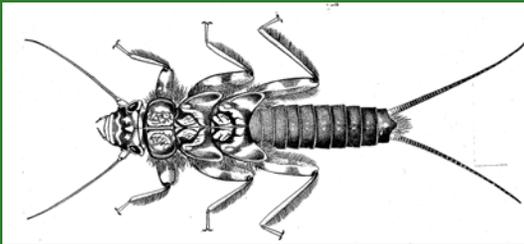


Macroinvertebrate Community Characteristics in Relation to Longitudinal Differences in Biological Condition: A Framework for Validation of Metric Responses to Cumulative Perturbations in the Channelized Lower Missouri River

Barry C. Poulton



Brief Overview of LMR Macroinvertebrate Studies

Characterize community in different habitats & substrate types



Examine efficiency and suitability of sampling methods



Identify longitudinal effects from cumulative water quality impacts



Validate large river metrics & identify longitudinal response gradients



Evaluate biological condition and water resource status



Develop large river biocriteria and relate to aquatic life use attainment

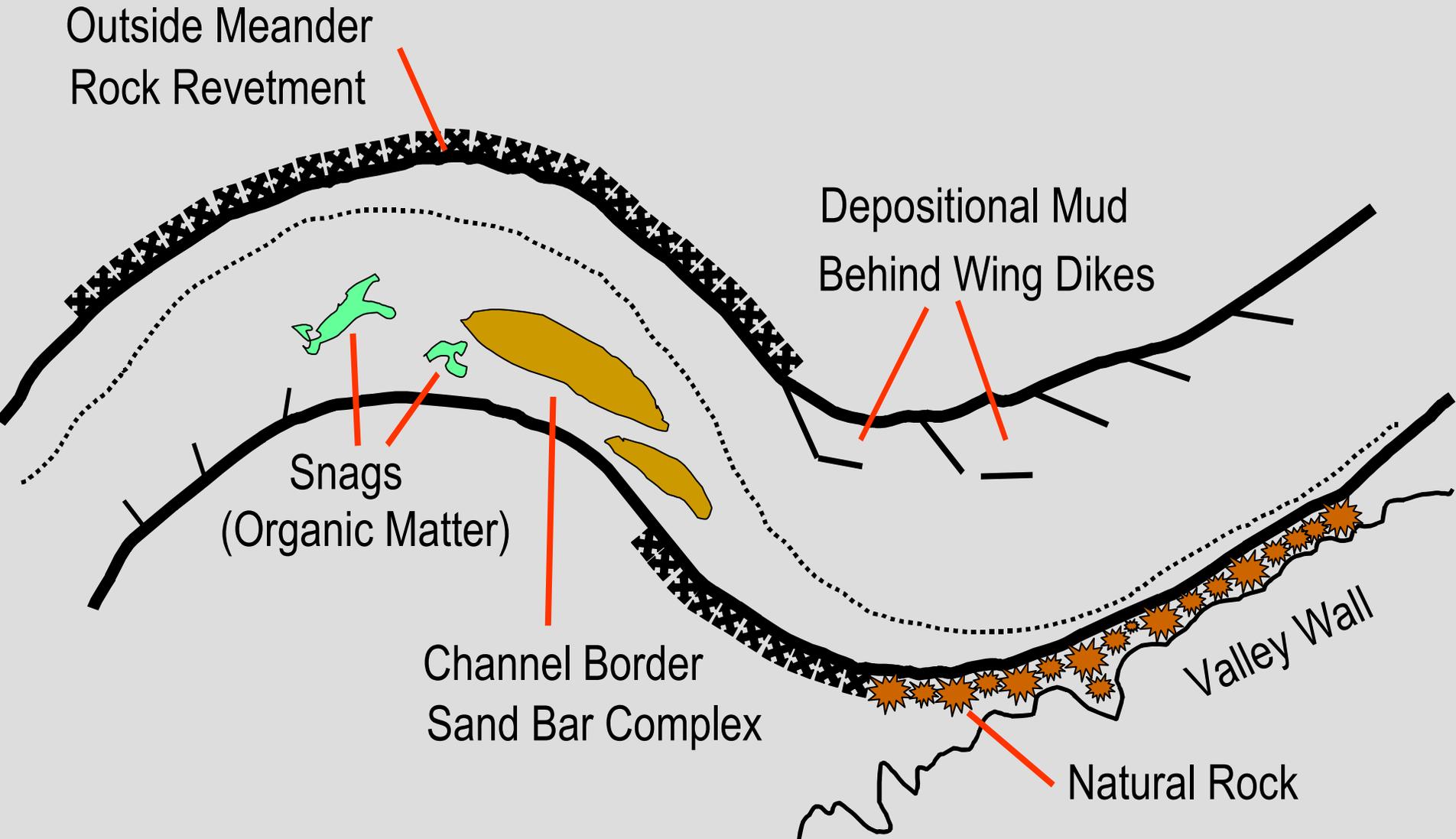
Specific Macroinvertebrate Research Studies - LMR

