

Trends in Terrestrial Riparian Resources 2001 - 2004

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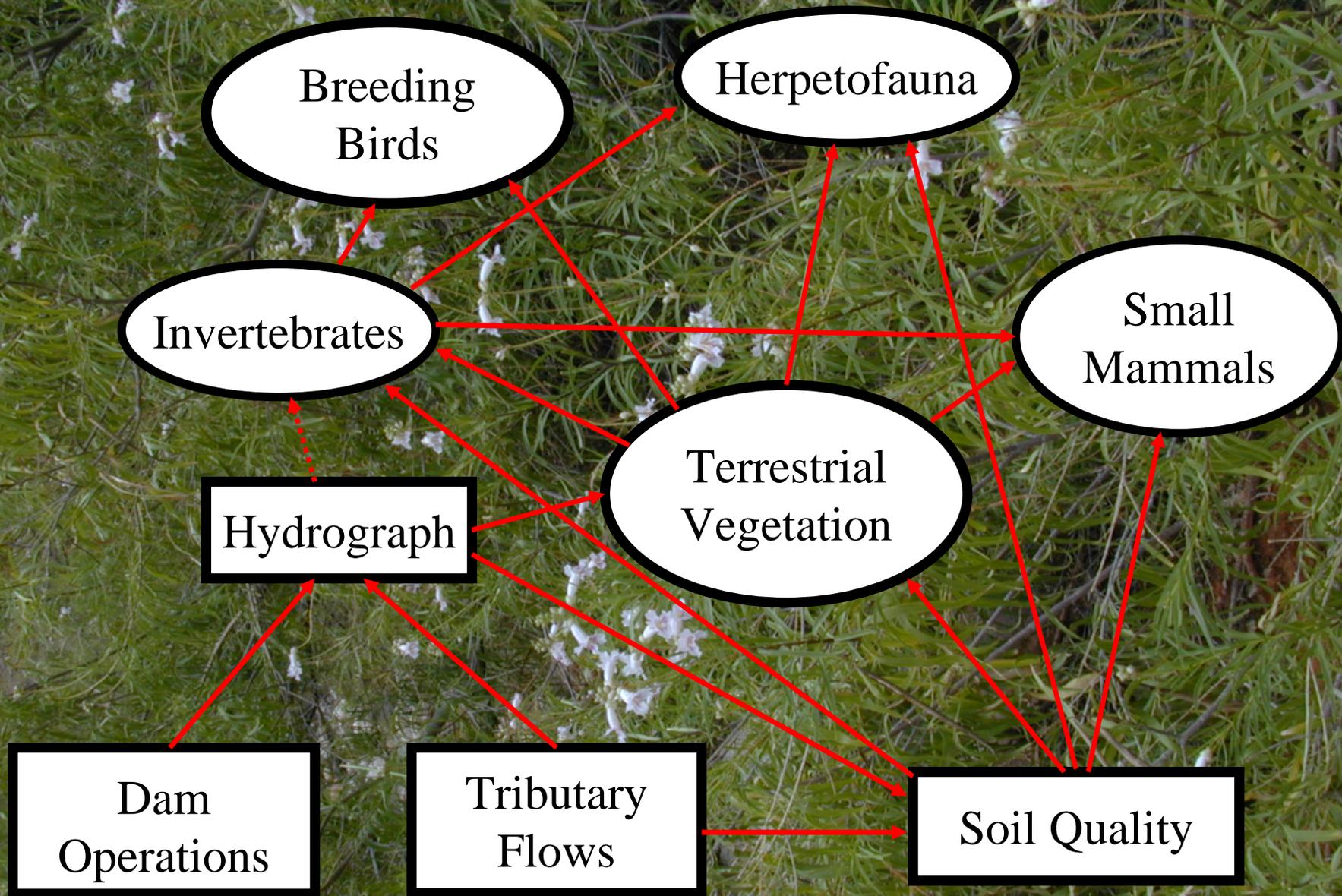
J. Frey, NMSU

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Terrestrial Protocol Evaluation Panel

(Urquhart et al. 2000)

- Monitoring of well studied species
 - Avifauna (breeding birds and waterbirds)
 - Vegetation
- Inventory / monitoring of less studied groups
 - Arthropods
 - Herpetofauna
 - Mammals
- Sample so that data can be integrated



Conceptual Model of Terrestrial Riparian System

178 Bird Sites, 65 per year

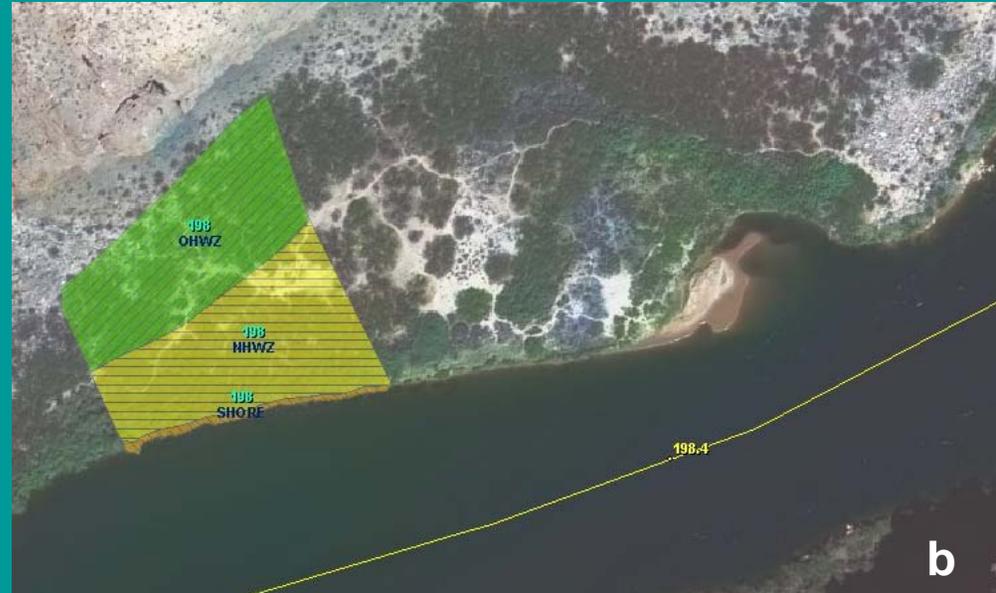
Integrated patches are a subset: 34 patches, 14 per year

Augmented Serially Alternating Panel Design

	Time Period (Years)						
Panel	2001	2002	2003	2004	2005	2006	2007
Repeat (37)	X	X	X	X	X	X	X
Rotate 1 (28)	X					X	
Rotate 2 (28)		X					X
Rotate 3 (28)			X				
Rotate 4 (28)				X			
Rotate 5 (28)					X		
Total	65	65	65	65	65	65	65

