

US EPA ARCHIVE DOCUMENT

**Integrated analyses of fish,  
macroinvertebrate and algal IBI's in  
the mid-Atlantic uplands:  
A complete bioassessment approach**

**Thomas Belton<sup>1</sup>, Richard J. Horwitz<sup>2</sup>, Camille A. Flinders<sup>2</sup>,  
Brian Margolis<sup>3</sup>, Amanda C. Kindt<sup>2</sup>**

**<sup>1</sup>New Jersey Department of Environmental Protection (NJ DEP), Trenton,  
New Jersey**

**<sup>2</sup>Patrick Center for Environmental Research, The Academy of Natural  
Sciences, Philadelphia, Pennsylvania**

**<sup>3</sup>New Jersey Department of Environmental Protection, Bureau of Freshwater  
Monitoring (NJ DEP BFM), Trenton, New Jersey**

# Acknowledgements

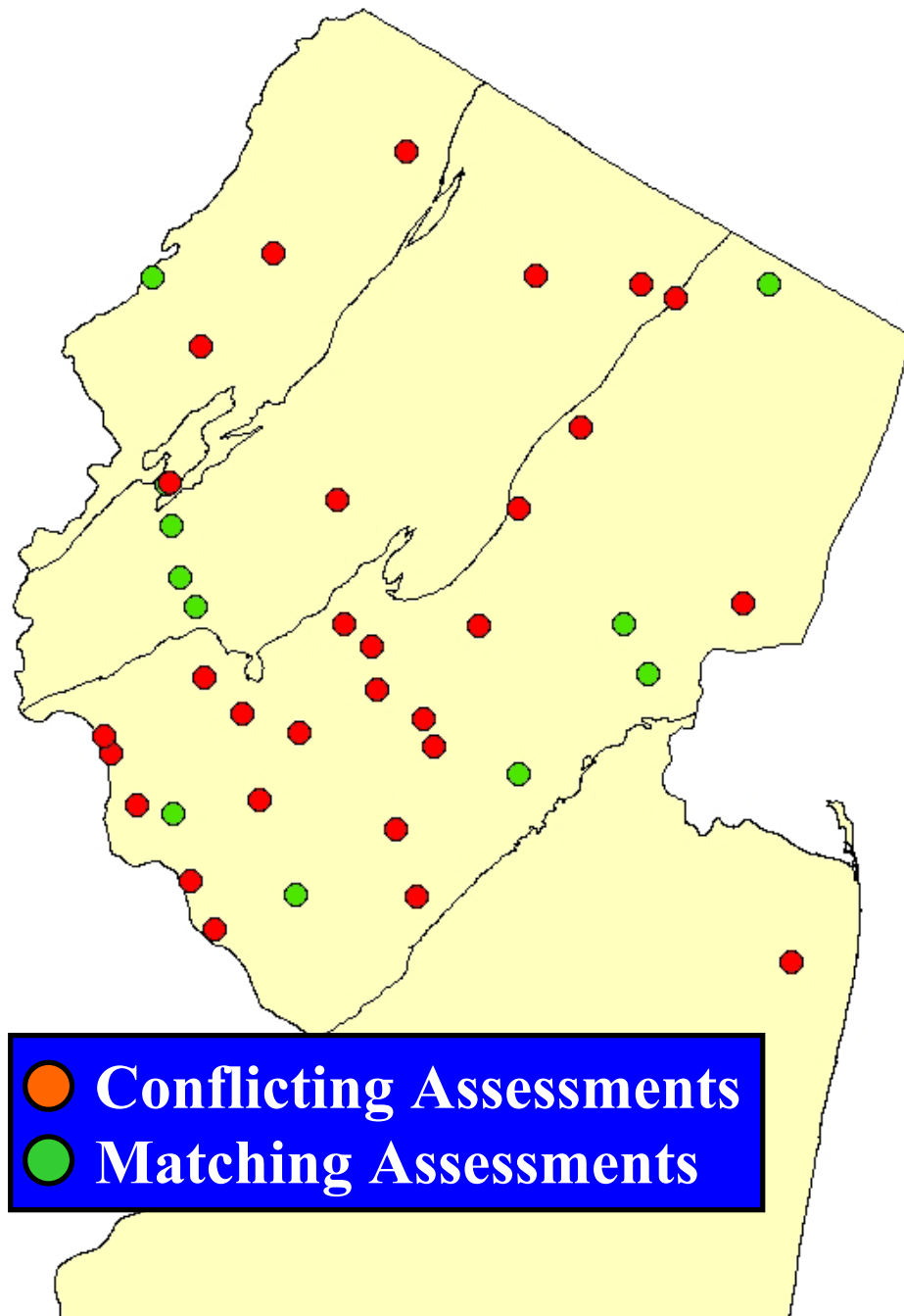
- **USGS NAWQA program**
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# **Problems with integrating bioassessments**

- **Currently, no procedure to integrate assessments across taxonomic groups or sites**
- **Potential for over-protective or under-protective listings**
- **Potential for loss of information from different indices**
- **Difficulty interpreting contrasting results**

## New Jersey:

69% of monitoring sites had conflicting assessment ratings between fish and macroinvertebrate IBIs

