Tracing food web connectivity across created and reference brackish marsh landscape mosaics

to rev

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Background

Heterogeneous habitats facilitate cross-landscape food webs

- Coastal wetlands are complex landscape mosaics
- Variety of aquatic sub-habitats
 - Subtidal channels
 - Intertidal creeks
 - Marsh ponds
- ry results, s • High productivity + multiple energy pathways + habitat heterogeneity \rightarrow spatial subsidies



Trophic relay is a potential mechanism governing spatial subsidies

- Trophic relay: energy transfers mediated by consumer or prey movements across ecotones
- Nekton are potential vectors in marsh food webs results, subject Preliminary



James A. Nelson^a

Trophic relay is a potential mechanism governing spatial subsidies

- Trophic relay: energy transfers mediated by consumer or prey movements across ecotones
- Nekton are potential vectors in marsh food webs
- Mediated by physical characteristics
 - Regional differences in tidal amplitude
 - Geomorphology



dynamics SHELBY L. ZIEGLER $(D, 1, + KENNETH W. ABLE,^2 AND F. JOEL FODRIE^1$



Created marsh geomorphology can differ from preexisting marshes

- Louisiana's coastal land loss → large-scale restoration efforts
- Marsh creation is a common technique
 Subt
 Preliminary results, subt



COMPLETED, ONGOING, AND FUTURE PROJECTS



Created marsh geomorphology can differ from preexisting marshes

Created Marshes

- Louisiana's coastal land loss \rightarrow large-scale restoration efforts
- Marsh creation is a common technique





Preexisting Marsh

- Potential food web implications
 Restoration evaluation

Questions

- What are the patterns of energetic connectivity within a brackish marsh • Does marsh creation affect nekton community trophic linkages?r citation

- - Aquatic: Channel > ponds
 - Benthic-detrital and Terrestrial: Channel < ponds
- Creeks will link the channel and ponds 2.
 - Highest overlap: others onto creeks
 - Creeks: broadest niche, most varied pathway dependence





Energy pathway dependence





Benthic-Detrital Terrestrial

Methods

and the second

Samples were collected from 2 created & 1 reference marsh At each site: subtidal channel, marsh ponds, intertidal creeks

Methods





AckgroundMethodsResultsDiscussionSamples were collected from 2 created & 1 reference marshAt each site: subtidal channel, marsh ponds, intertidal creeks











17 species

7 species



Data Analysis: Community-wide metrics

subject to

δ13C

Isotopic Niche Metrics

- δ^{13} C, δ^{15} N, δ^{34} S
- Multivariate Metrics:
 - Niche position
 - Euclidean distance between. • 'esults, centriods
 - Niche width •
 - Ellipsoid volume
 - he overlap
 - Median %

Stable Isotope Mixing Models • δ¹³C & δ³⁴S



Benthic-detrital sources were combined

Benthic-Detrital

- 4 basal energy pathways:
 - Benthic-Detrital, Terrestrial, Epiphytic, • Aquatic
- Accounted for trophic discrimination
- Model outputs: Medians and 95% CI •

Results

a start

Question

 Some support of the second seco • What are the patterns of energetic connectivity within a brackish marsh

- Benthic-detrital and Terrestrial: Channel < ponds

Aquatic

Benthic-Detrital Terrestrial

kground Methods					<u>Result</u>	:S					
					Α		10	LHA (Cre	ated)		
Isotopic niche: Chan	nel	VS.	Po	nds	10-		_ 12.			20 -	
					δ ¹⁵ Ν		δ ¹⁵ Ν (x34 o	2 10-	
					4 -		4 -	-		0-	
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					12-		12			20-	
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• All community overlaps rai	igeu	45-	9370		44		4 -			0 -	
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inaly						Sul	o-habitat	Pond		Channel	
alimite		row	onto	column		Pond			Creek		Channel
PICE	Median	↓ ↓	(%)		LHA	LHB	LHC	LHA	LHB	LHC	72
	High	Pond		LHB	-	-					87
	гиди		LHC				-				58
				LHA				-			
	LHB					-					
	LOW		Channe		62	53	46			-	