- Localized effects of cumulative urban impacts (water & sediment quality)
- Contaminant body-burdens in burrowing mayflies
- Effects of Zebra Mussel infestation
- Trend monitoring studies
- Success of habitat rehabilitation projects
- Forage habitat & food resources for invertebrate-feeding fish & wildlife



Typical habitats within a meander segment

Channelized Lower Missouri River







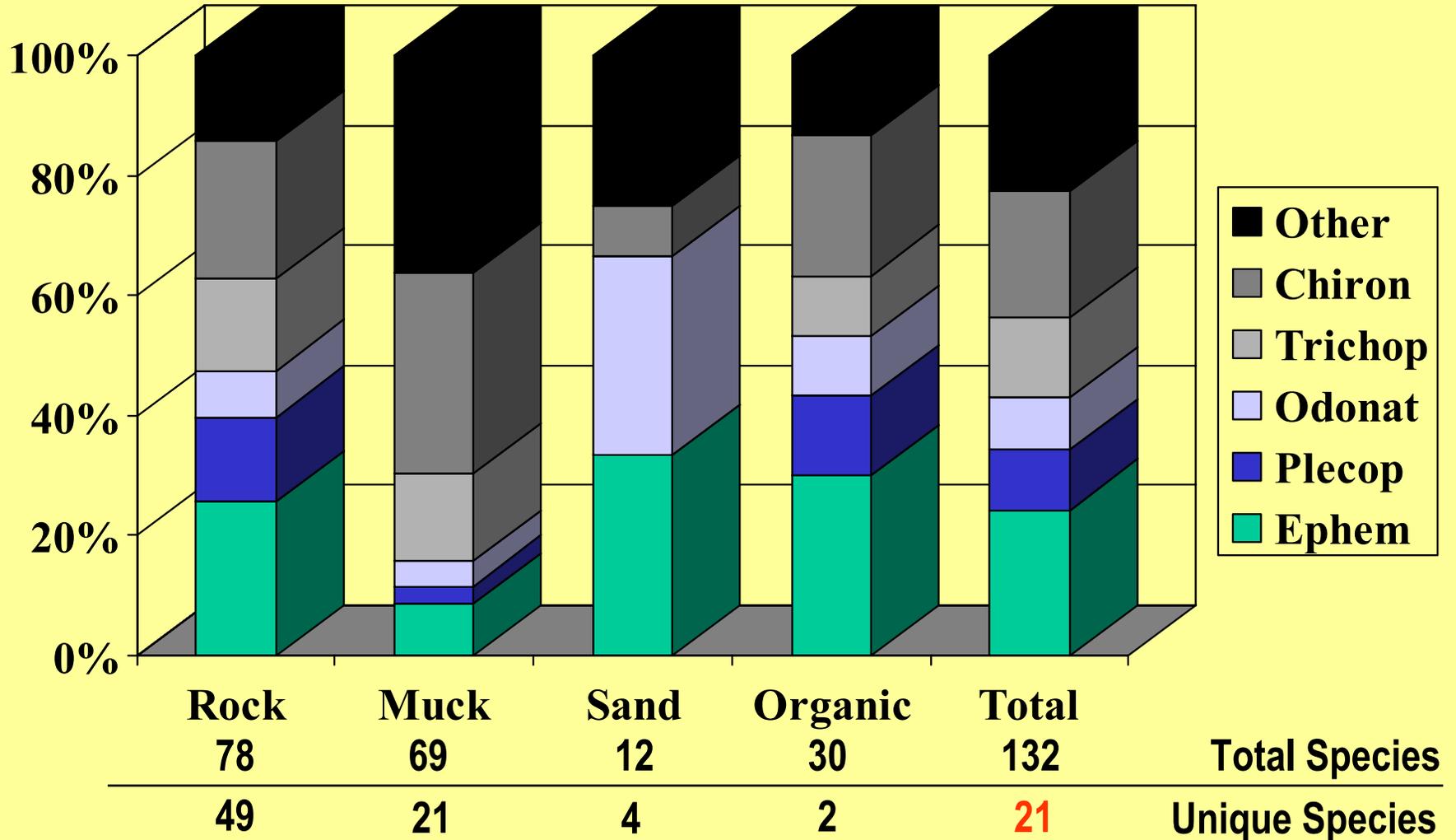




Indicator Species	Habitat or Substrate Type					
	Rock Low Velocity	Rock Mod. Velocity	Channel Border (Sand)	Deposition Zone (Mud)	Clay Bank	Organic Snags
<i>Acroneuria evoluta</i>						X
<i>Attaneuria ruralis</i>						X
<i>Hydroperla fugitans</i>		X				
† <i>Isoperla longiseta</i>		X				
<i>Paragnetina kansensis</i>						X
<i>Homoeoneuria ammophila</i>			X			
<i>Hexagenia spp.</i> (4 species)				X		
<i>Pentagenia vittigera</i>	X					
<i>Pseudiron centralis</i>			X			
<i>Raptoheptagenia cruenata</i>	X					
<i>Tortopus primus</i>					X	
<i>Hydropsyche orris</i>		X				
<i>Potamyia flava</i>		X				
<i>Epicordulia princeps</i>						X
<i>Gomphurus spp.</i> (2 species)	X					
<i>Stylurus plagiatus</i>			X			
<i>Axarus sp.</i>				X		
<i>Robackia sp.</i>			X			

Distribution of Taxa Richness in 4 Substrate Types

Lower Missouri River - mainstem



Justification for Habitat Pre-Stratification in LMR

- Parallel to design used for bioassessments in wadable streams
- Habitats are distinct and repeatable longitudinally for 90% of LMR
- Sampling methods used are substrate (or habitat) dependent
- Fauna in LMR initially characterized by habitat (now well-known)
- Each habitat is treated separately because endpoint metrics differ
- Over-sampling not usually a problem (funding-dependent)

List of Endpoint Metrics – LMR Macroinvertebrates

- * Total Taxa Richness

EPT (% and richness)

% Chironomidae

- * % Ephemeroptera

Hilsenhoff Biotic Index

Shannon-Wiener Diversity Index

Scraper/Filtering Collector Ratio

Density (# / m²)

% Dominant Taxon

EPT/Chironomidae Ratio

- * EPOT (% and richness)