Rationale: Site Impacts , Breadth of Sample, Statistical Power

Avifauna patches vs. Integrated sampling patches



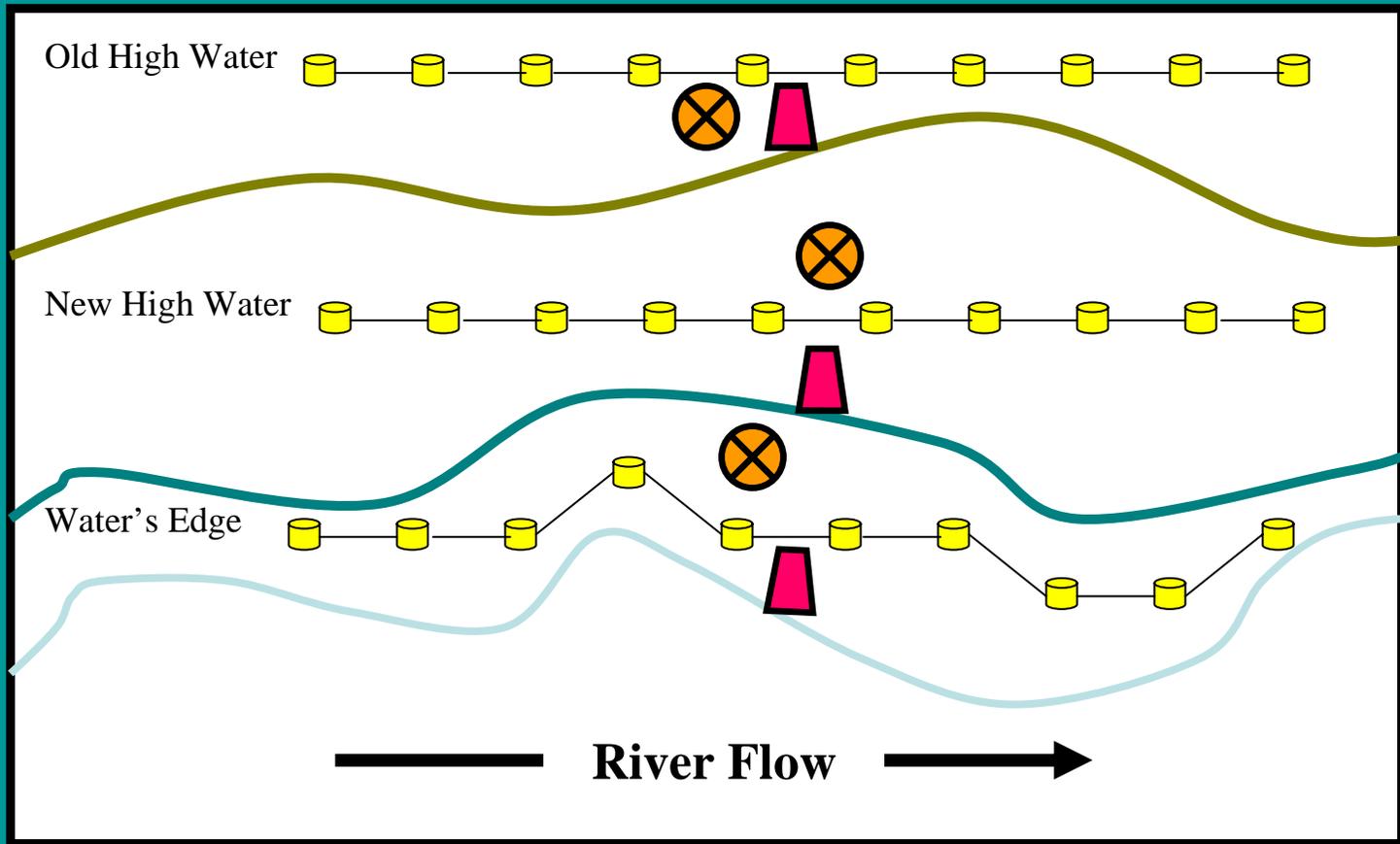
Hydrologic Zones

Shore: Top of flows + 1m

NHW: Shore to ~ 90 kcfs

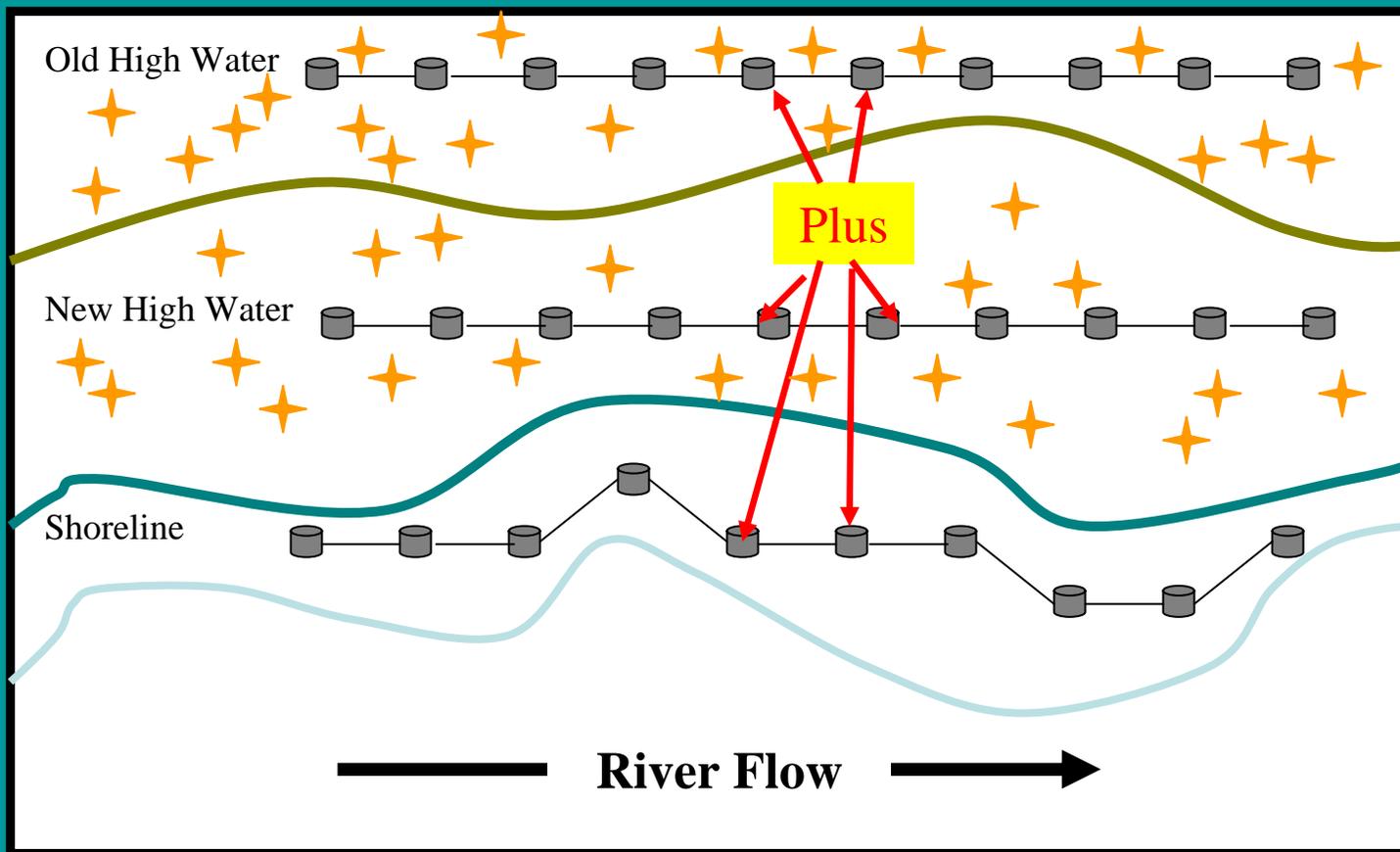
OHW ~90 kcfs - ~120 kcfs

Arthropod Sampling

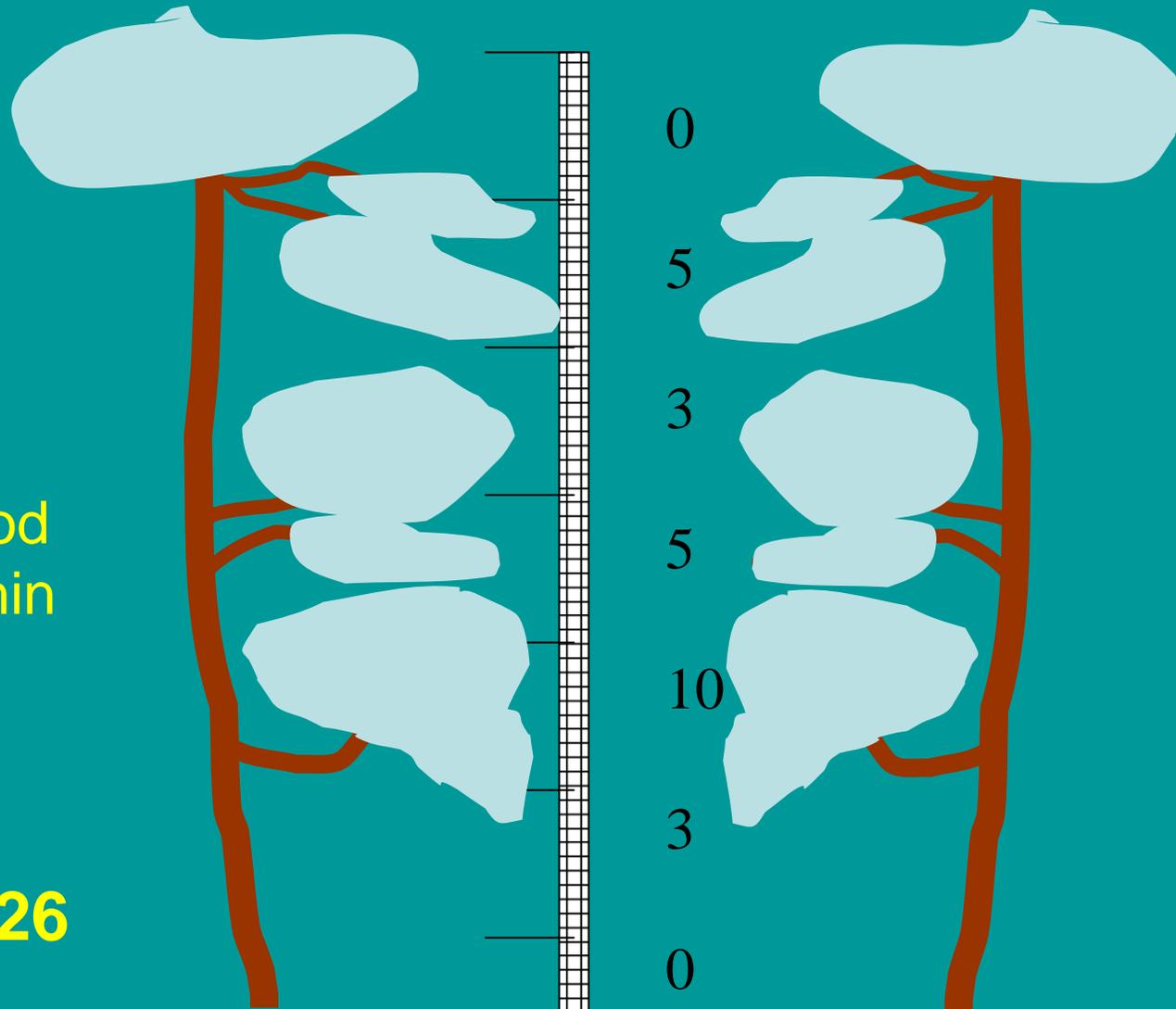


Plus sweeps by plant species and general collecting

Vegetation Structure and Composition Surveys



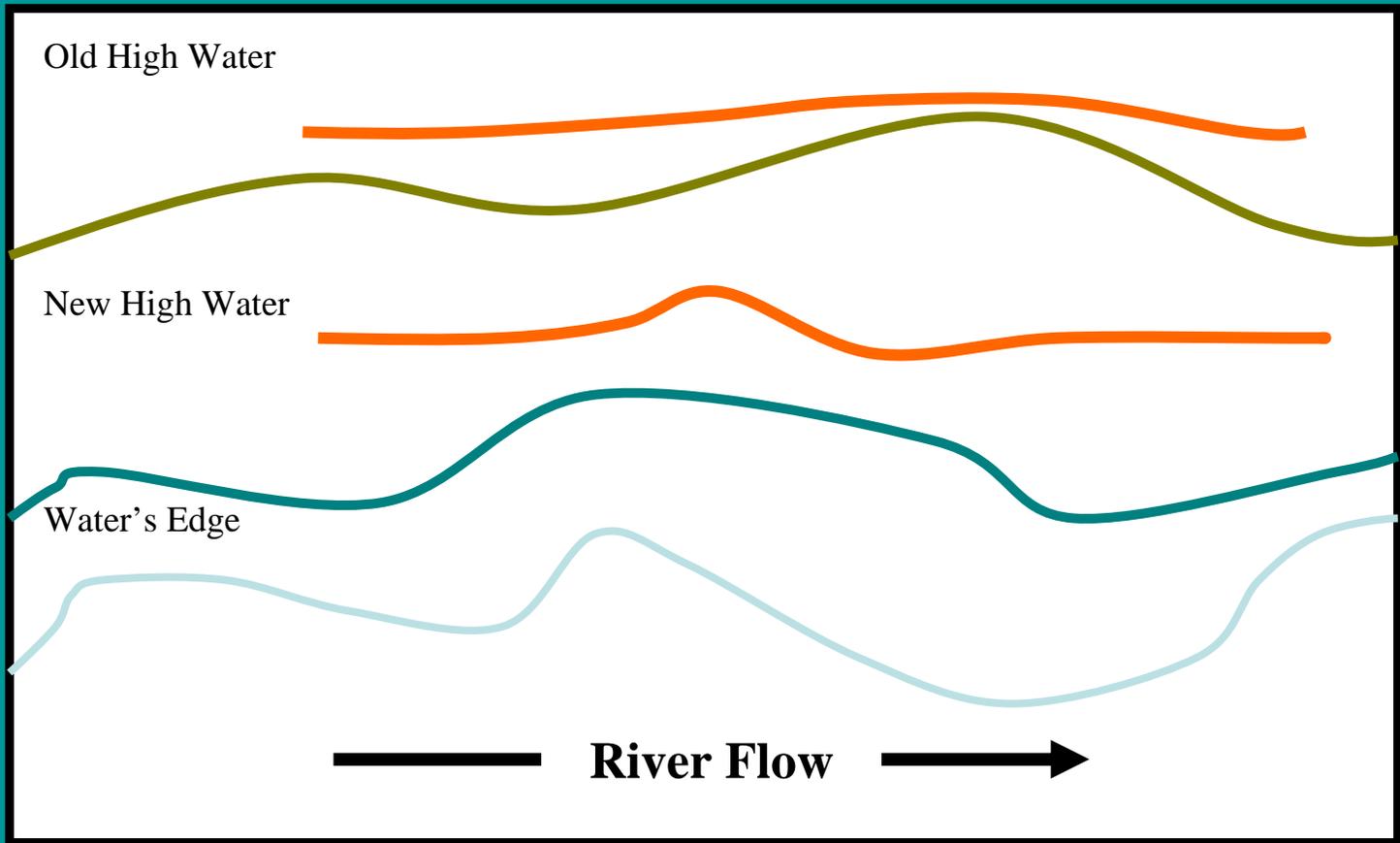
Total Vegetation Volume



The number of 10cm sections of a survey rod with live contacts within 10 cm.