Mixing Models: Channel vs. Ponds

- Channel: mixed pathway dependence, high uncertainty
- Ponds: clear rankings, more constrained
- Aquatic pathway contributions are greater to Channel than Ponds
- Benthic-detrital dependence higher in Ponds than Channel
- Similar terrestrial pathway contributions



Question

• What are the patterns of energetic connectivity within a brackish marsh communities in: 1. The channel & ponds will be the most distinct • Lowest overlap: onto each other Subject to Aquatic: Channel

- <u>Benthic-detrital</u> and <u>Terrestrial</u>: <u>Channel < ponds</u>



Benthic-Detrital Terrestrial

Question

• What are the patterns of energetic connectivity within a brackish marsh

- dependence nal







Benthic-Detrital Terrestrial



Method

Results

Mixing Models: Creek vs. others

- Creeks are similar to the channel community
- Possibly intermediate for benthic-detrital and aquatic energy dependence
 Preliminary



Question

• What are the patterns of energetic connectivity within a brackish marsh

dependence nal

Aquatic



Benthic-Detrital Terrestrial

Question

• What are the patterns of energetic connectivity within a brackish marsh



Terrestrial Aquatic

Benthic-Detrital

Results

Question

Preliminary results, subject to revision and not for citation

Isotopic niche: Created vs. Reference

- Ponds & LHA creek had distinct positions, but minor difference
- Pond-Pond and Creek-Creek overlaps relatively high (>84%)
 - Except onto LHB communities





	row	onto	column	Pond				Channel		
Median	↓	(%)	\Rightarrow	LHA	LHB	LHC	LHA	LHB	LHC	Channel
overlap			LHA	-	65	84	68			73
High	Pond		LHB	93	-	89		75		87
			LHC	86	60	-			69	58
			LHA	58			-	67	85	89
	Creek		LHB		67		92	-	95	91
Low			LHC			58	84	71	-	87
	Channel		62	53	46	91	70	87	-	

Mixing Models: Created vs. Reference

- Generally the same
- Benthic-detrital contributions are lower in LHB pond
- Benthic-detrital contributions are lower to created creeks
- Increased algal contributions at created sites





Discussion

Questions

- What are the patterns of energetic connectivity within a brackish marsh landscape?
 - Is trophic relay occurring?
- Does marsh creation affect nekton community trophic linkages?
 - Minor differences, but niche contraction at created site LHB- why?



Isotopic niche



Terrestrial **Benthic-Detrital** Aquatic



Taxonomic composition and sub-habitat accessibility might explain patterns of trophic similarity Marsh transients

- ...munity: rrequent platform access Small home ranges and high site ject to revisive fidelity Creek community: Mix Mix

Marsh residents

not



Taxonomic composition and **sub-habitat accessibility** might explain patterns of trophic similarity



Taxonomic composition and sub-habitat accessibility might explain patterns of trophic similarity

- Marsh transients vs. residents
 - Channel community:
 - Limited access to the marsh platform
 - Migratory
 - Pond community:
 - Small home ranges and high site ject to refidelity
 Creek community:
 Mix
 - - Most similar to the channel
- Sub-habitat accessibility
 - Ponds can be spatially isolated
 - Creeks and channels physically connected



Is trophic relay occurring?

- Consistent terrestrial contributions across sub-habitats supports the trophic relay hypothesis
- Alternative mechanisms: passive mixing (i.e., outwelling)
 - High overlap across sub-habitats (≥46%)
 Benthic-detrital: difficult to tease apart



Marsh creation: Niche contraction at the youngest site



Marsh creation: Niche contraction at the youngest site



Conclusions & Implications

- Spatial subsidies from marsh platform \rightarrow aquatic habitats
- Mediated to some degree by trophic relay
 to revision
 Lake Hermitage Marsh Creation: similar aquatic food web to preexisting reference >5 years post-construction
- Mechanistic framework for evaluating restoration of ecosystem function



Created Marshes





Future Directions



Clarify creek and channel pathway dependence • CSIA

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