- * % Filtering Trichoptera

- * % Large River Taxa

- * Chironomidae Taxa Richness

- * % Oligochaeta

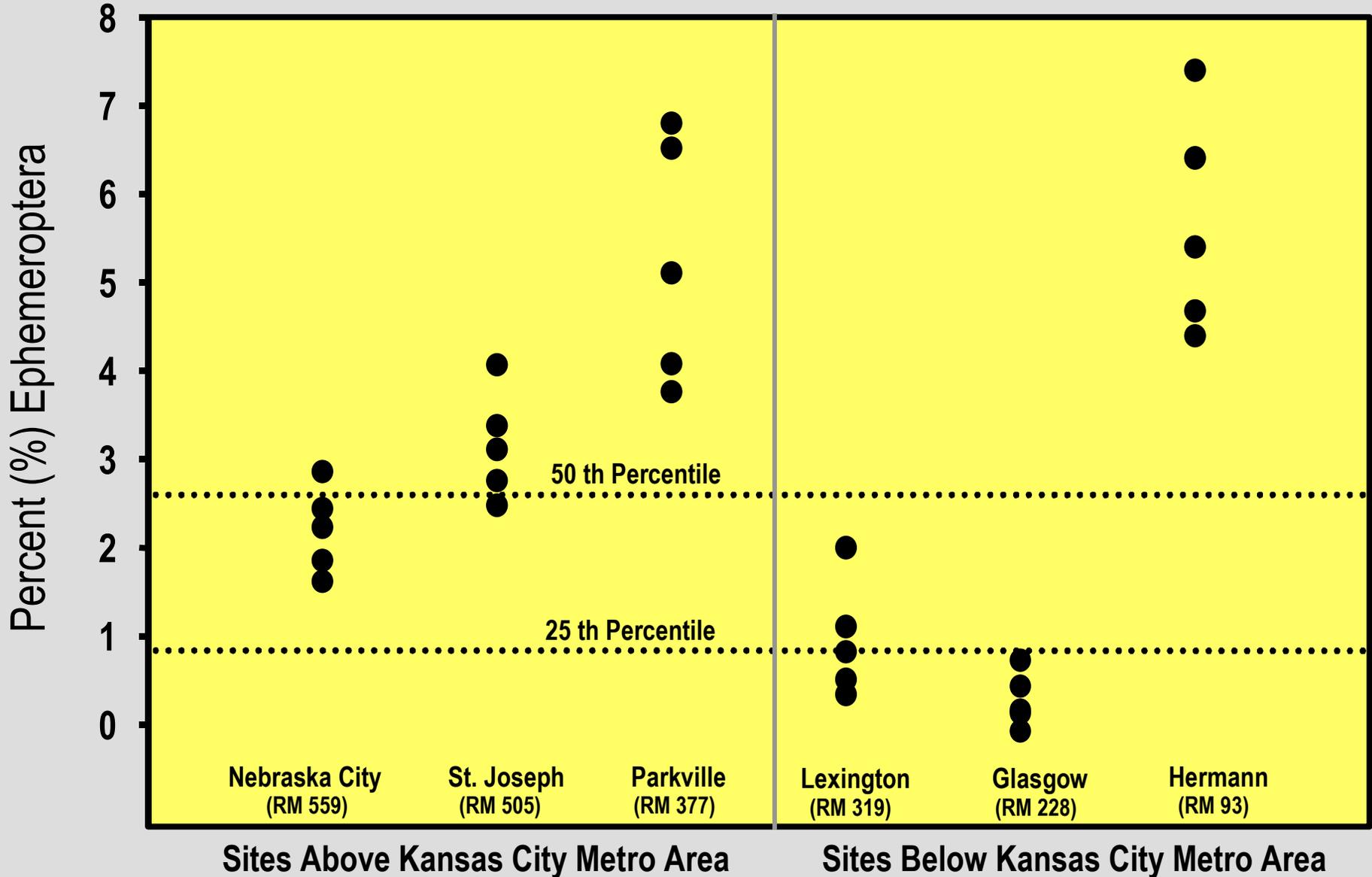
For Coarse Substrate (Rock)

For Depositional Substrate (Mud)