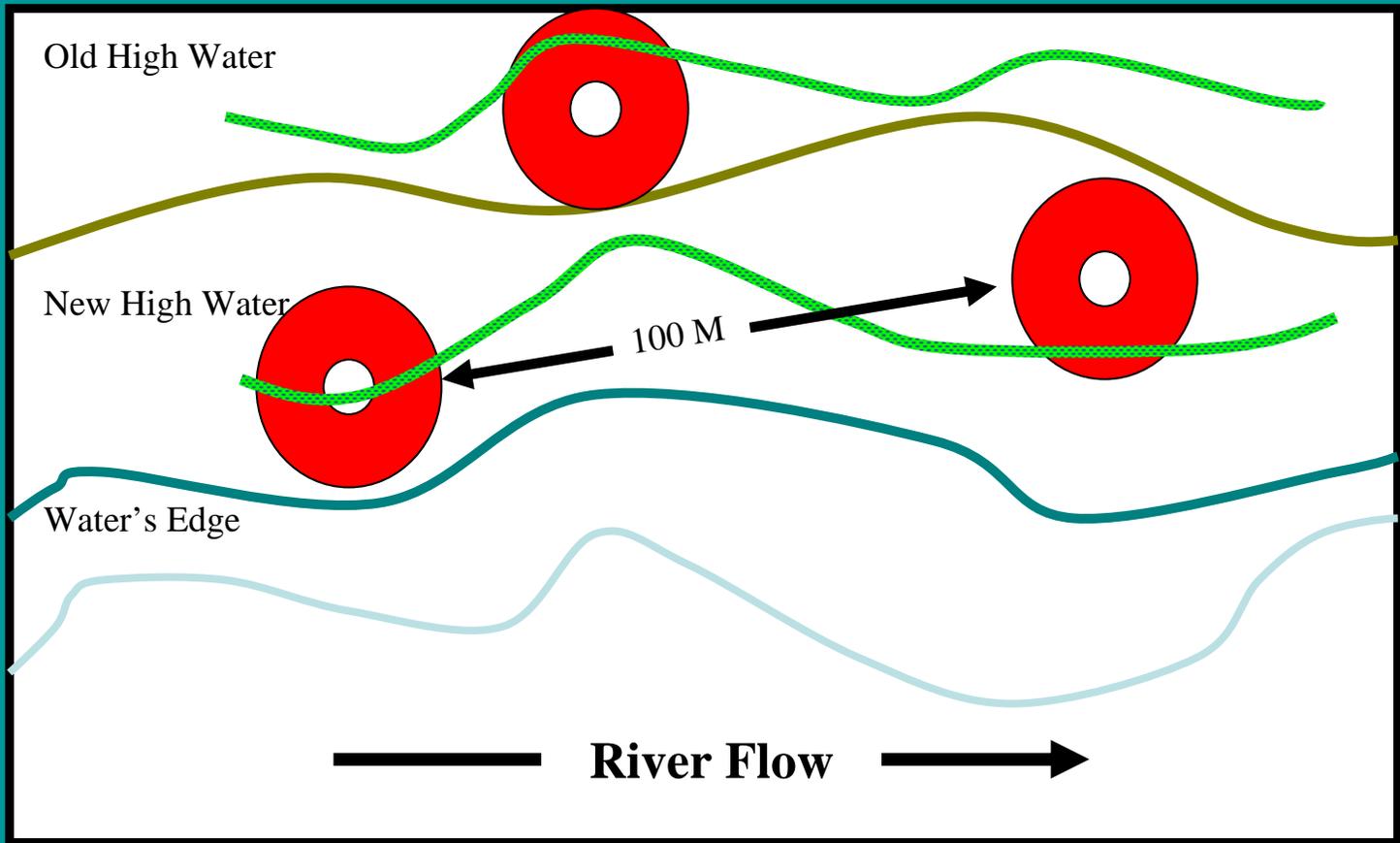
$$\text{TVV} = 26$$

Herpetofaunal Sampling

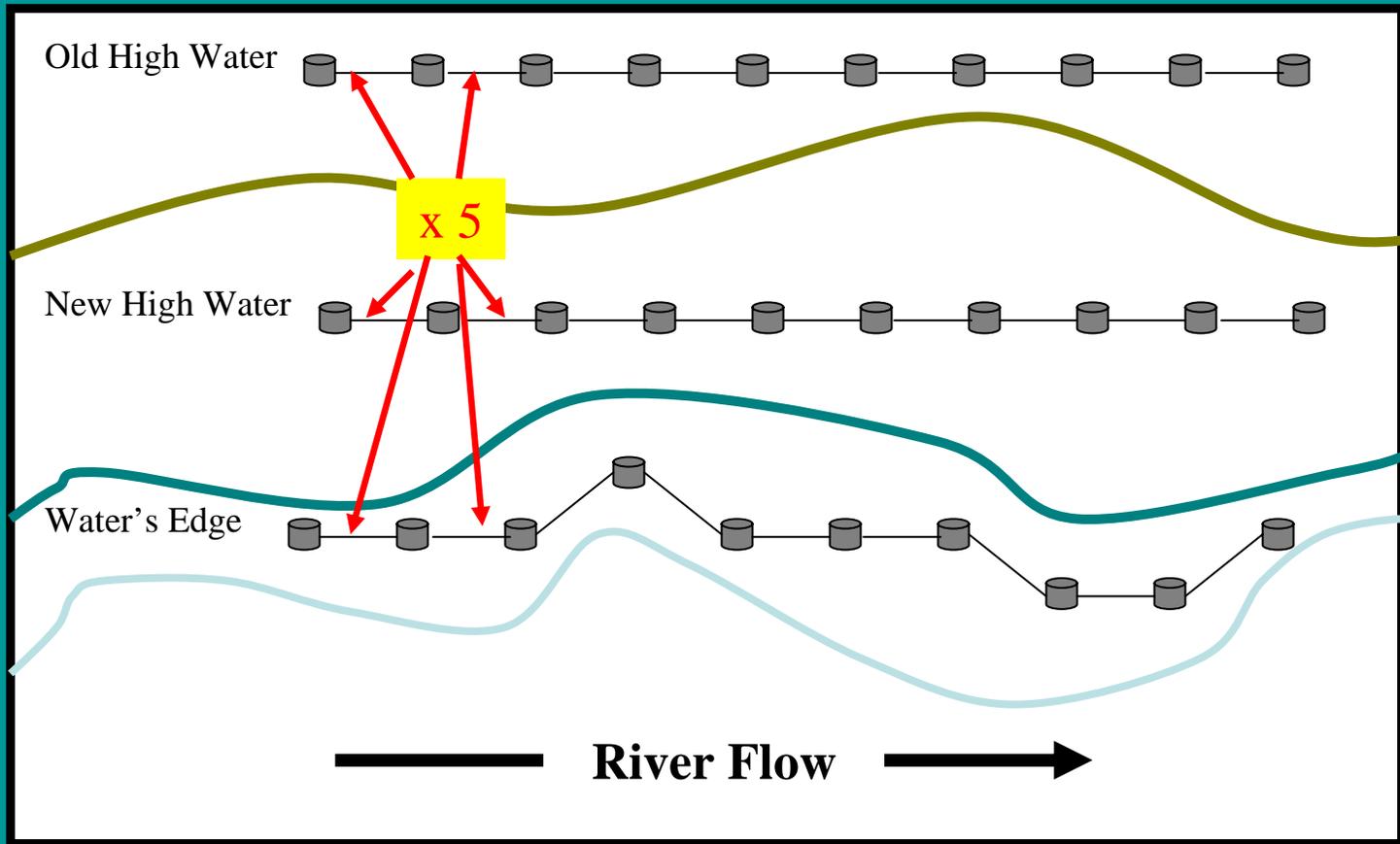


Plus general visual searching of entire site

Breeding Bird Surveys



Small Mammal Sampling

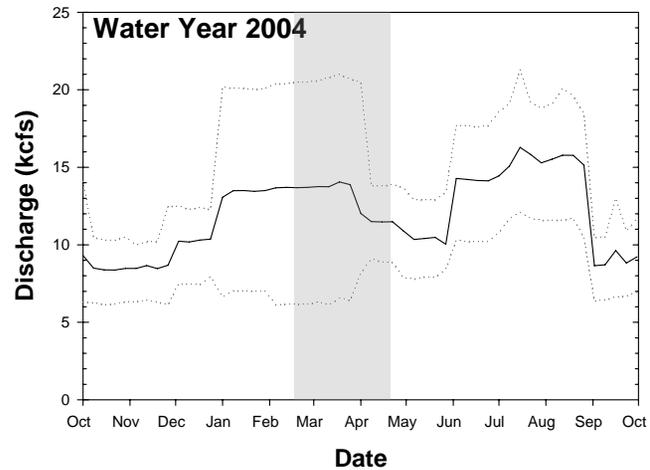
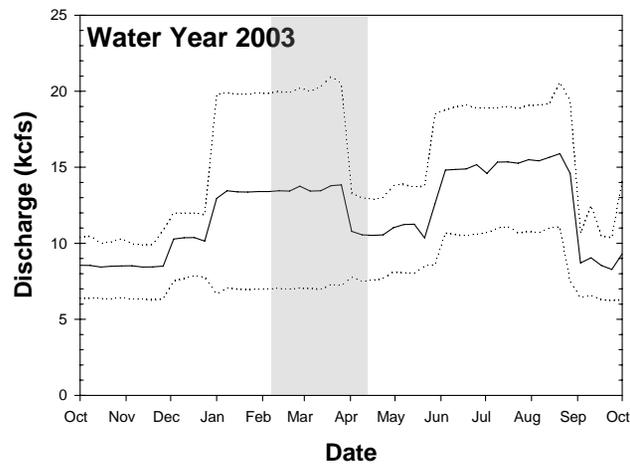
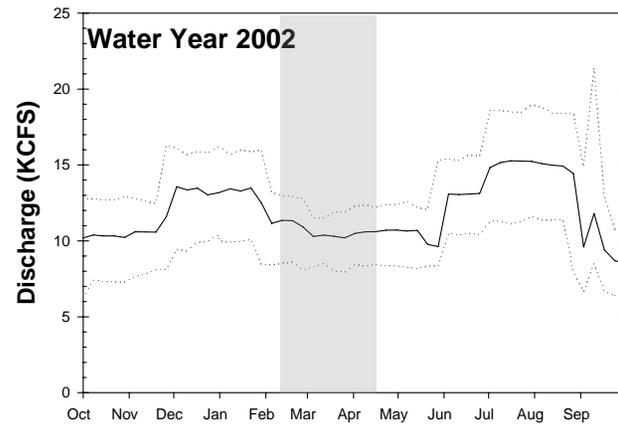
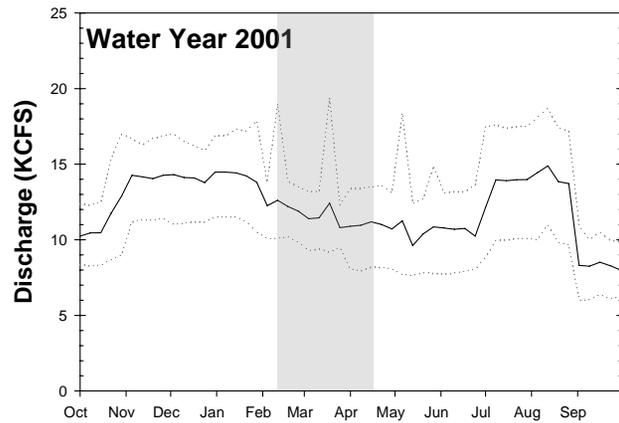


Plus presence and age of beaver, bighorn, coyote, ringtail, mountain lion, fox, etc.

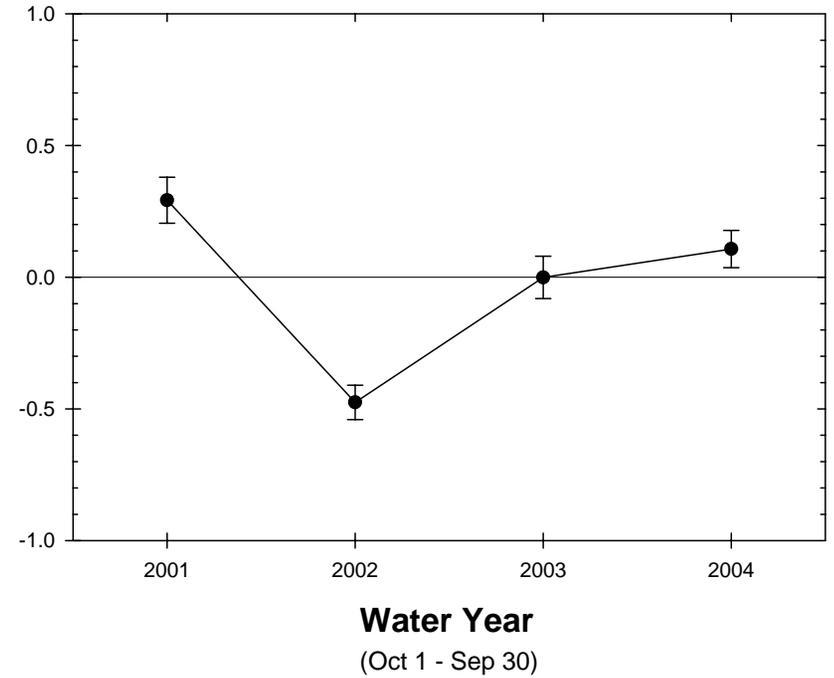
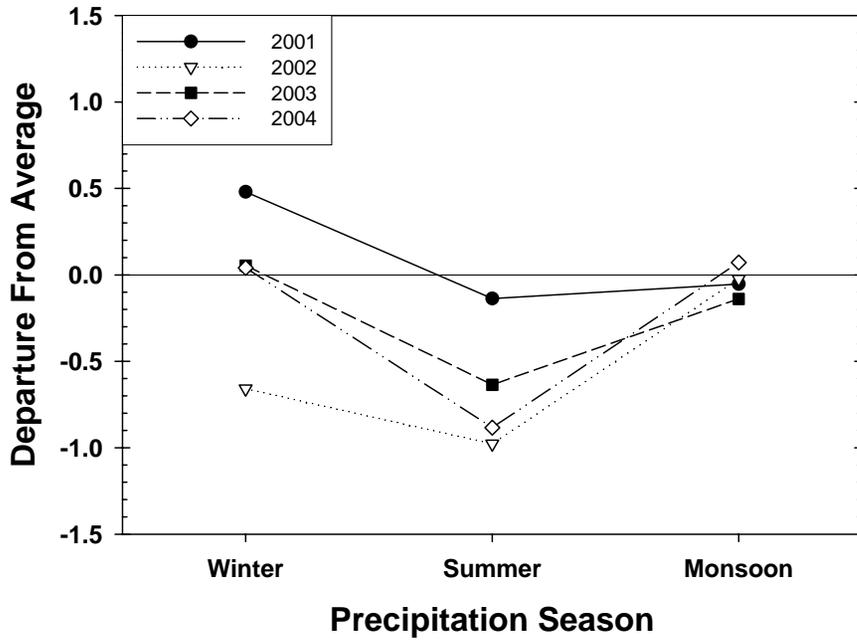
Factors Affecting Vegetation

- **Zone** (Shoreline, New High Water, Old High Water)
- **Canyon Width** (Wide / Narrow)
- **Site** (Includes soil, slope, aspect, rim height, etc.)
- **Year**
 - **Hydrograph** (Max, min, mean)
 - **Precipitation** (Relative to long term averages)
- **Investigator Impacts**

