Effects of Drought on Restored and Reference Brackish Marshes in the Northwestern Gulf of Mexico

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Texas “Exceptional Drought” of 2010 – 2011

• Oct 2010 – Sept 2011 = driest 12 months on record for the state of Texas
• Average of 11” (-16” from avg)
Objectives

• To evaluate effects of extreme drought in Texas coastal systems
• Took advantage of ongoing monitoring project in a brackish marsh restoration project
• Before/after impact of extreme drought on brackish system
Study site

Lower Neches Wildlife Management Area
Lower Neches Restoration Location

• Chenier plain used to receive water via sheet-flow, but highly disrupted
• Freshwater flow was reduced and salt water introduced through construction of canals and inter-coastal waterway
• Native vegetation largely died off, converted into open water
• Mitigation is being undertaken to bring vegetation back (2007)
• LNR site is now rain-fed with some tidal influence
• Brackish (typically 2 – 14 ppt)
Lower Neches Wildlife Management Area

c.a. 1953

Marsh
Lower Neches Wildlife Management Area

Open Water

c.a. 2006
Lower Neches Wildlife Management Area

c.a. 2008
Lower Neches Restoration

- Planted with *Spartina alterniflora* Vermilion
- Quarterly sampling
  - Salinity and water quality
  - Emergent vegetation
  - Submerged aquatic vegetation
  - Fauna associated with SAV

*Summer 2007*  
*Summer 2008*
Salinity 3x higher than normal in summer 2011

Salinity (ppt)
Emergent vegetation density was not affected by drought.
S. alterniflora fitness did not change during drought
Aquatic: *Myriophyllum spicatum* absent in spring 2011
Salinity 3x higher than normal in summer 2011

- Restored
- Reference

Salinity (ppt)

Date
Jan 09 Apr 09 Jun 09 Aug 09 Oct 09 Jan 10 Apr 10 Jun 10 Sep 10 Jan 11 Apr 11 Jun 11 Sep 11 Jan 12 Apr 12
*Ruppia maritima* biomass may have recovered slightly in response to *M. spicatum* decline.
Fish density declined during drought

- Total fish density (#/m²)
- Date: Jan 09 to Sep 11
- Restored
- Reference

Graph showing the decline in fish density during drought, with restored and reference populations compared.
Possible shifts in fish species present?

• General reduction in fish abundance, 10-fold reduction in *Poecilia latipinna*
• Gulf menhaden *Brevoortia patronus* present April – June 2011
Invertebrate density declined dramatically – largely due to disappearance of the snail *Probythinella louisiana*
Invertebrate density, without snails, was lower during drought
Invertebrate species composition changed beginning April 2011

• *Probythinella louisianae* decreased from 500/m² at restored sites in September 2010 to 0/m² in September 2011

• *Penaeus aztecus* (brown shrimp) appeared in April 2011 (3-24/m²)
Summary

• Salinity was three times higher in June 2011 than in June 2010
• Emergent vegetation was not impacted by drought
• SAV biomass was much lower in drought year
• Fish and invertebrates densities were much lower in drought year

Drought and Construction Techniques Influence Ecosystem-Level Restoration of a Brackish Marsh
Poster #345 Session 2 (Wed-Fri)
Conclusions and Implications

- Brackish systems are particularly susceptible to extreme drought effects because of salinity changes.
- Extreme drought affected SAV much more than emergent vegetation.
  - Vermilion *S. alterniflora* was resistant to drought conditions, including low rainfall and high salinity.
  - SAV biomass and faunal community declined during drought, likely due to increased salinity.
- Monitoring programs should include both emergent vegetation and aquatic habitats.
- Ecosystem services (refuge, wave dampening, nutrient uptake by SAV) provided by aquatic habitats may be impacted by extreme drought.
Thanks!

Any questions?

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Lower Neches Restoration Location
Lower Neches Restoration Location

c.a. 2011