Implementation Of A Long-Term Quantitative Mussel Monitoring Program In Kentucky

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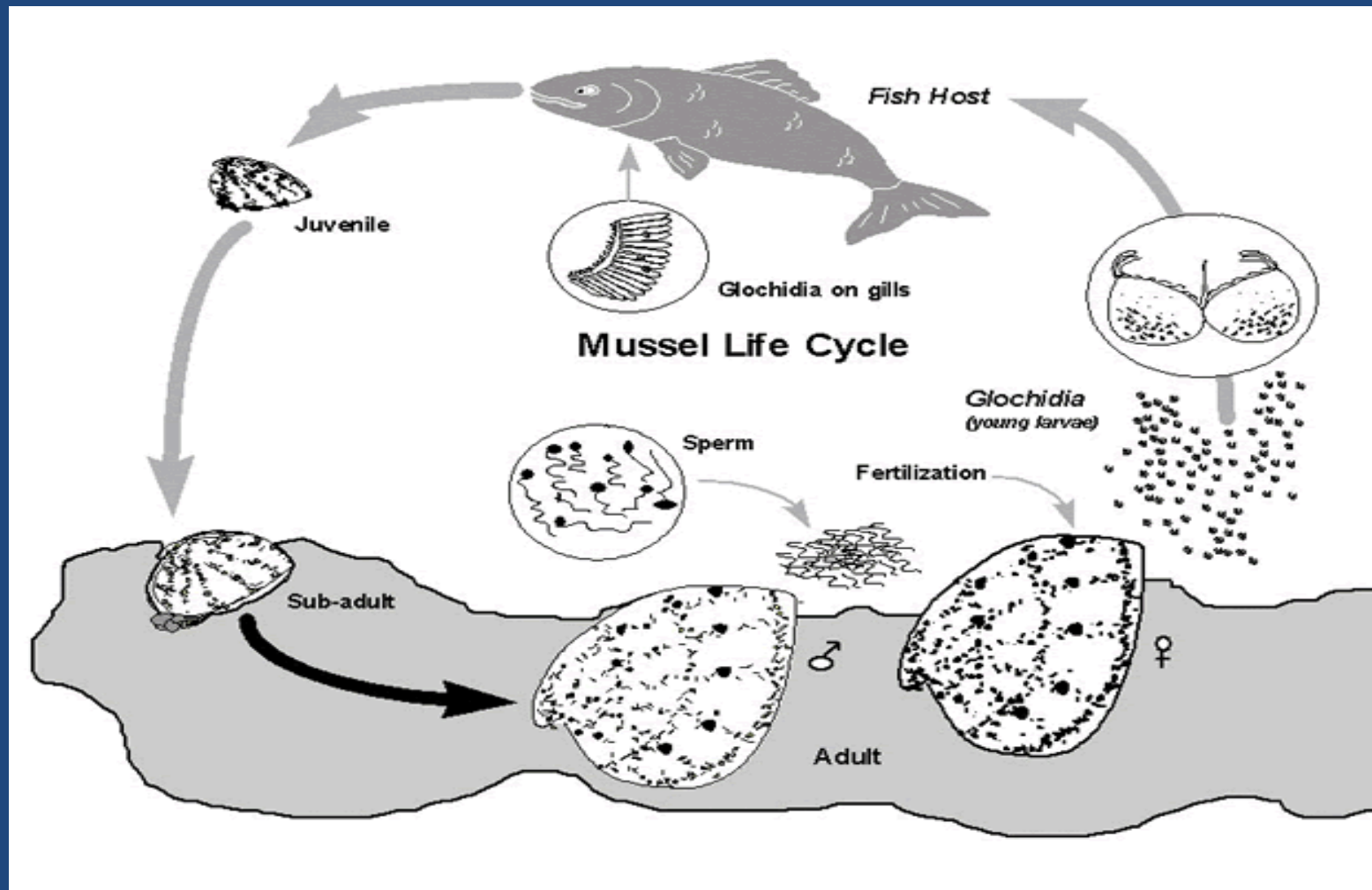
OUTLINE