Hydrographs 2001 - 2004

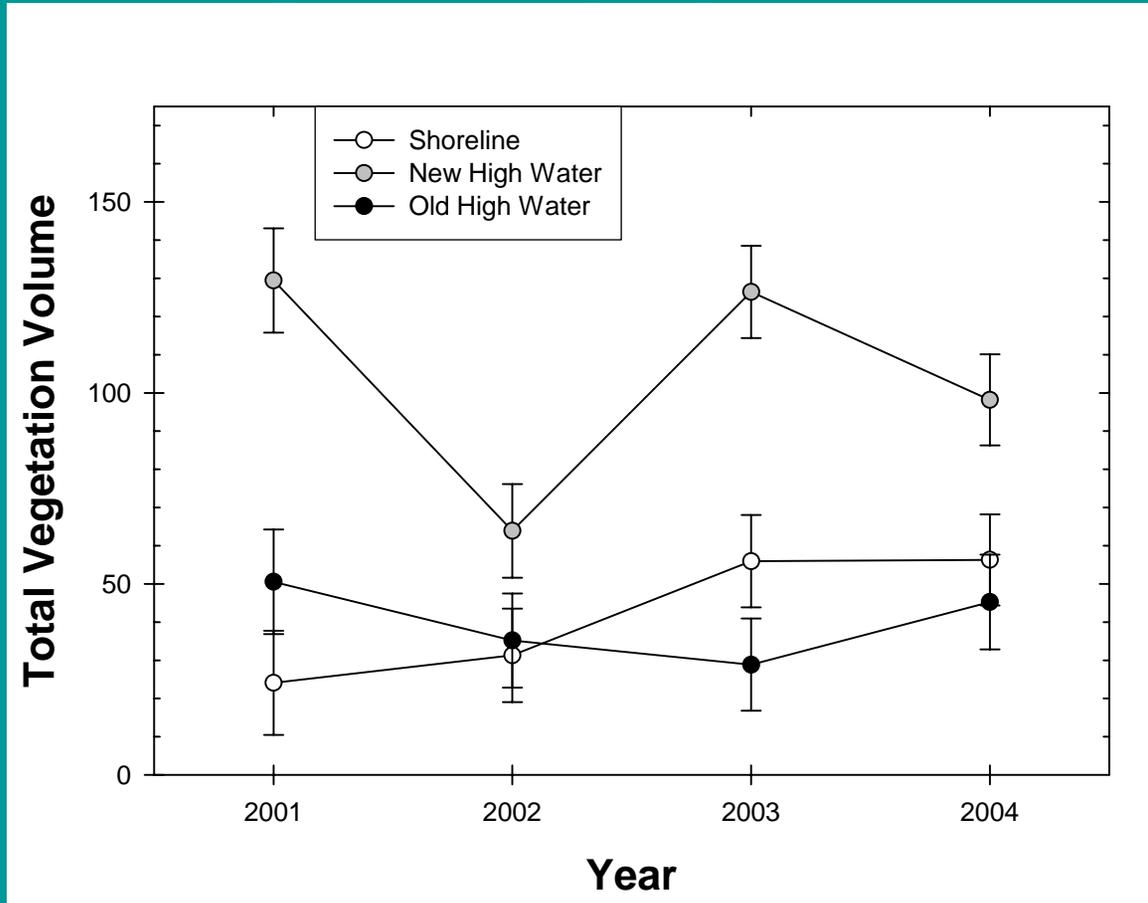


Precipitation Patterns



Total Vegetation Volume

Integrated Sampling Transects



Year Effect:

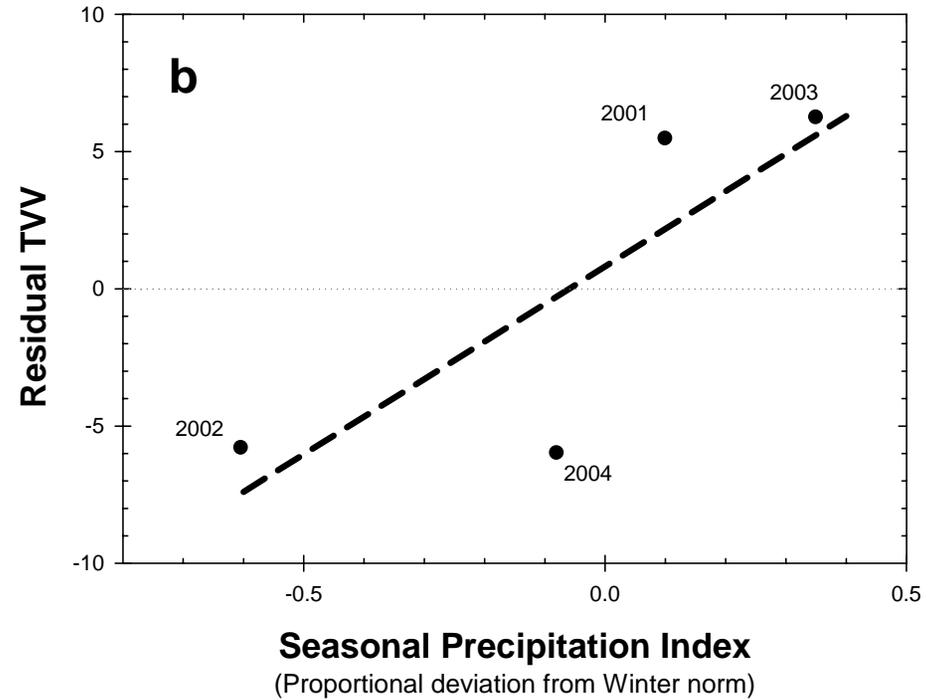
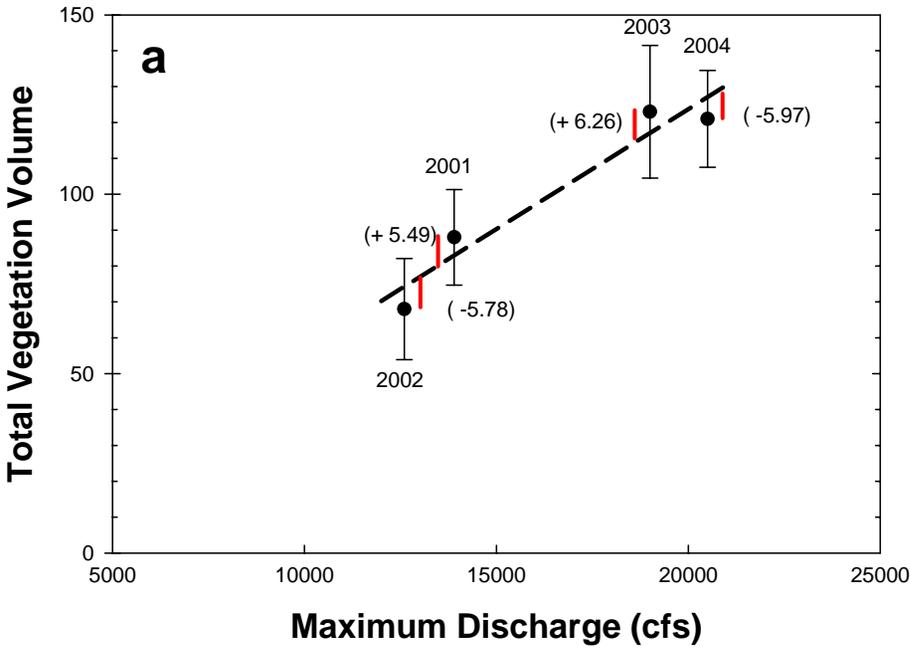
Shoreline $F_{(3,11)} = 0.16$, n.s.