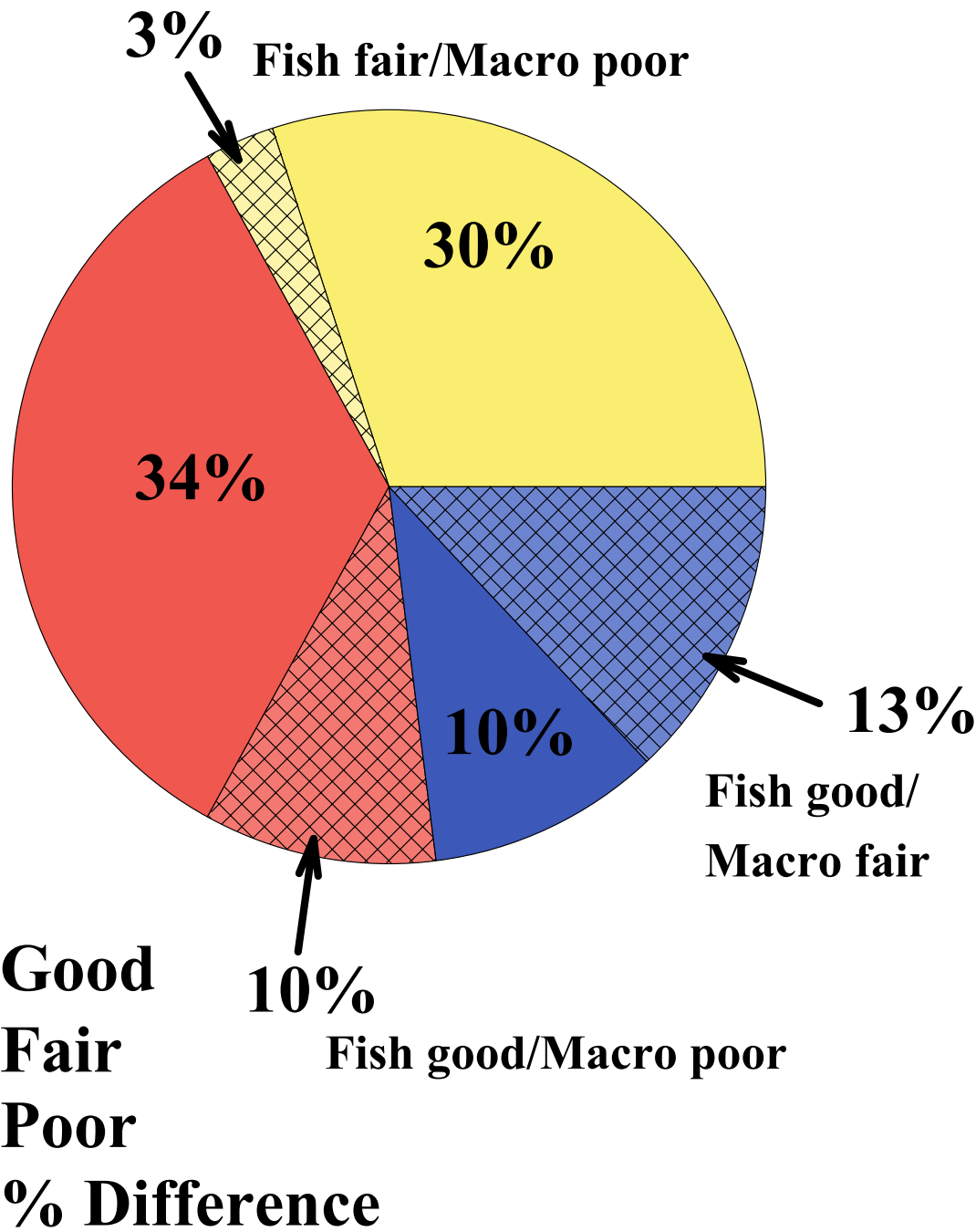


# Maryland:

•Fish IBI overestimates good streams

•Invertebrate IBI overestimates poor streams

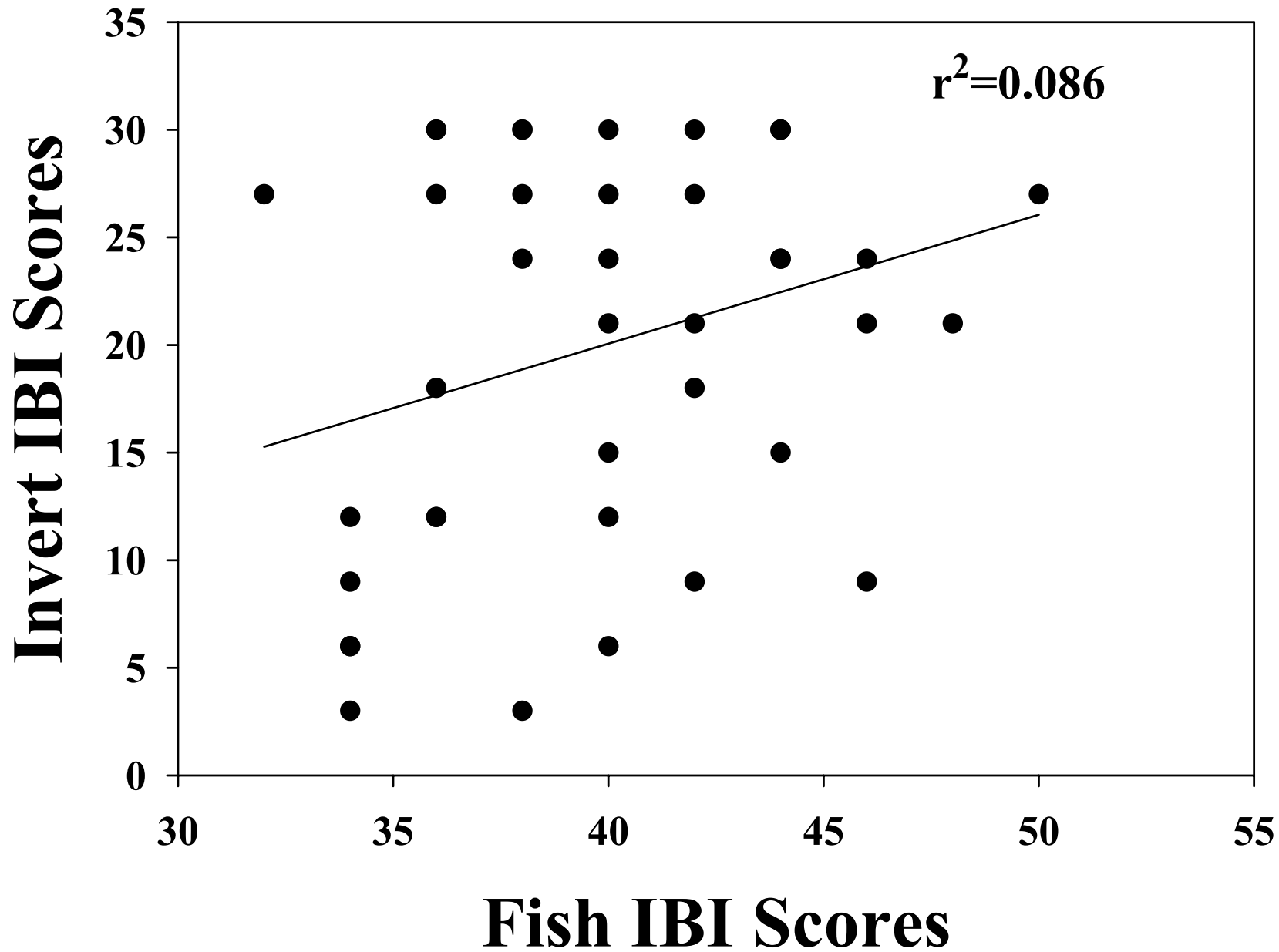
Created with data from:  
State of the Streams: 1995-  
1997 Maryland Biological  