- Freshwater Mussel Basics
- Background - *Surface Water Quality Monitoring Program*
- Changes to existing programs
- Plans for the future (implementation)
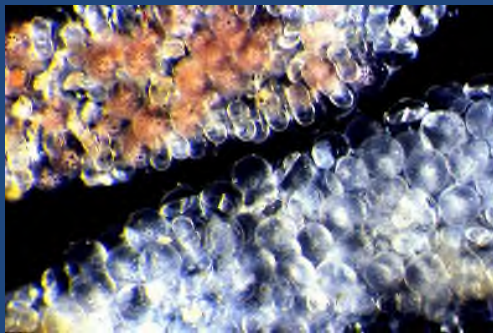
Why Mussels for Long-Term Monitoring?

- Excellent indicators of water quality

- Filter harmful agents from water

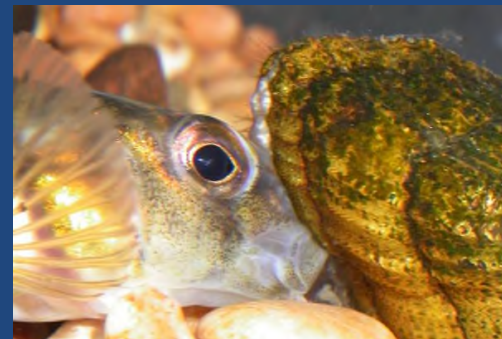- Long-lived organisms (~5 years to > 60 years in US)

Mussel Life History

Host Fish Attraction - Adaptations

Host Fish Attraction-More Adaptations

Imperilment of Freshwater Bivalves

- North America ~ 300 species, most in Southeastern US
    - 70 % listed as endangered or threatened

- Historically ~ 100 species in KY
    - 20 % extinct or extirpated from KY
    - Half are rare or Federally Endangered (~40 species)

Factors Affecting Mussel Declines
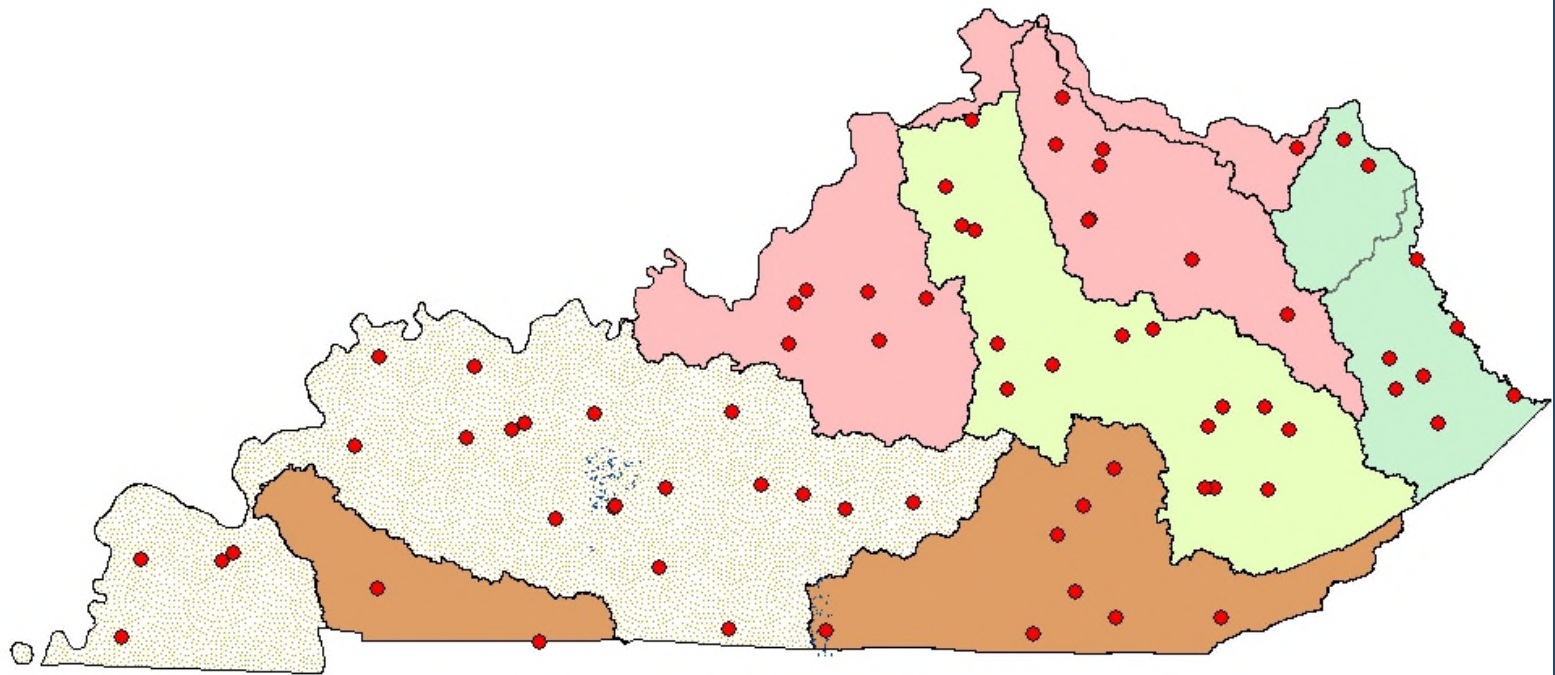
- Habitat loss/alteration

