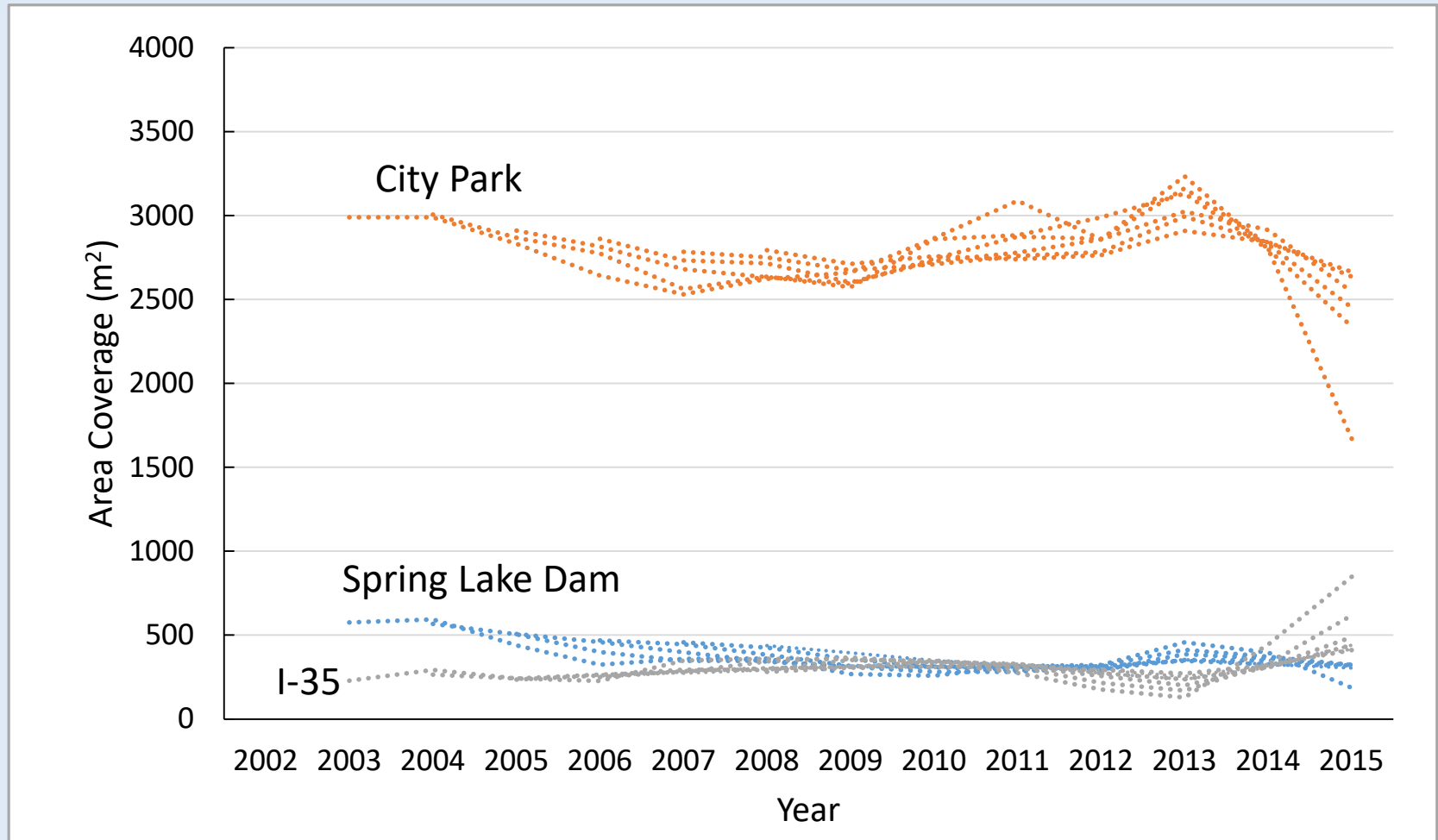
# San Marcos River Native Macrophytes



# San Marcos River Non-Native Macrophytes



# San Marcos River Non-Native Macrophytes



# Summary

- Macrophytes appear to be resilient to disturbance in the short-term
- Seasonal patterns were variable but consistent between spring and fall
- Species richness and diversity was variable
- Planting of natives and removal of non-native macrophytes
  - Increases in some native cover
  - Decreases in Hydrilla, Hygrophila and Ceratopteris
- Long-term monitoring program represents one of the few such programs that exist globally