Stream Survey Results. Pub#  
EA-99-6



# Assessment differences may result from:

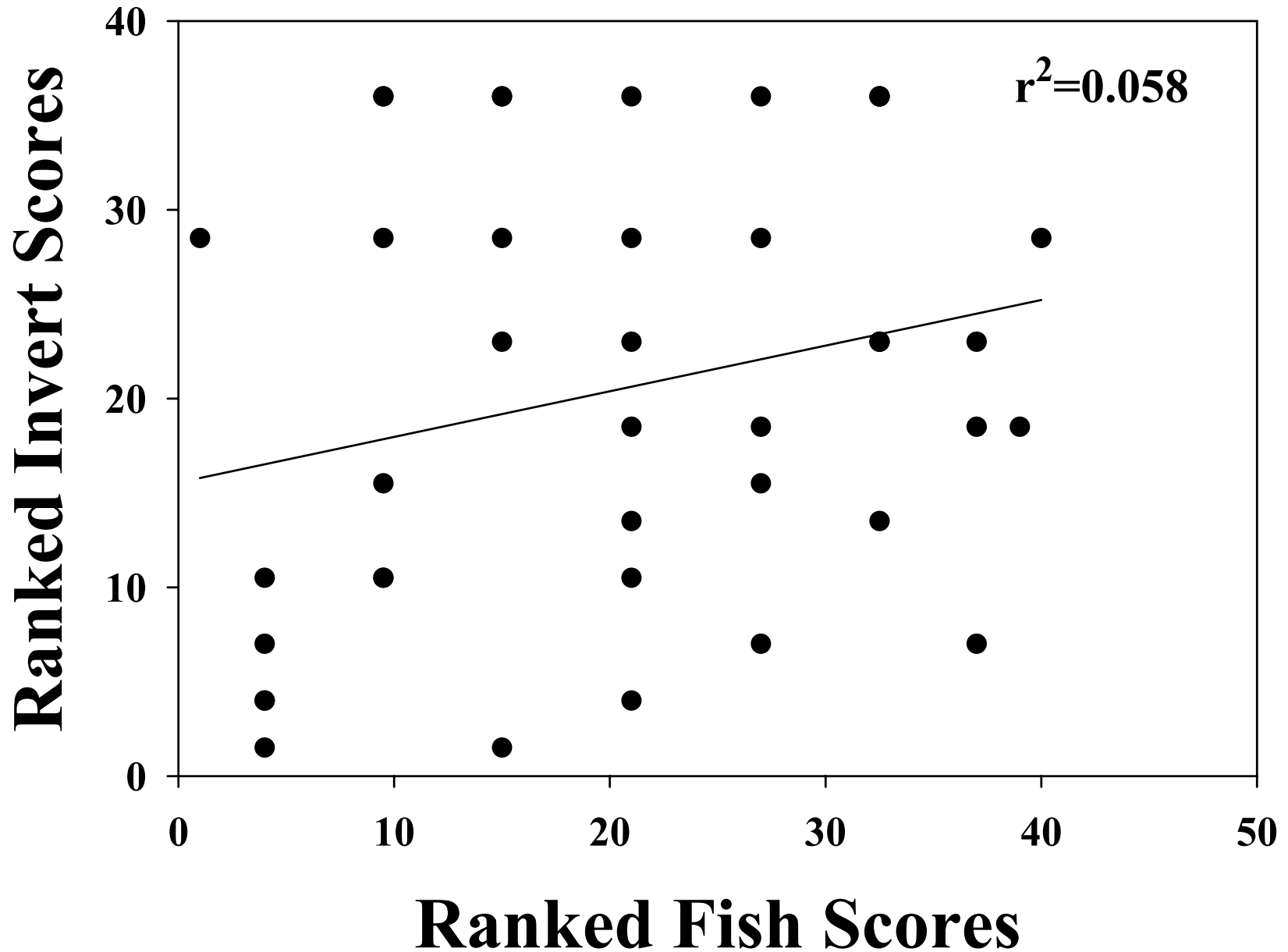
- **Adjustment for stream size, etc.**
- **Definition of metrics**
- **Mismatch of cutpoints**
  - **More likely with different shape of stress-response curves**