  - Impoundments

  - Siltation

- Pollution

  - point source

  - non-point source

- Invasive species
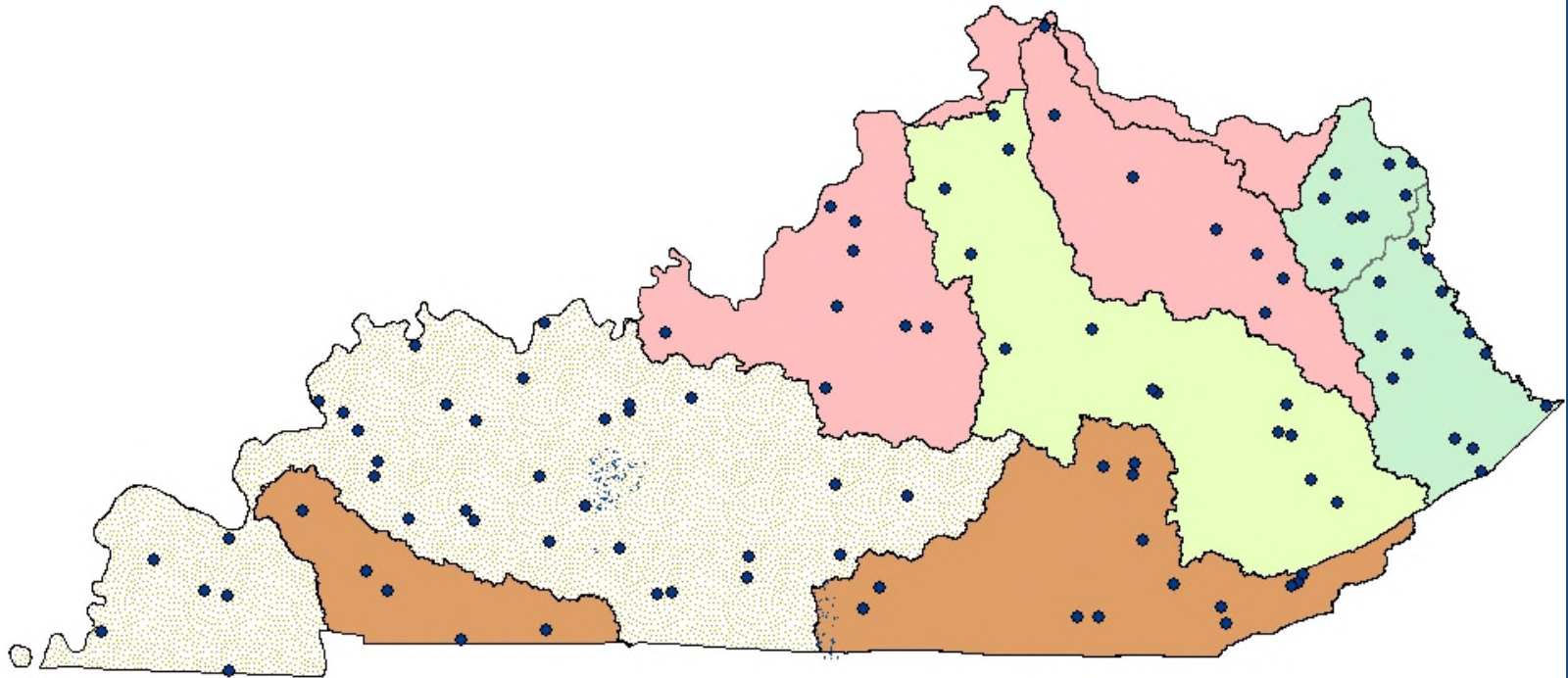
  - zebra mussels

  - Asian clams?

Ambient Water Quality Network

- In 1979 KDOW established a network of stream stations for long-term monitoring

- Network consisted of 44 stations

- 1998 expansion-statewide monitoring initiative
    - -primary sites (sampled bi-monthly every year)
    - -rotating sites (sampled monthly on a 5-year rotation)

Primary ambient water sites in KY

Rotating ambient water sites in KY

Biological Monitoring Program

- Existing program