For Both Substrates

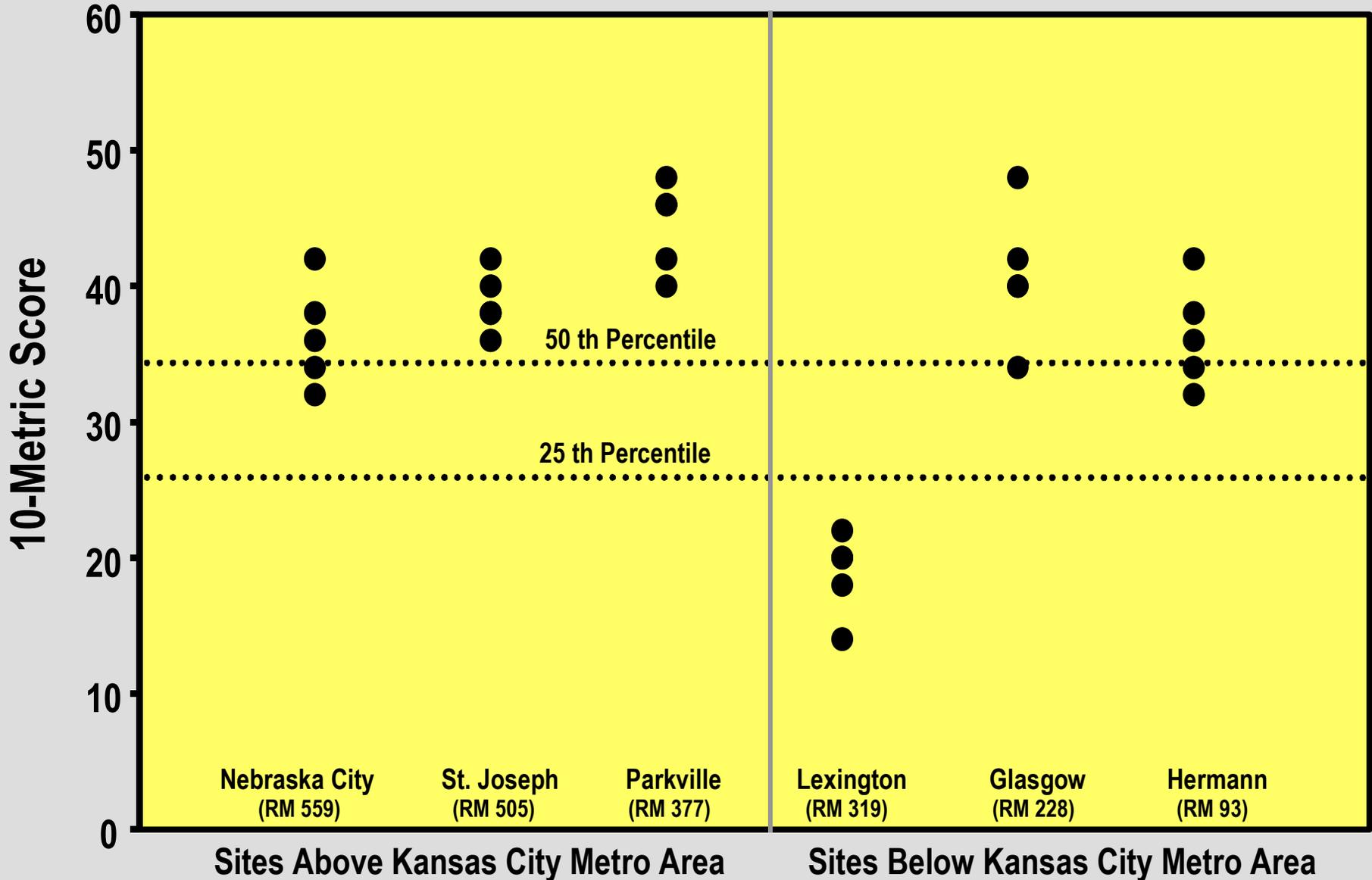
Percent (%) Mayflies for 6 LMR sites

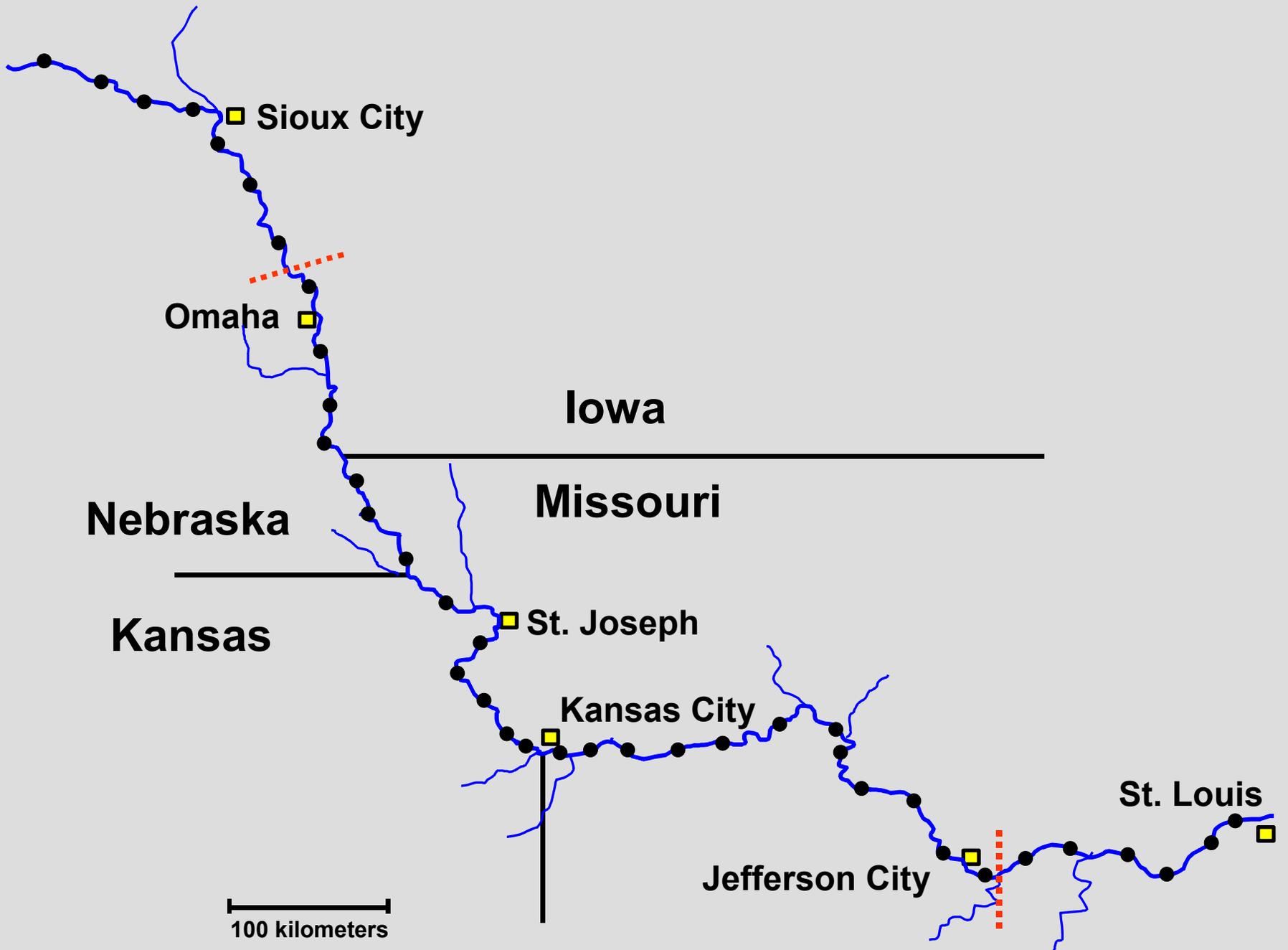
Petite Ponar data from 1996



Relative score for 6 LMR sites – Biotic Condition

Rock basket data and 10 macroinvertebrate metrics





Summary - Currently Funded LMR Study

Goal

Establish longitudinal response gradient to validate endpoint metrics

- 18 sites, 2 habitats, 3 methods, Autumn index period
- Simultaneous basic water quality and sediment contaminants