# Fish IBI vs. Invert Scores





# Fish vs. Invert Scores (Ranked)



# Potential source of differences:

## Sampling variance & bias:

- **Within metric variance**
- **Difference in location and time of fish and macroinvertebrate samples**
- **Truncation of stress gradient by site selection**
  - **No fish sampling at sites with poor habitat**

# Potential source of differences (cont'd):

## Different Responses of Taxa groups to:

- **Spatial scale: watershed versus local response**
- **Temporal scale**
- **Seasonal sensitivity: winter, spring, summer flows, etc.**
- **Response to different stressors**
  - **Water quality**
  - **Detrital quality**
  - **Habitat**

# **Analytical Approaches to Integrating Metrics**

- **Investigate variance & bias**
- **Use wide range of sites**
- **Look at relationships among individual metrics**
- **Link to watershed land use at different scales**
- **Link to flow regime**

# Metrics Examined

- **Macroinvertebrates**

- NJ AMNET (5 metrics)
- Additional (trophic structure, indicator taxa, etc.)

- **Algae**

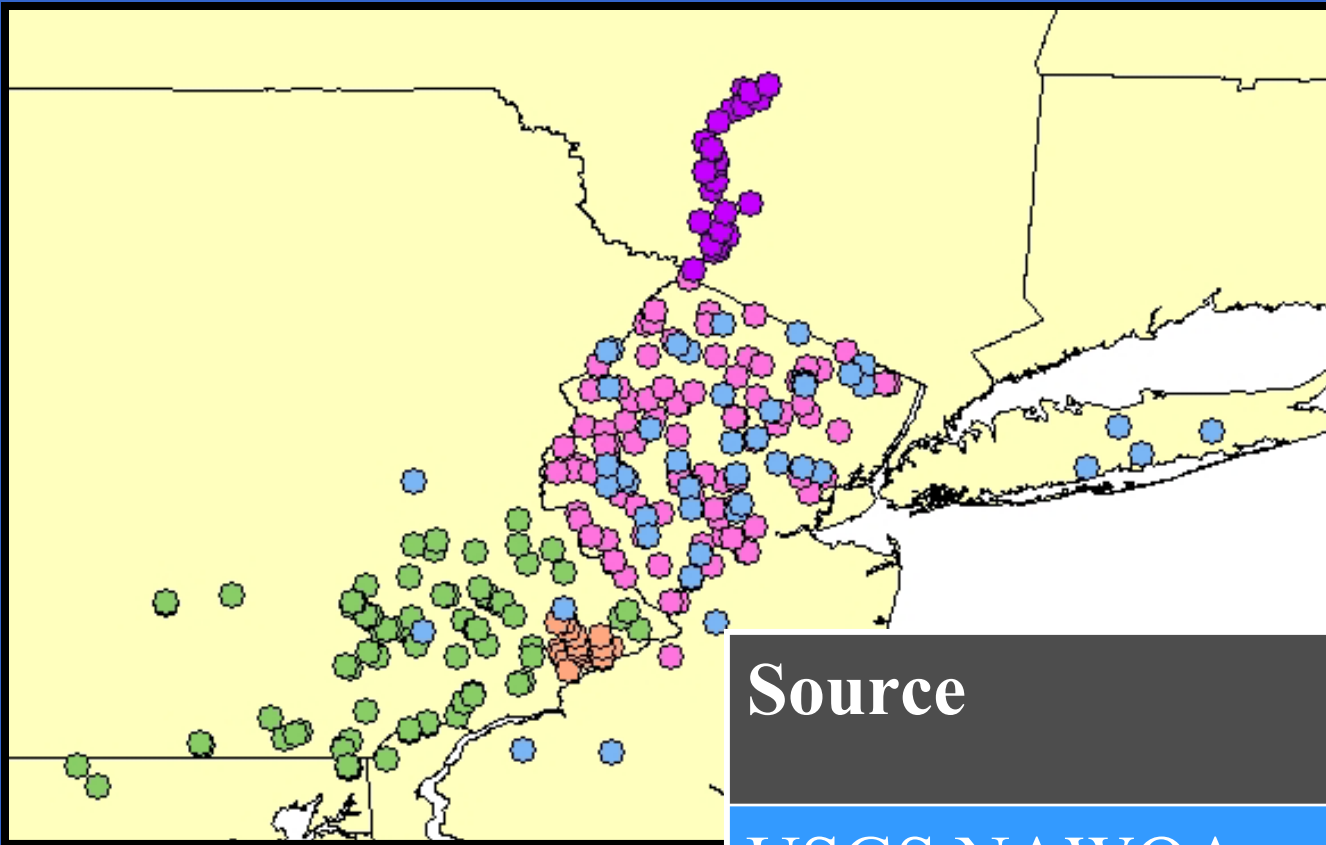
- 6 metrics including richness, siltation, and tolerance measures; under development