New High Water $F_{(3,11)} = 5.90$, $p < 0.05$

Old High Water $F_{(3,11)} = 1.67$, $p \sim 0.10$

Total Vegetation Volume

Integrated Sampling Transects Effects of Flow and Precipitation

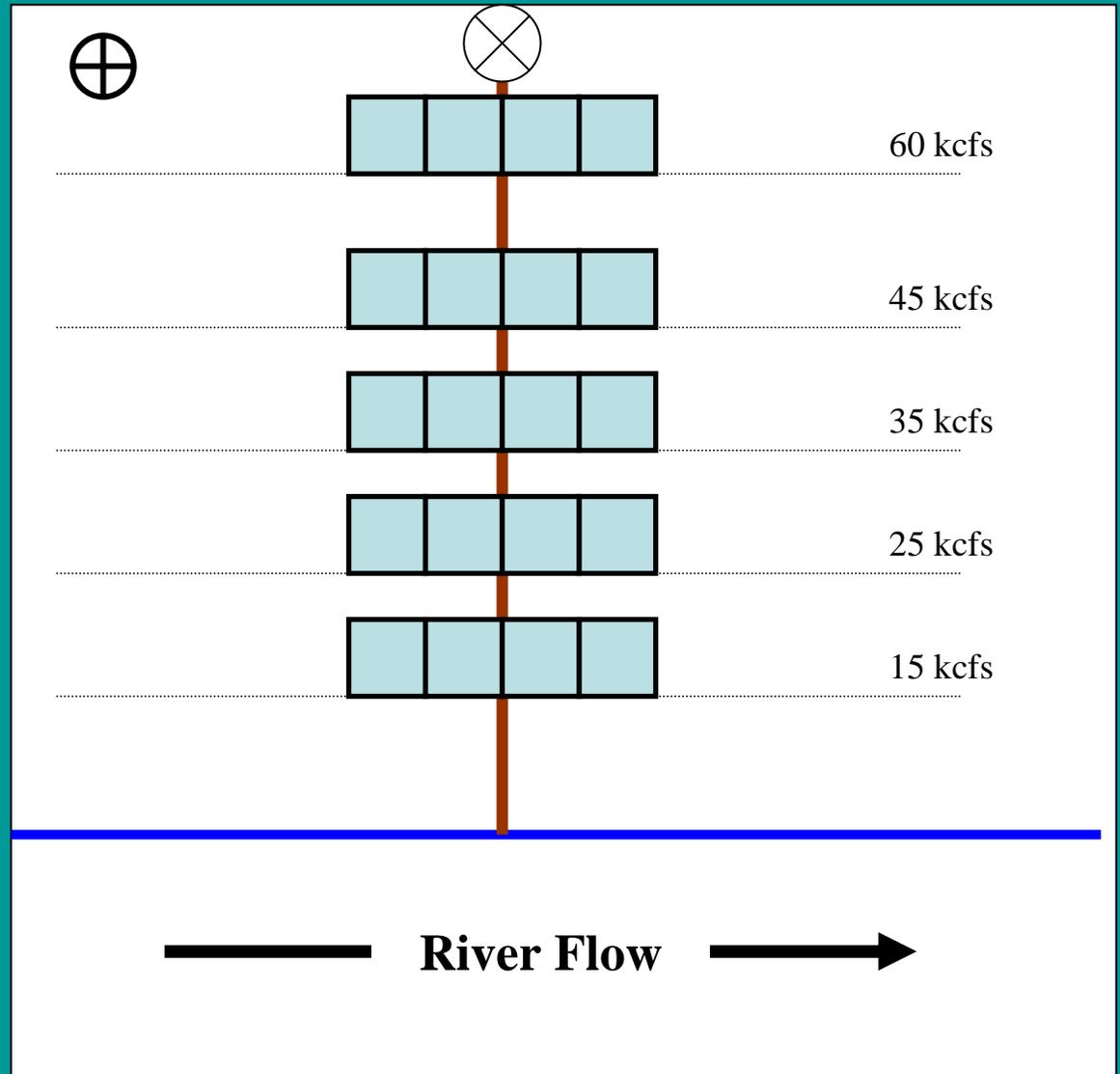


Vegetation Cover

Fall Surveys

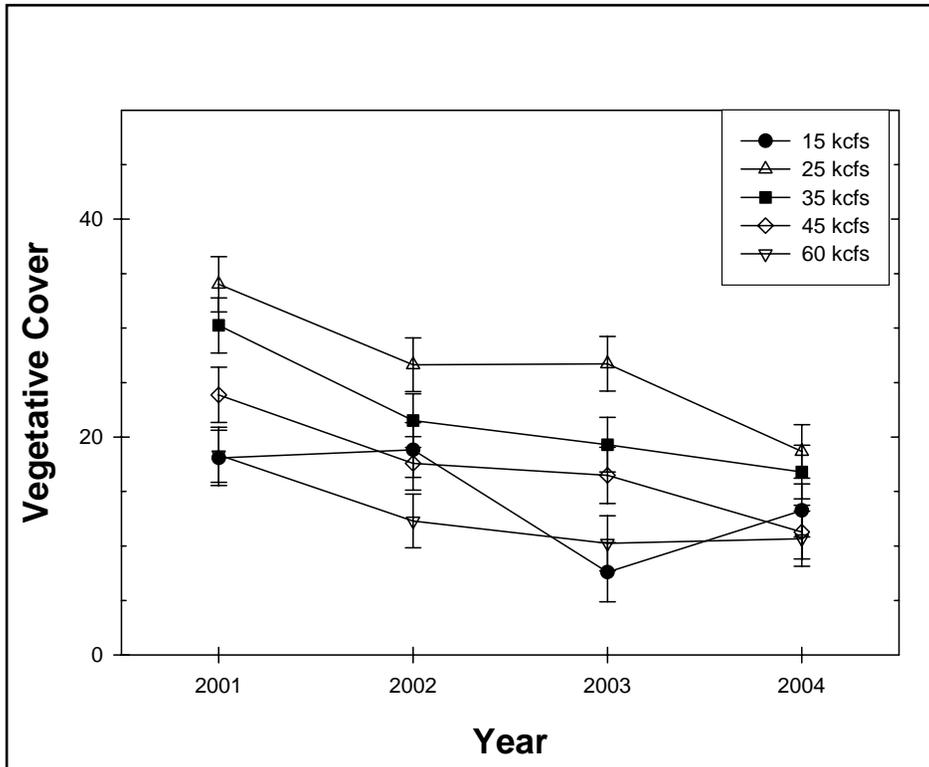
4 plots per stage

1m sighting frame



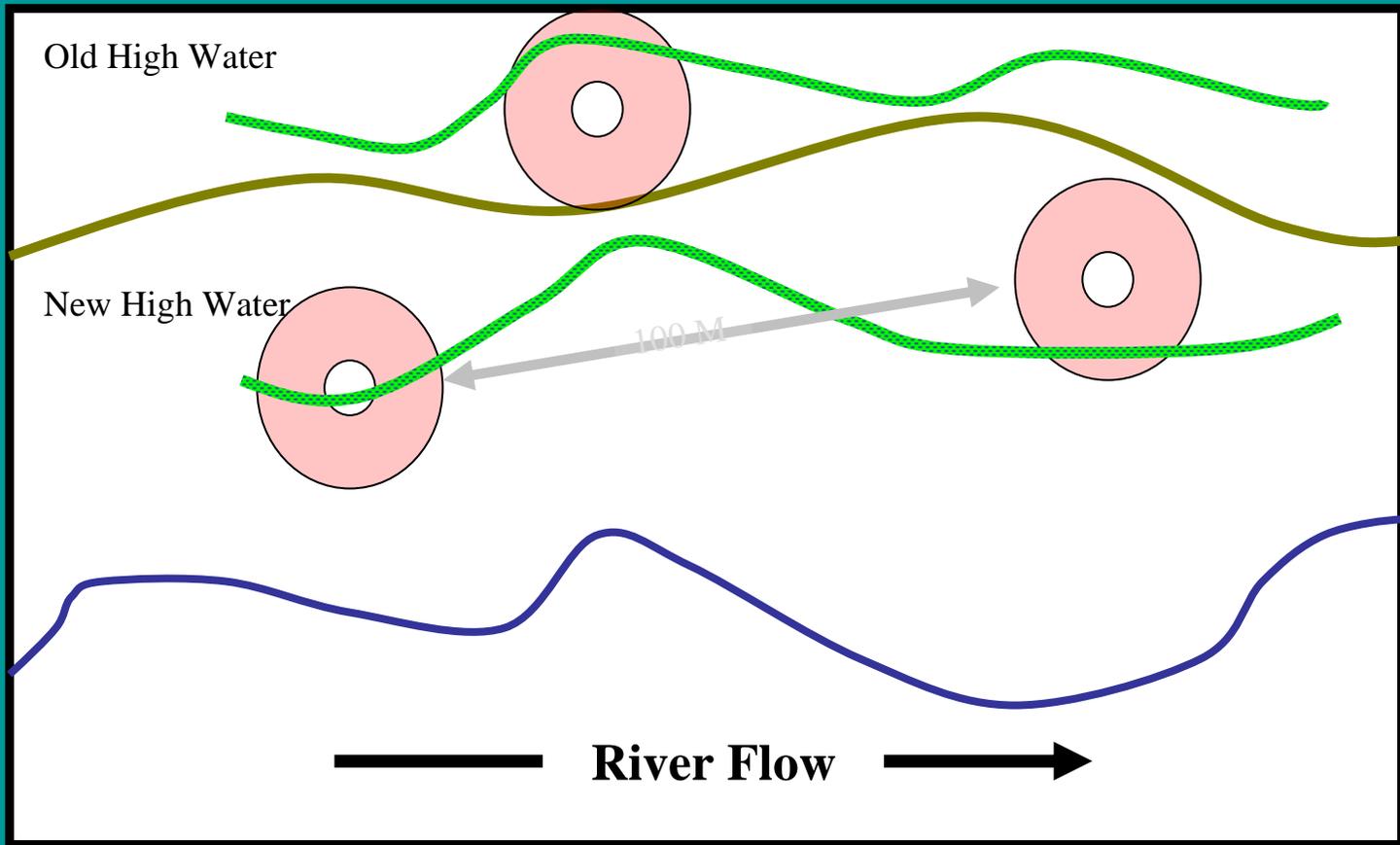
Vegetation Cover

Fall Surveys

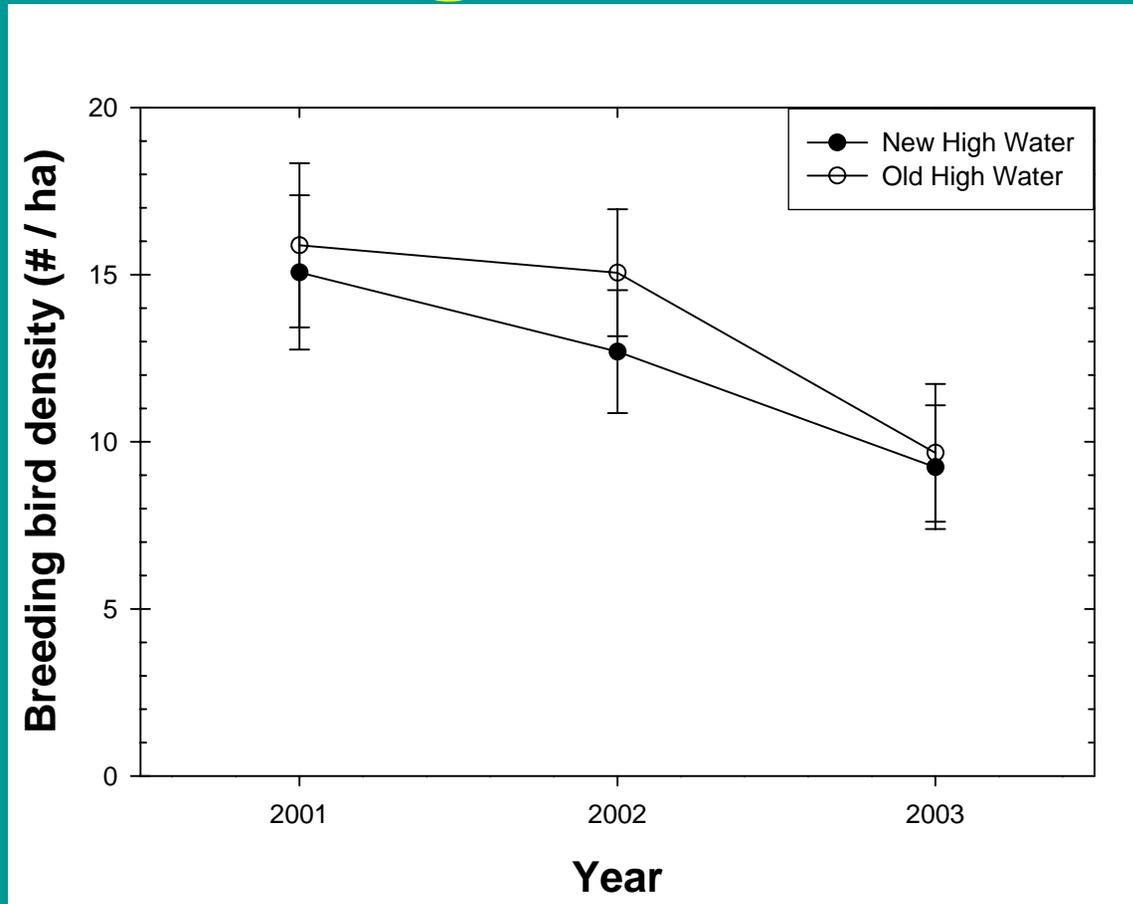


Zone	Year	Flow	Precip
15	n.s.	n.s.	n.s.
25	***	(+) ***	(-) **
35	***	(+) ***	(-) **
45	***		(+) ***
60	***		(+) ***

Breeding Bird Surveys



Breeding Bird Density

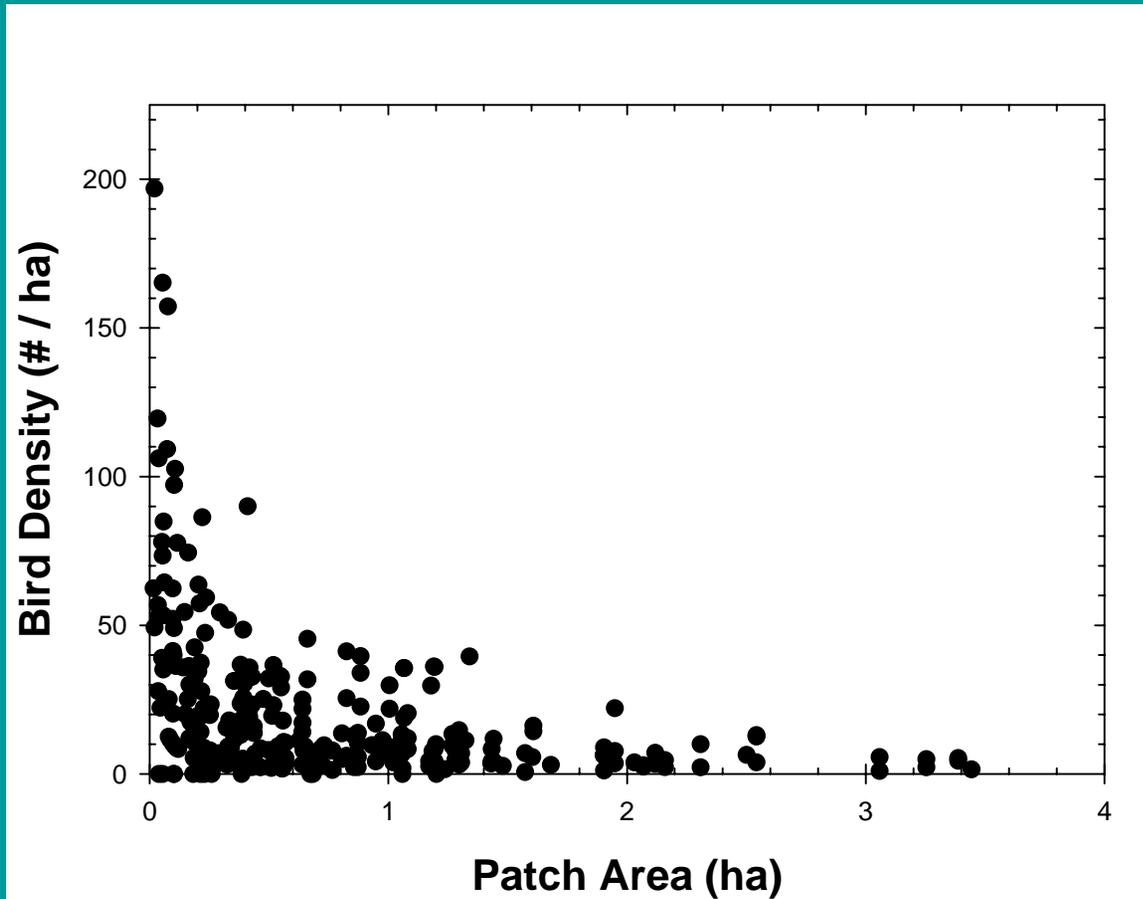


Year Effect:

New High Water $F_{(2,96)} = 2.09, p = 0.13$
Old High Water $F_{(2,81)} = 2.50, p = 0.08$