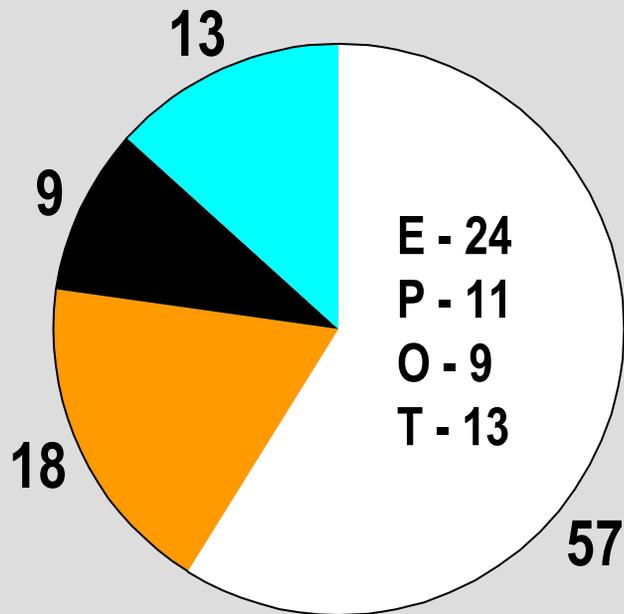
Sampling Design & Approach

upstream/downstream site selection based on longitudinal features (urban areas, tributaries), with pre-stratification by habitat

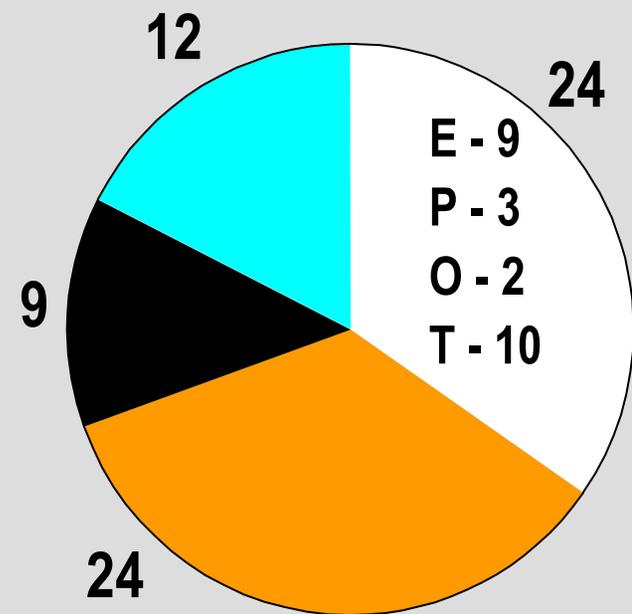
“Site” Definition

A 10 km reach that includes repetition of selected habitats

Taxa Distribution in 2 Habitats – Lower Missouri River



Rock Basket & Kick Net
(Coarse Substrate)



Petite Ponar
(Depositional Mud)

Justification for Selection of the 2 LMR Habitats

1. coarse substrate (revetment) 2. depositional mud (dike fields)

- Same as for bioassessments in wadable streams / small rivers
- Habitats are repeatable and have distinct composition
- Sampling methods used are well-established and reliable for LMR
- Many widely-used metrics were developed specifically for them
- Most significant, most stable, and highest species richness
- High frequency allows randomization within relatively short reaches