- **Fish**

- McCormick, et al. (Mid-Atlantic Highlands, for EMAP)
- Daniels, et al. (for NAWQA)
- NJ Bioassessment 10 metrics (8 used)

Similar but slightly different metric definitions

# Data Sources



Source	# Fish & Invert	# Algae
USGS NAWQA	52	44
TNC—Neversink	27	0
NJ DEP	136	51
Phila. Water Dept	21	0
ANS Projects	101	102
<b>Total</b>	<b>337</b>	<b>197</b>

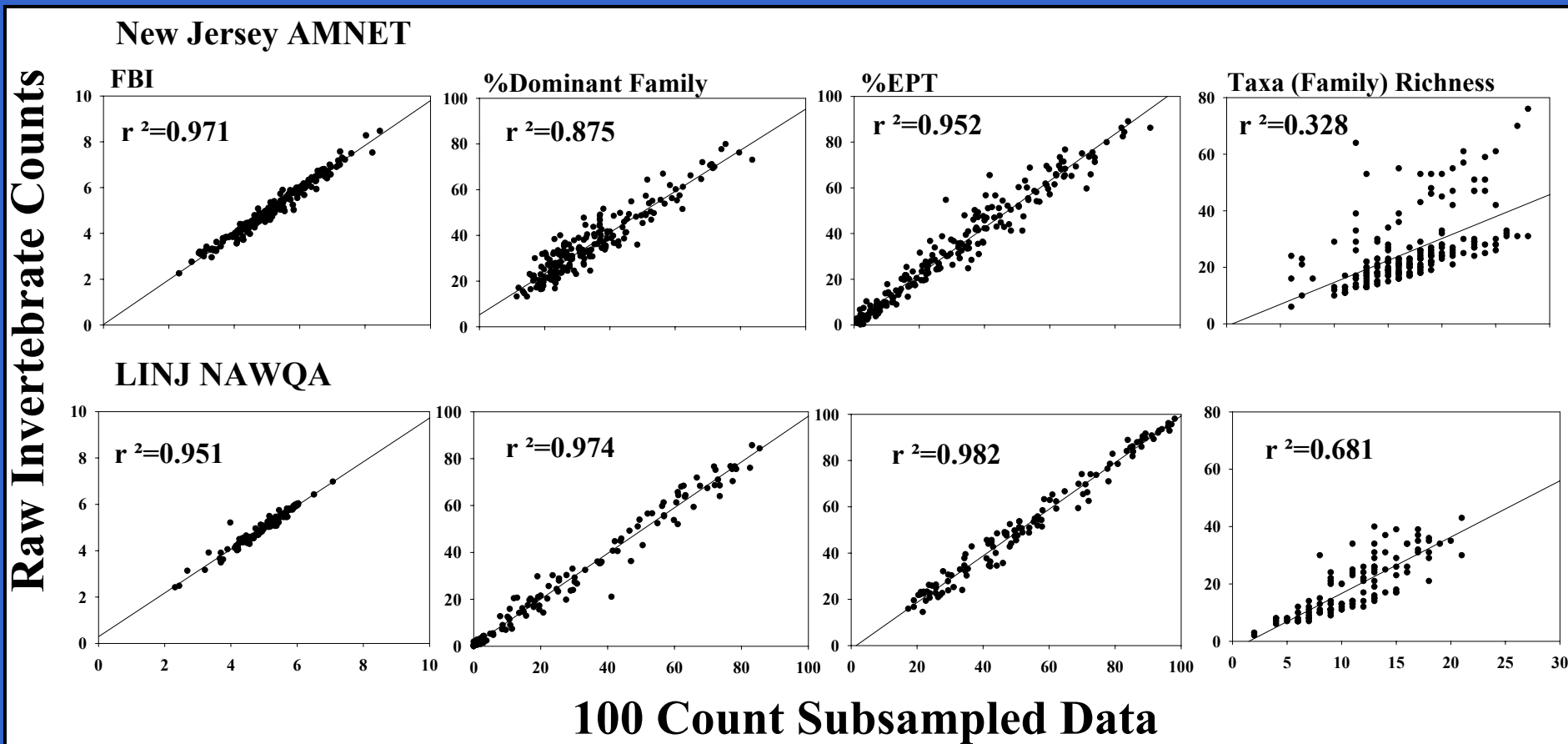
# Combination of Datasets

Identified differences in sampling & analysis:

- **Subsampled, uniform taxonomic resolution**
  - Generally low loss of precision
- **Used stable metrics**