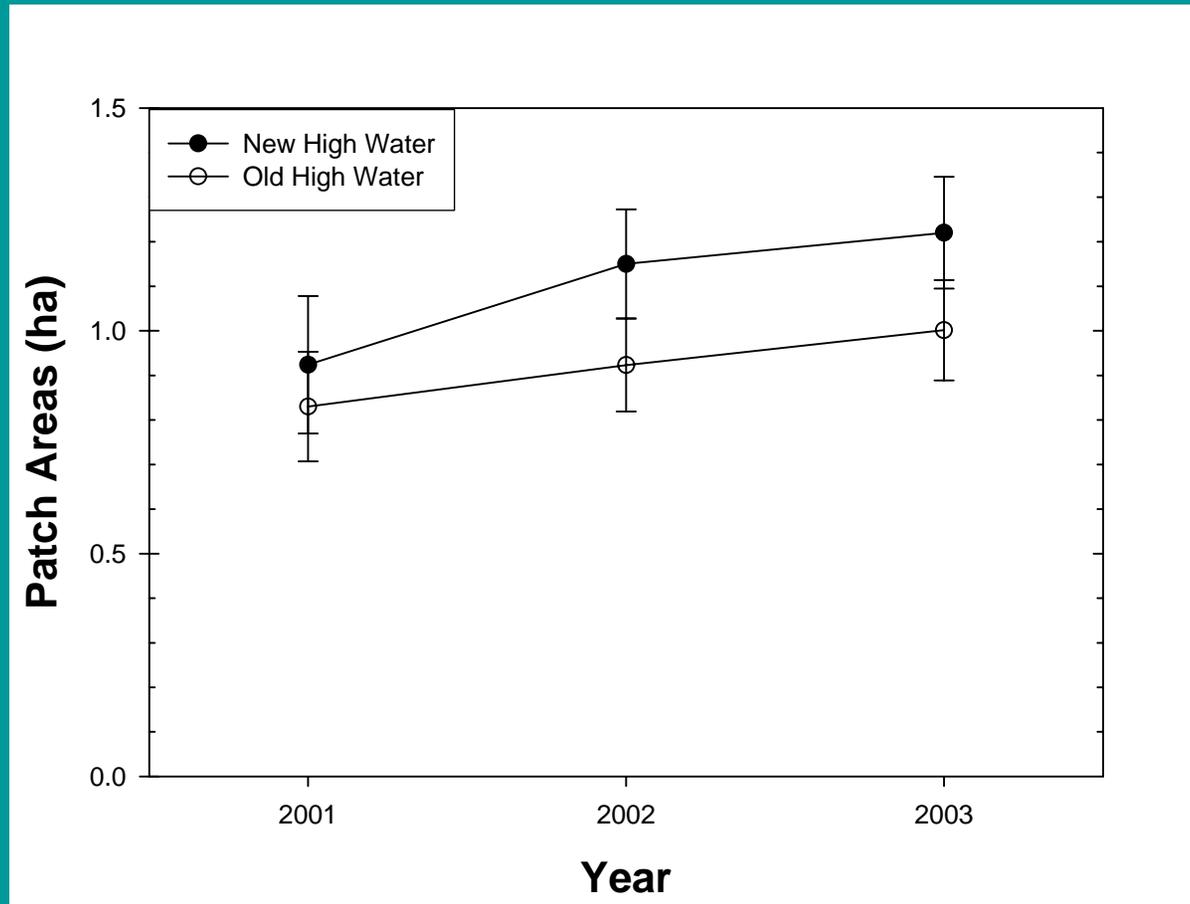
Breeding Bird Surveys

Effects of Patch Area on Density Estimates



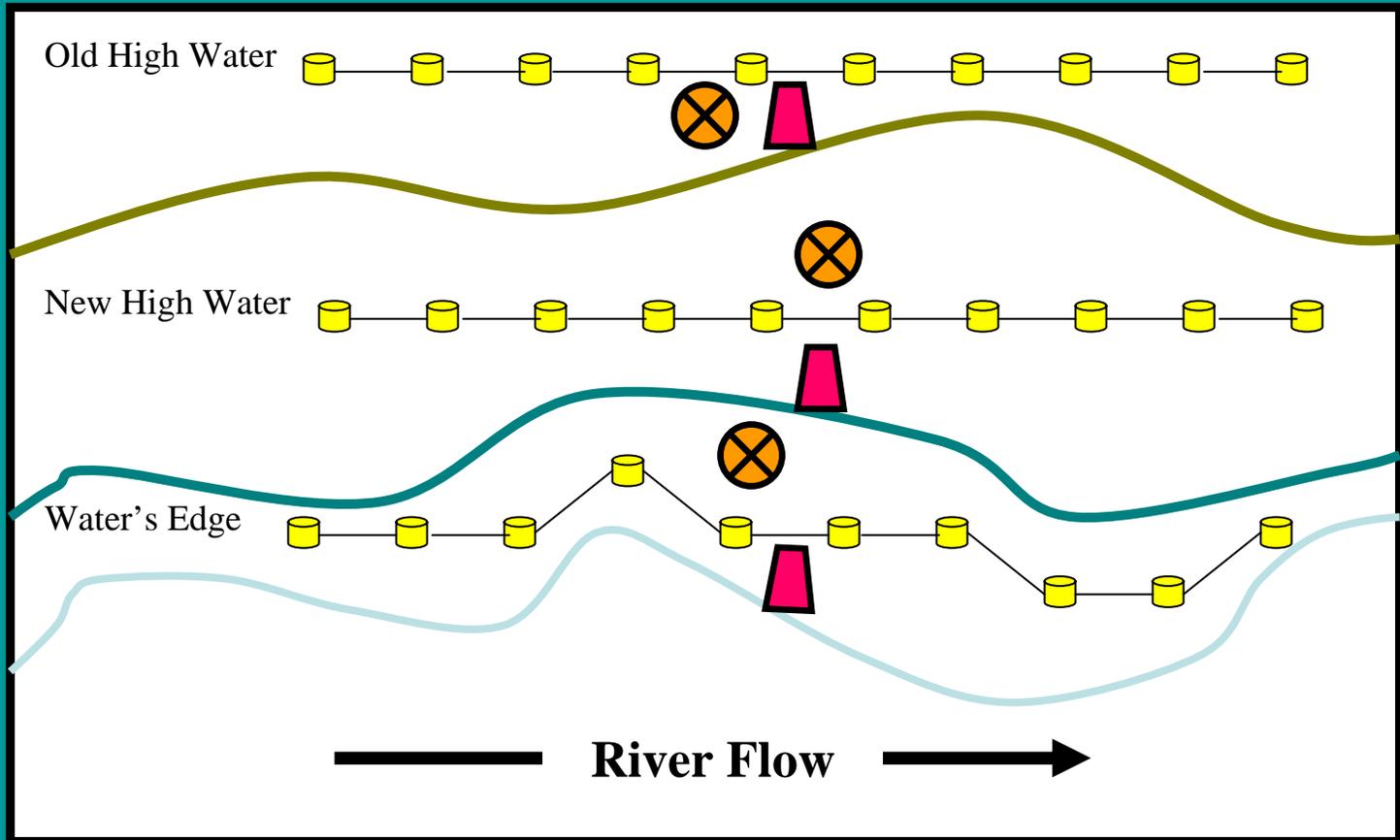
Breeding Bird Surveys

Effects of Patch Area on Density Estimates



But: Increases in areas of patches sampled accounts for only one-third of observed change in bird densities (NHW: 1.8 birds/ha; OHW: 1.0 birds / ha)