# Subsampling:

## High correlation with original data



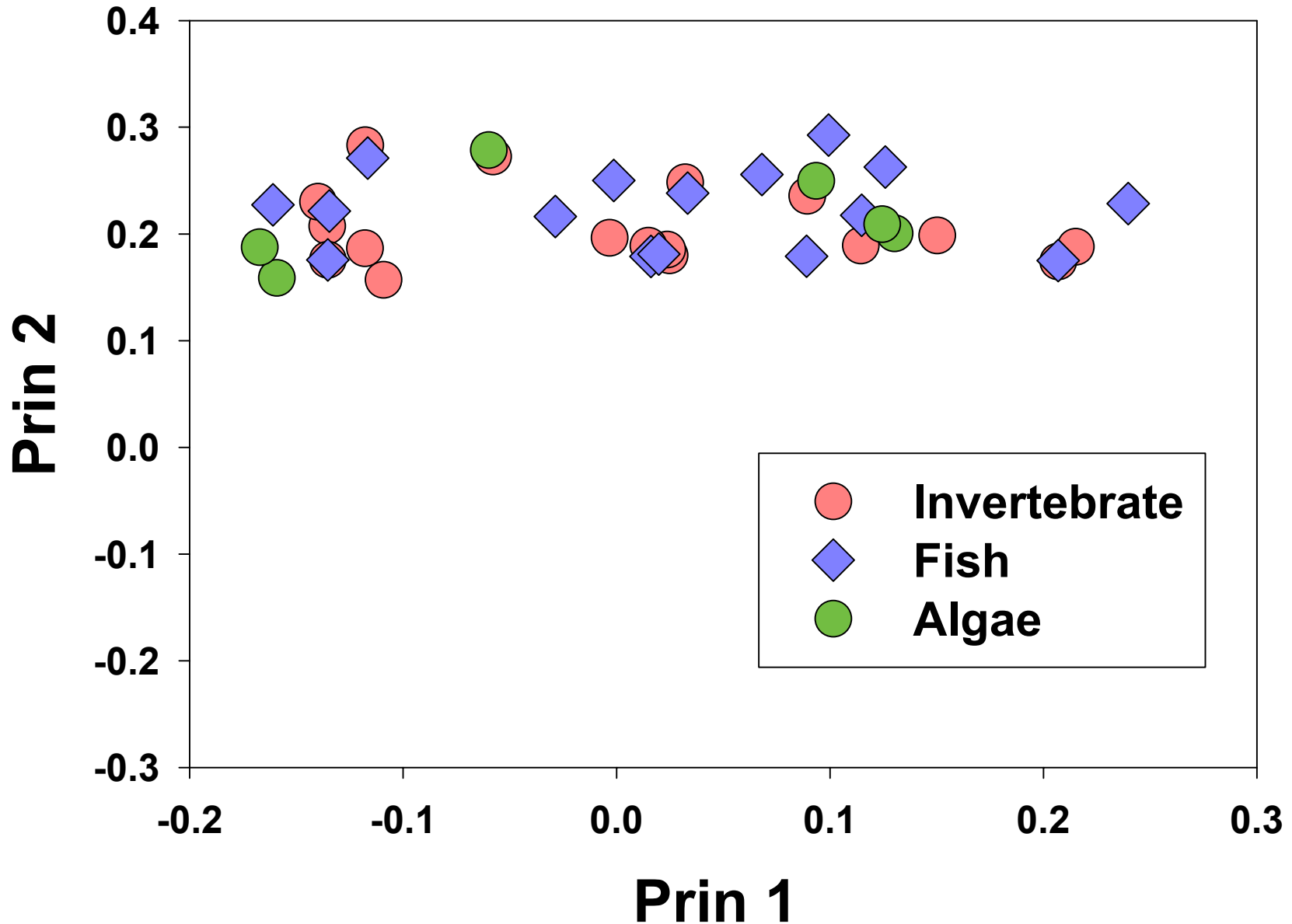


# Database Development

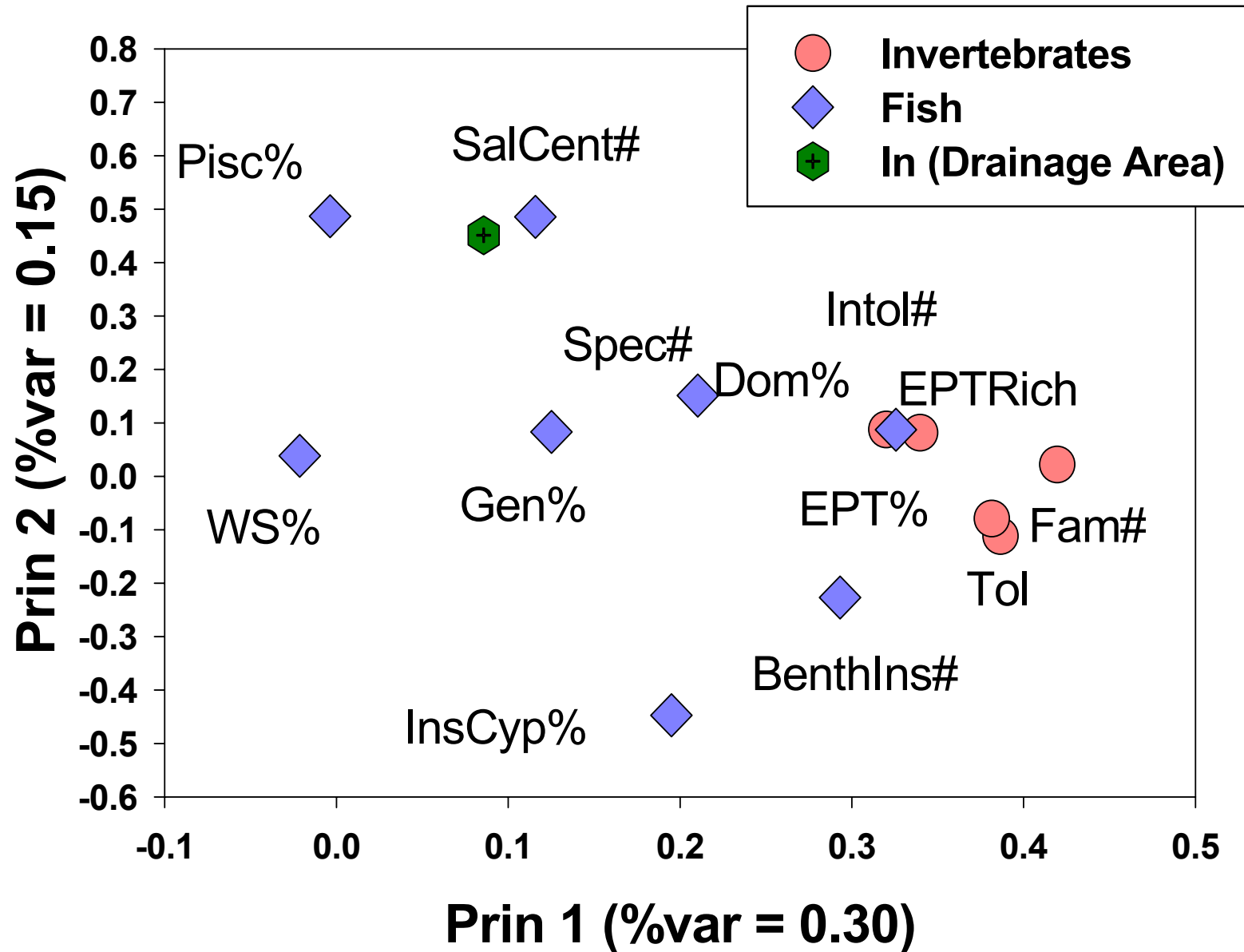
- Site Information
- Habitat Assessment Ratings
- Environmental parameters (land use, etc.)
- Samples (multiple collection dates)
- Community & metrics data (fish, inverts, algae)