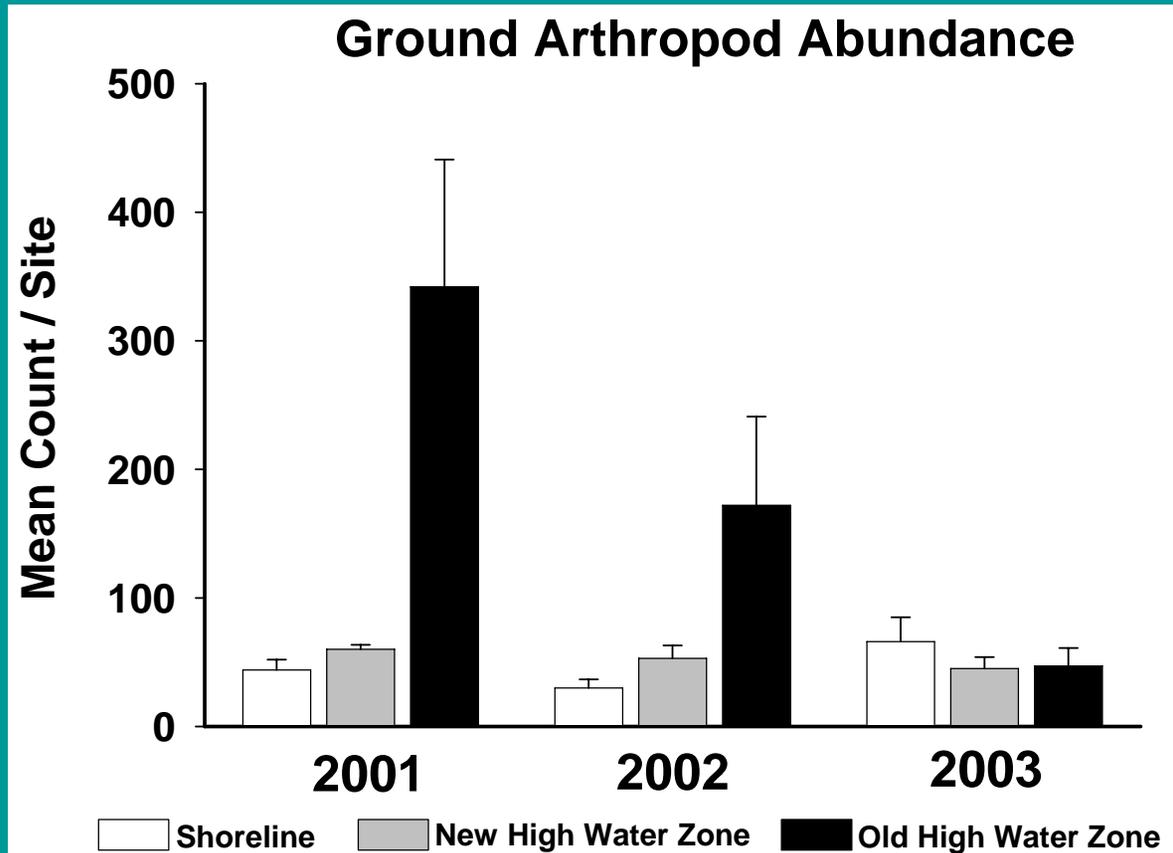
Arthropod Sampling



Three standard, quantitative sampling methods

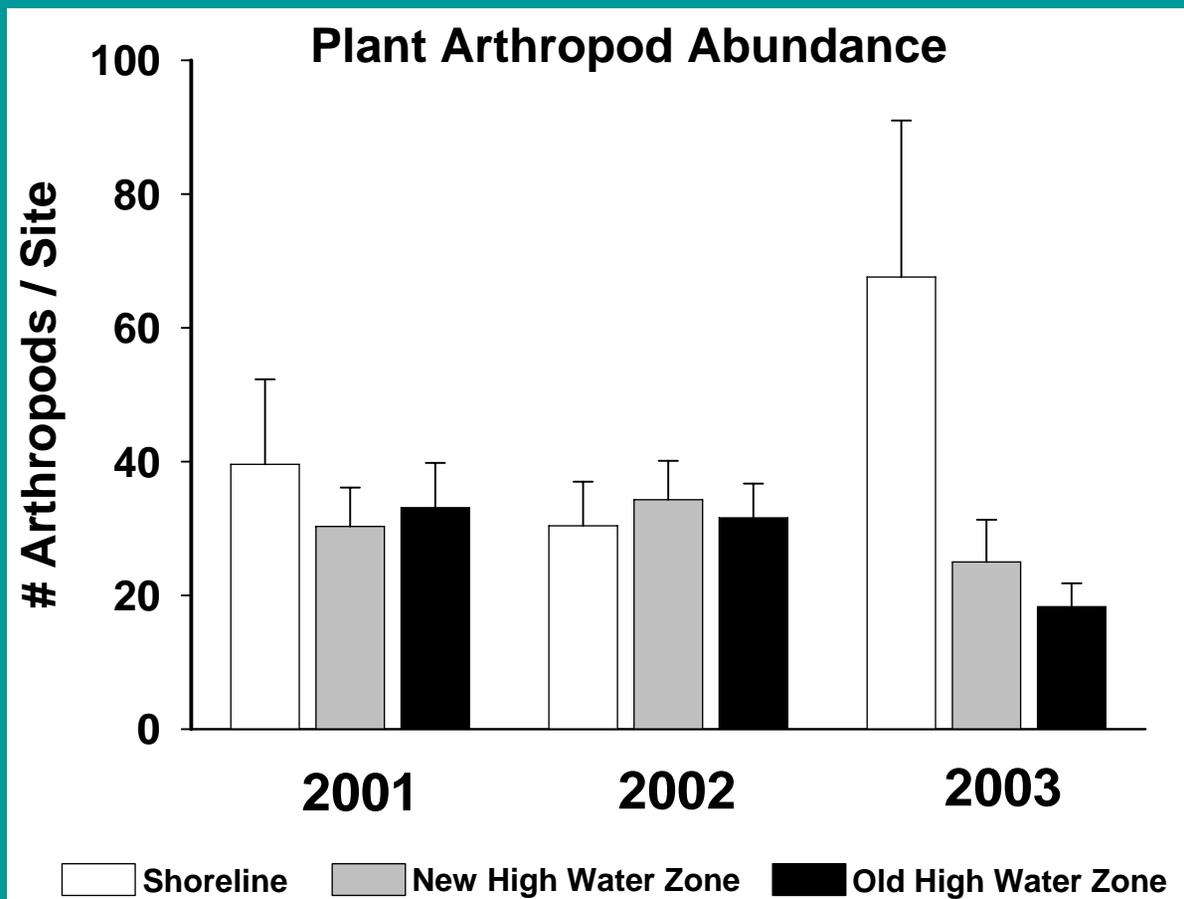
Arthropod Sampling

Pitfall Traps



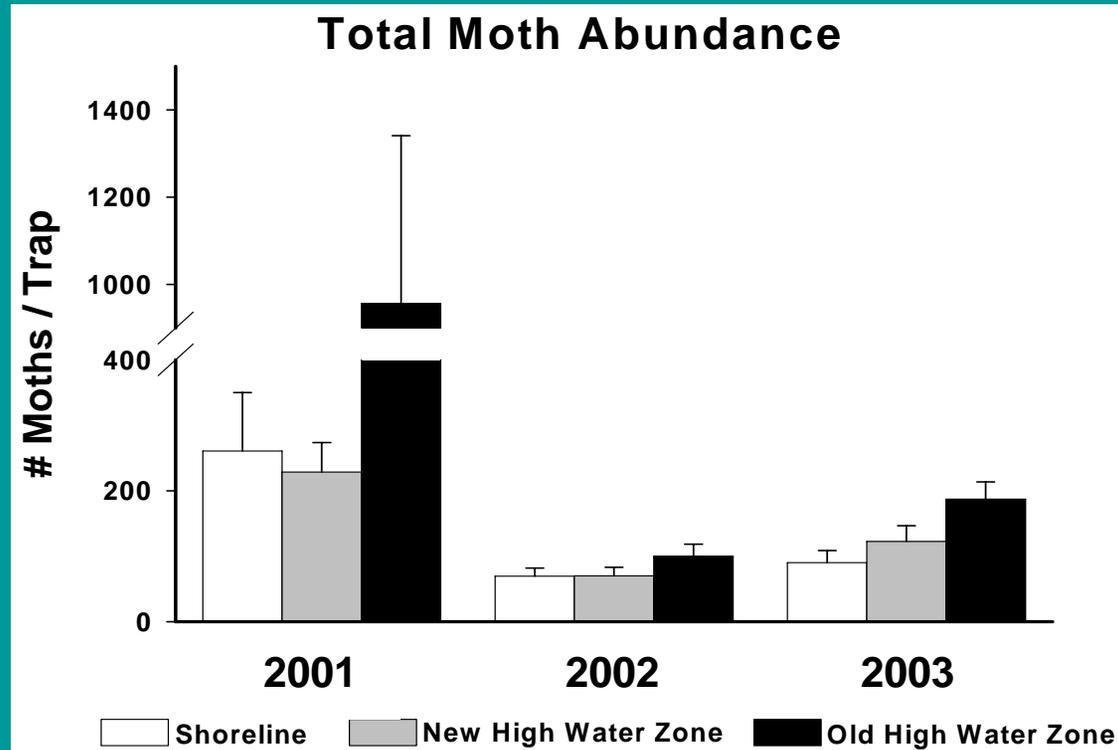
Arthropod Sampling

Plant Sweeps



Arthropod Sampling

Blacklight Traps



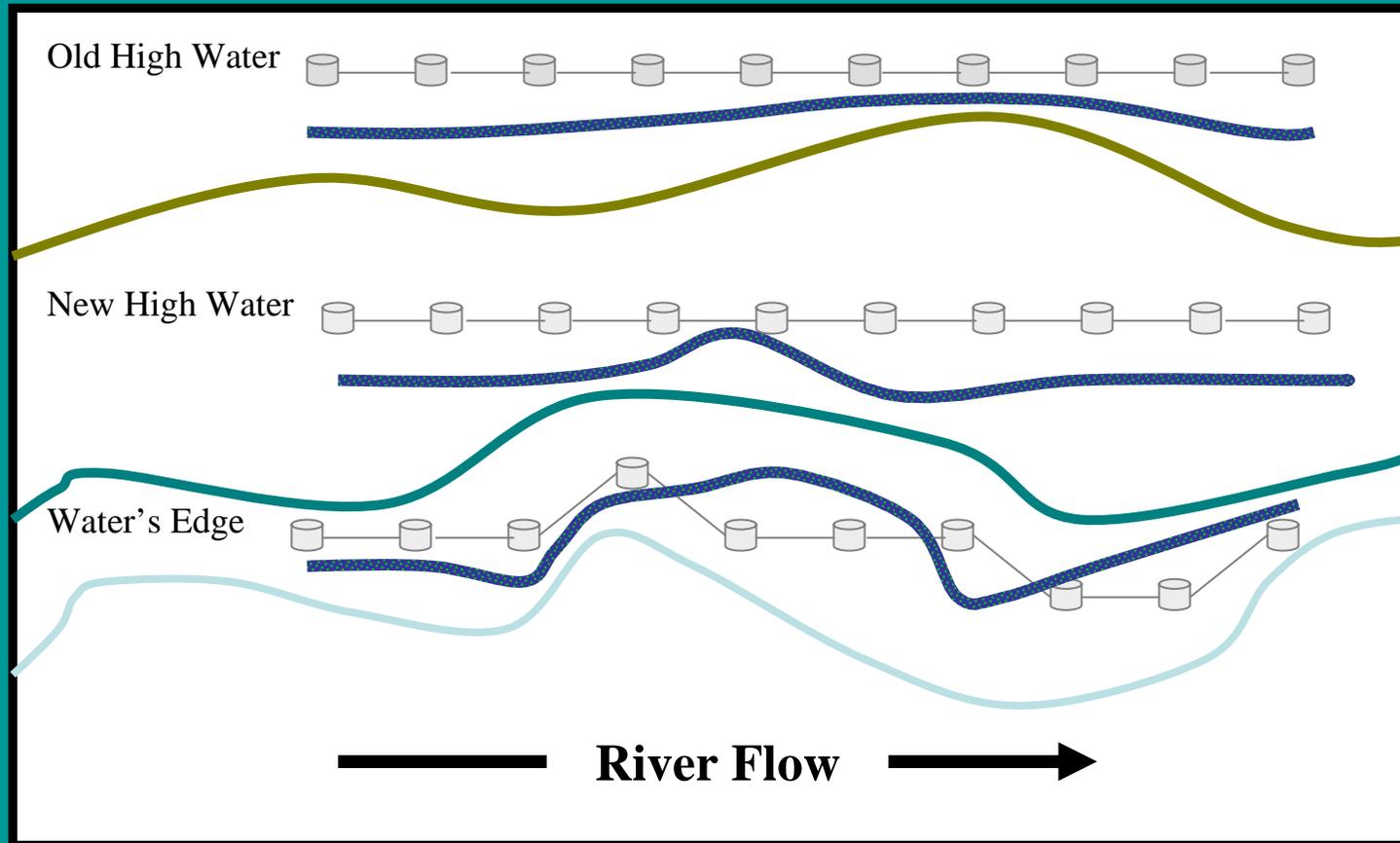
Ground-Dwelling Arthropods

Hydrologic zone indicators

Group	Shoreline	NHW	OHW
Spiders	<i>Arctosa littoralis</i>	<i>Schizocosa celerior</i>	<i>Psilochorus sp. 1</i>
Crickets	<i>Eunemobius carolinensis</i>	<i>Gryllus alogus</i>	<i>Gryllus sp. nov.</i>
Ants	--	<i>Leptothorax muscorum</i>	<i>Crematogaster depilis</i>

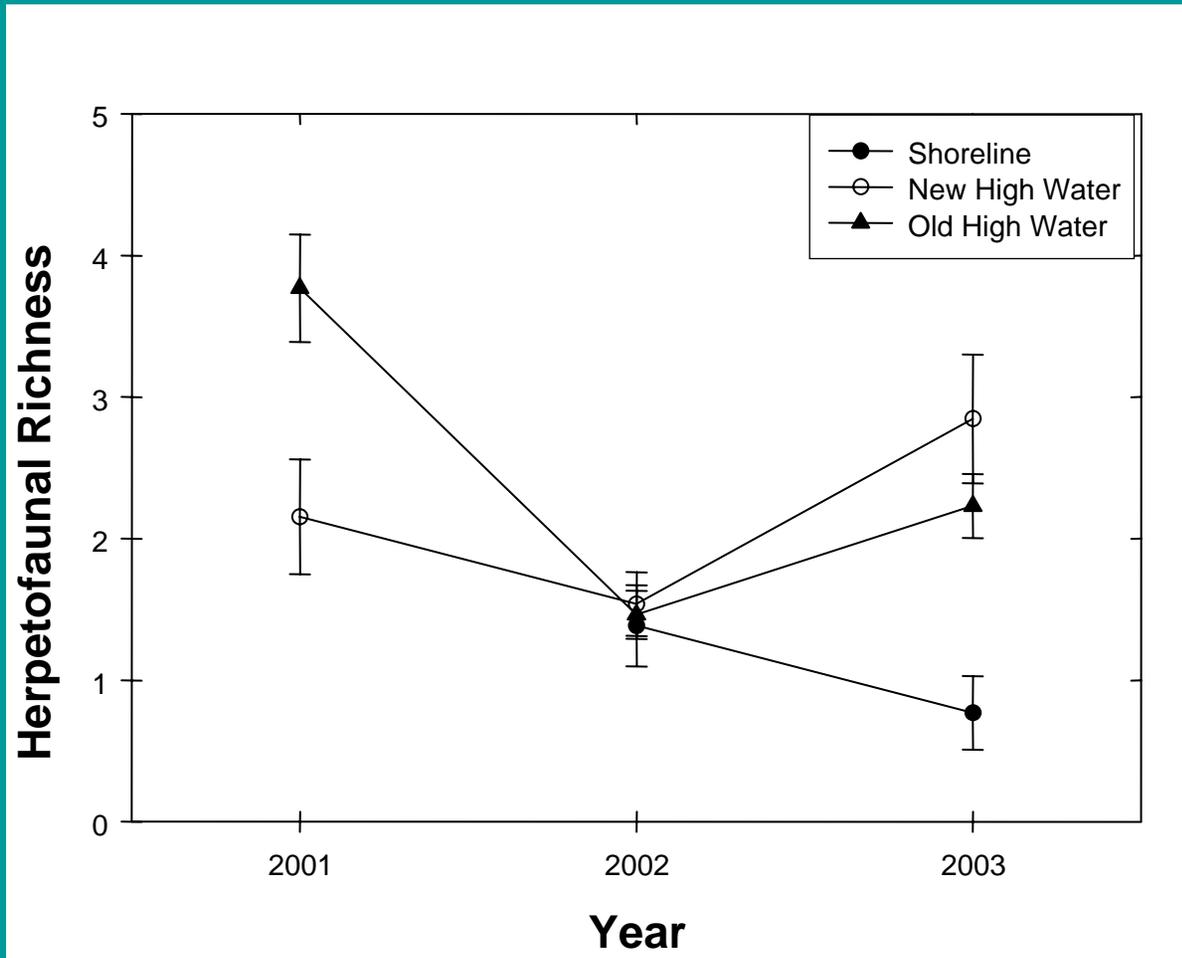
Herpetofaunal Sampling

Visual Surveys



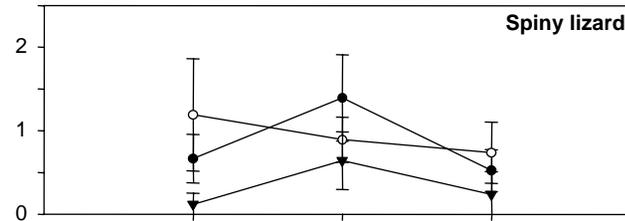
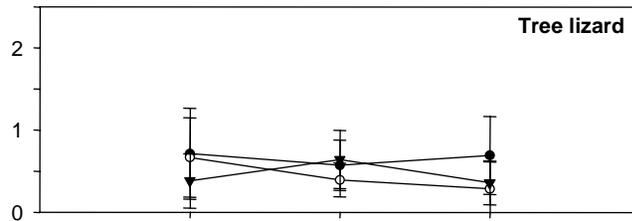
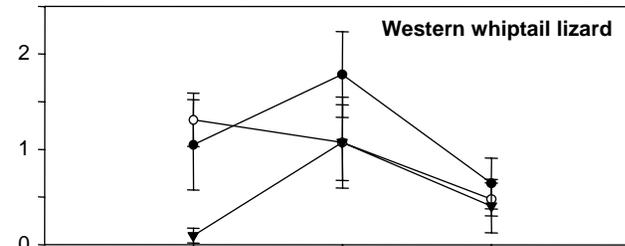
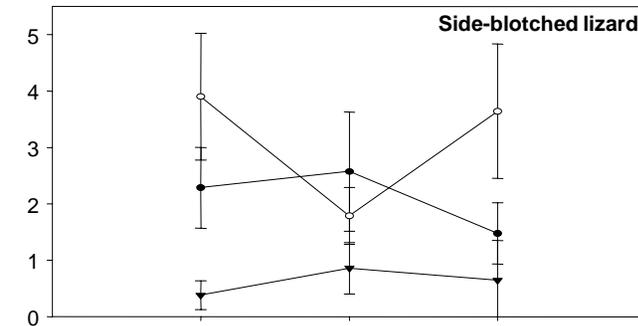
Herpetofaunal Sampling