**All linked  
with unique  
station  
number  
based on site  
location**

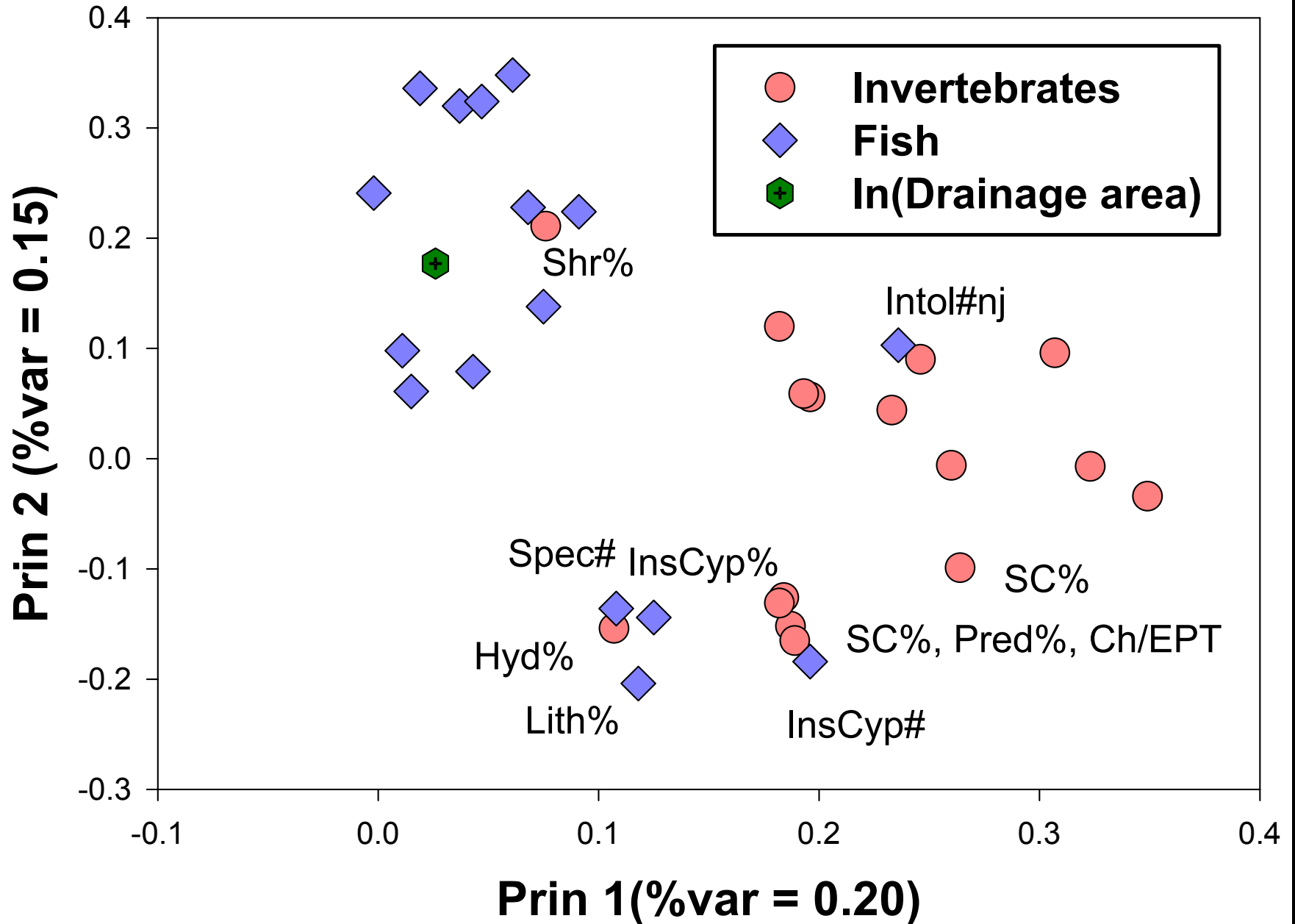
# Theoretical Intercorrelation of Metrics



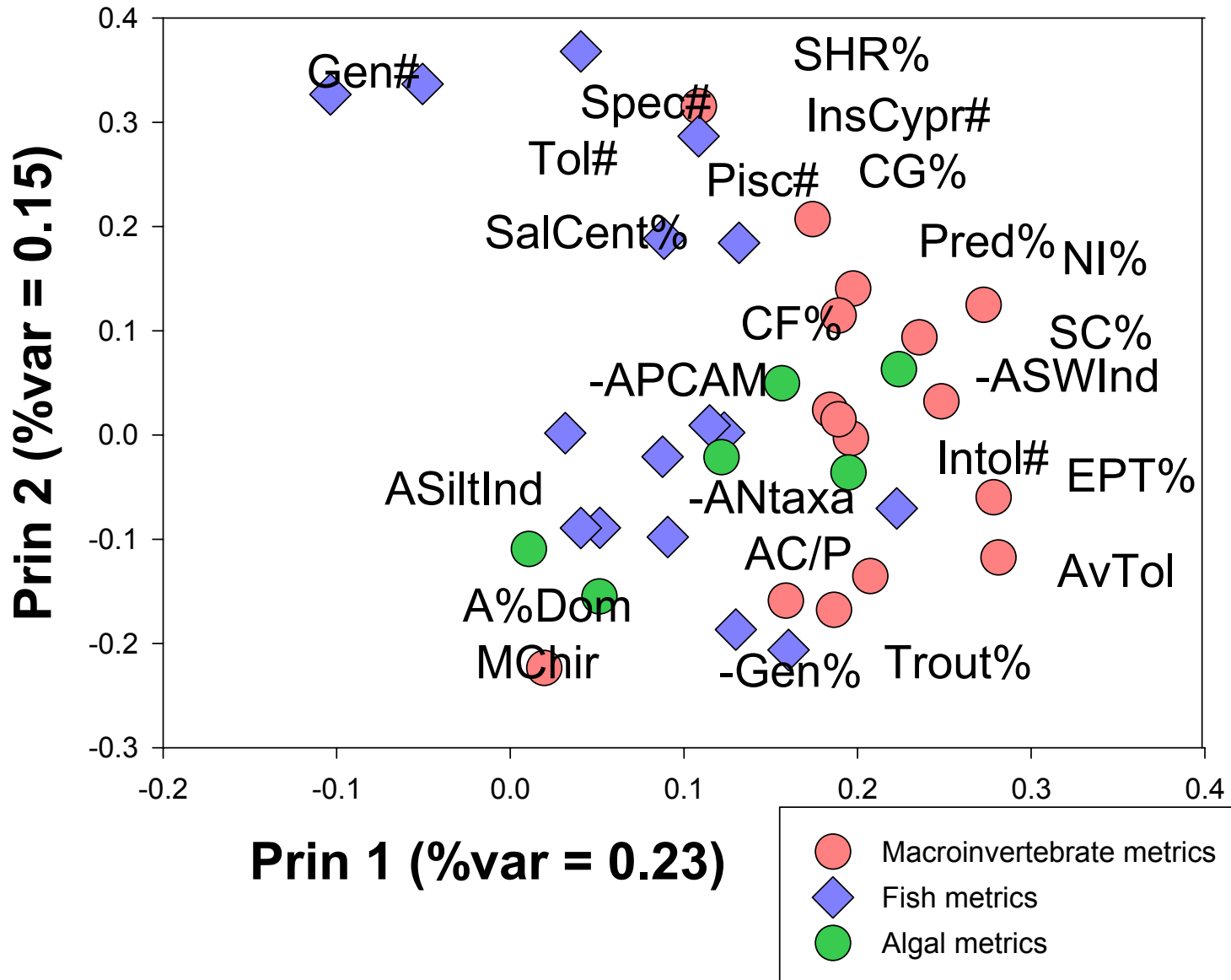
# NJ Metrics Watersheds > 5 sq mi



# PCA 32 Metrics All Sites



# PCA of Invert, Fish and Algal Metrics



# Conclusions

- **Current macroinvertebrate, fish, and algae indices and metrics generally not highly intercorrelated**
- **Current macroinvertebrate metrics correlated with each other and with some fish and algae metrics (e.g., richness of intolerant species, benthic invertivores) – “classic” stream quality measures**
- **Algal diversity metrics (richness, SW Diversity) negatively correlated with macroinvertebrate metrics**

# Conclusions (cont'd)

- **Relatively weak signal of fish “intolerance” reflects regional ecology**
- **Fish metrics designed to reflect range of stream conditions (pool conditions, trophic structure, etc.)**
- **Other macroinvertebrate indices (e.g., trophic structure) less highly correlated with current NJ macroinvertebrate indices**

# Ongoing Analyses

- **Development of additional algal metrics**
- **Incorporation of other types of macroinvertebrate (mussels, odonates) data and amphibian data**
- **Incorporation of standard habitat, land use, designated variable (e.g. proximity to dams, point source pollution) measures**
- **Analysis of abundance measures**
- **Detailed modeling of spatial and temporal patterns**