Visual Surveys



Herpetofaunal Sampling

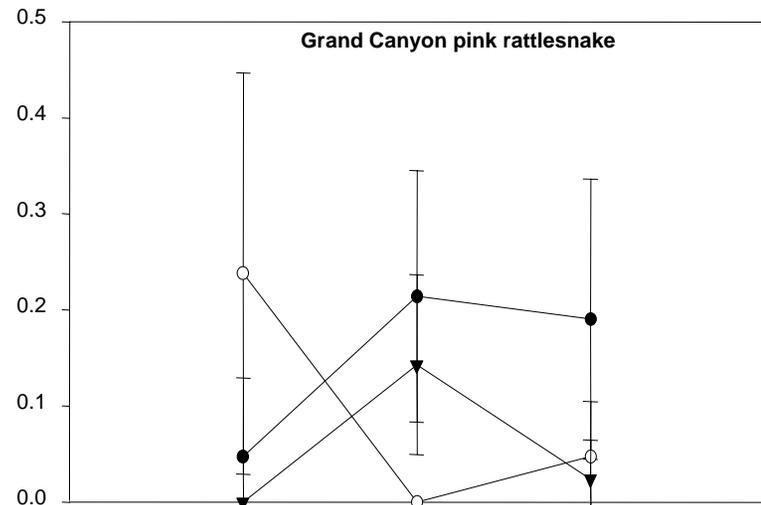
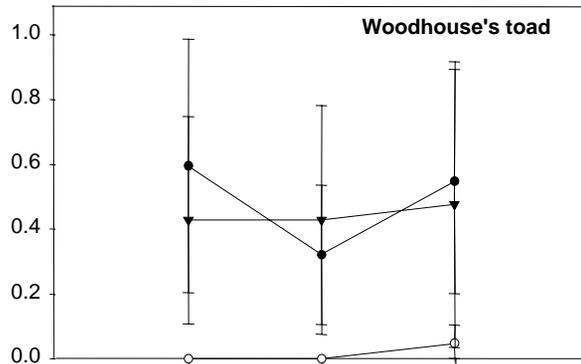
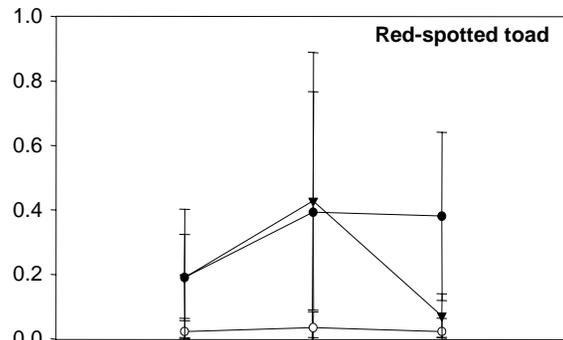
Lizard Abundances



Shore = triangles, NHW = closed circles, OHW = open circles

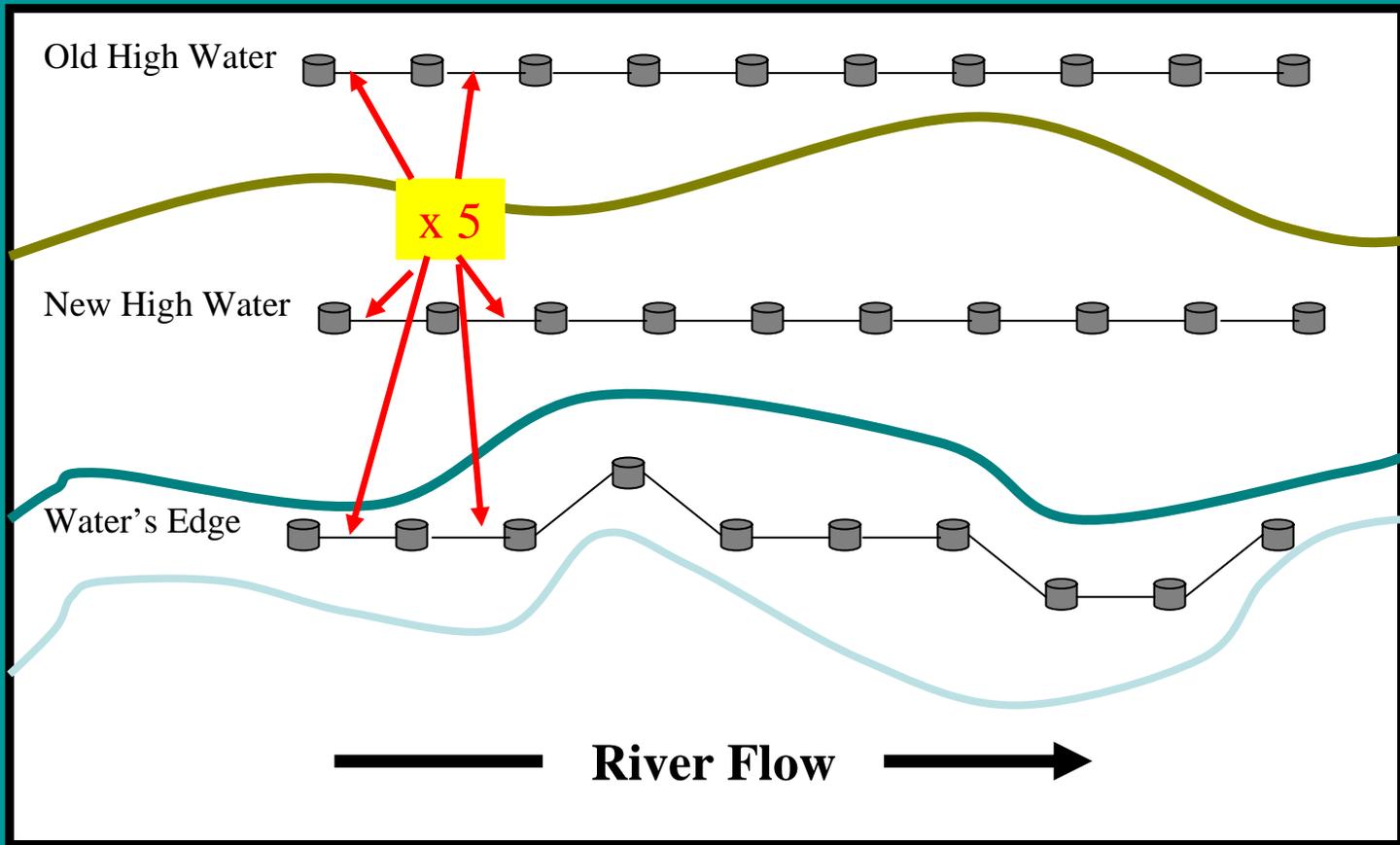
Herpetofaunal Sampling

Other species



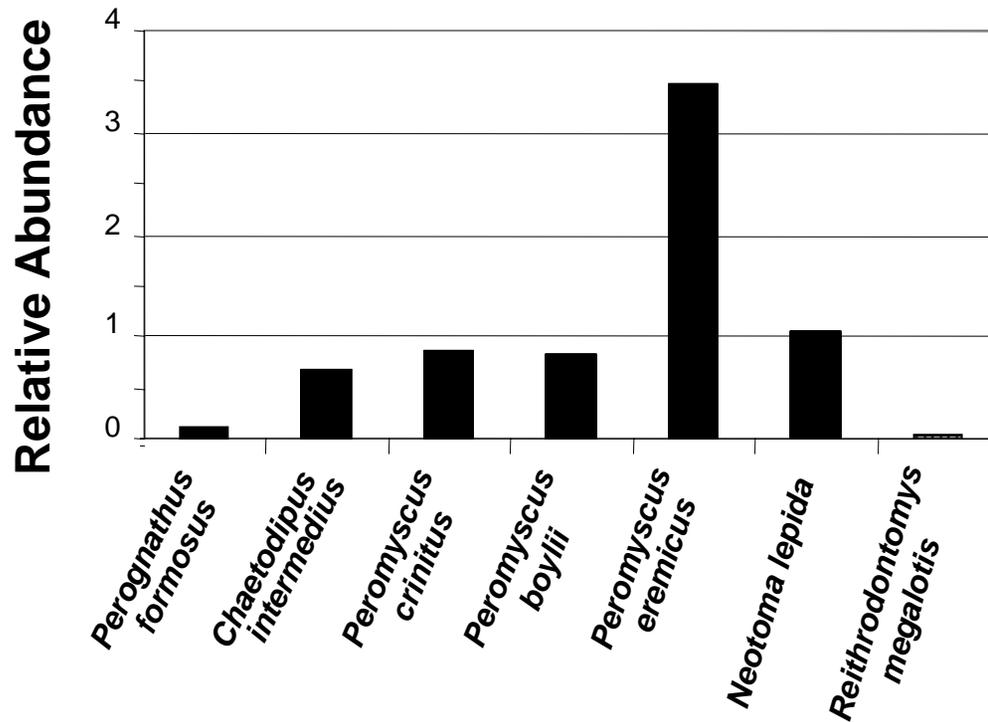
Shore = triangles, NHW = closed circles, OHW = open circles

Small Mammal Sampling



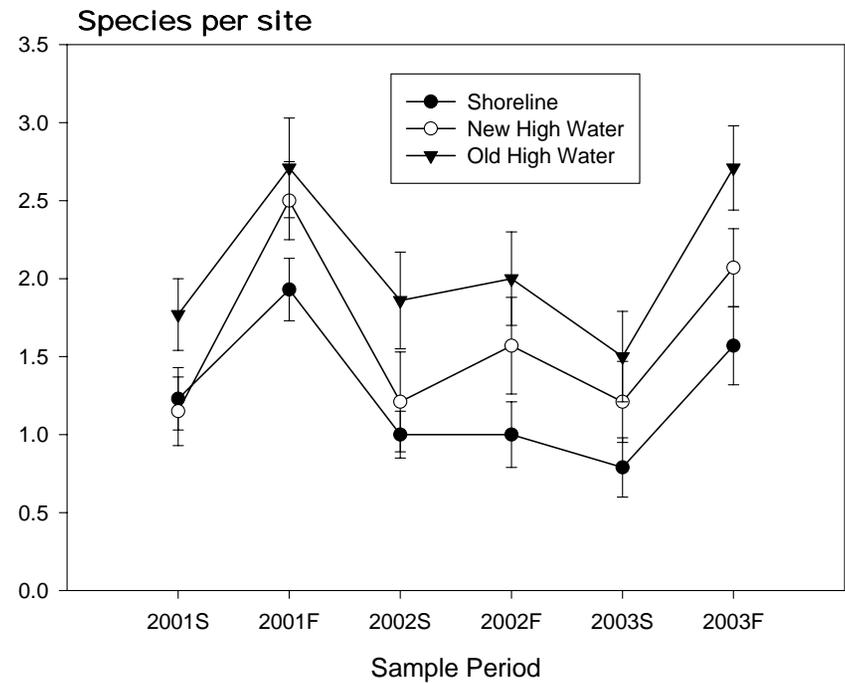
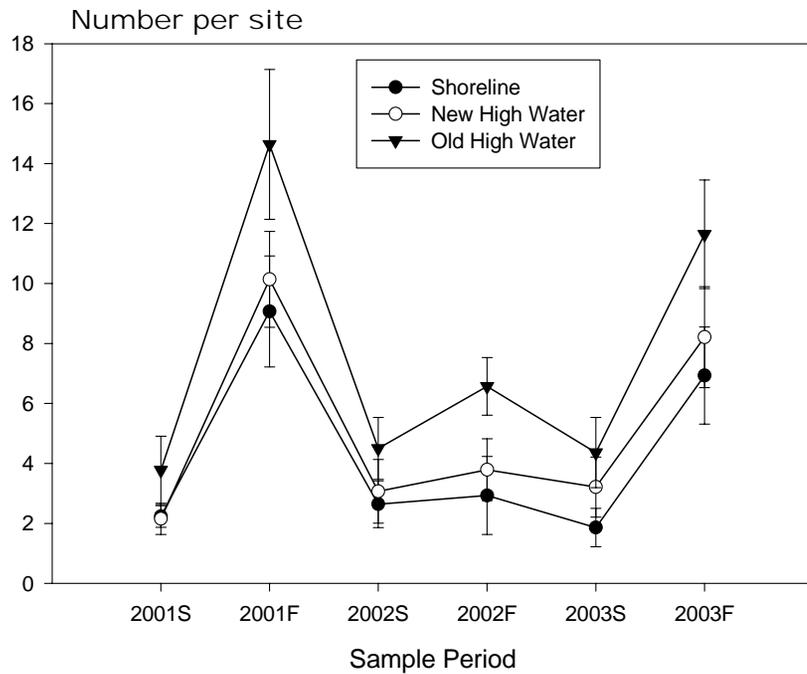
Small Mammal Sampling

Spring Surveys



Small Mammal Sampling

Spring and Fall Surveys



Summary

- **Vegetation**

- Total cover, vegetation density, and species richness are affected by flows and precipitation.
- Lower elevation plots are more strongly affected by flows, higher elevation plots by precipitation.
- Total cover has declined since 2001 in all plots.
- Repeated sampling of transects has not had a discernable effect on cover and richness.

Summary

- **Avifauna**

- Breeding bird density estimates are lower, but less variable, in larger patches.
- Breeding bird densities have declined since the initial surveys.

- **Arthropods**

- Densities of ground-dwelling arthropods in the OHW have declined. No pattern in other zones.
- Some taxa show high fidelity and specificity to hydrologic zones and therefore make good indicators.
- High variability in arthropod numbers do not allow the use of most taxa as monitoring tools.

Summary

- **Herpetofauna**

- Richness declined steeply in 2002, and has recovered since.
- High variability in density estimates, due to short-term fluctuations precludes using herpetofauna as a monitoring tool without a change in protocols.

- **Small Mammals**

- Strong differences were found among years of survey, due primarily to variability in fall surveys.
- Spring surveys reflect overwintering survival, and fall surveys reflect fecundity related to food availability.
- Small mammal captures were related to minimum river flow (+) and standardized precipitation index (-).

THANK YOU:

**GCMRC: Dr. Barb Ralston, Carol Fritzing, Tom Gushue
Humphreys Summit Guides**

**The many volunteers on whose bleached bones the
successes of this project have been built.**