- Sites at or near Primary Ambient Water Network sites

- Original goal: long-term trend analysis on fish communities, sites sampled on 5-year basin rotation

2013 Planning

- Interest in developing a mussel monitoring program
- Biological Monitoring Program a good fit

  -trend analysis, long-term program

  -freshwater mussels long-lived organisms
- Development and approval of a rough outline for mussel monitoring plan beginning in 2014
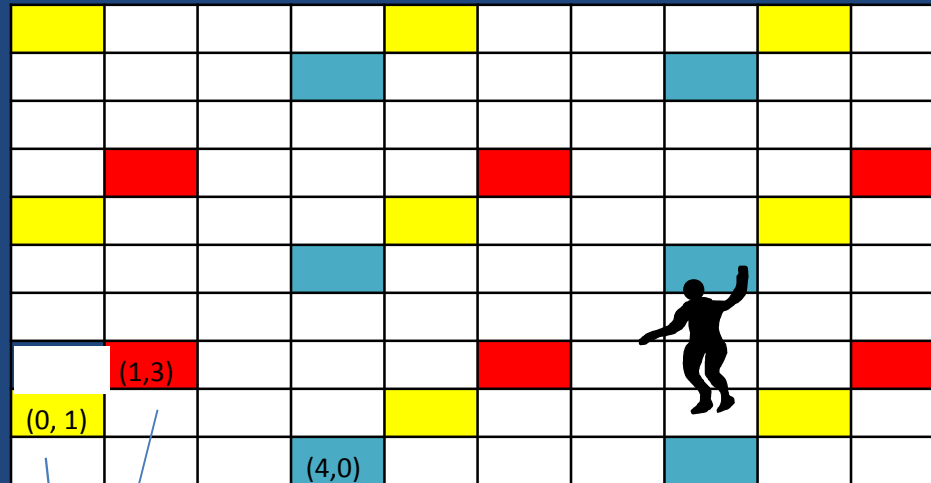
General Plans for Mussel Monitoring Program

- Select 10-15 existing Ambient Water Sampling sites (2014)

- Quantitative sampling- each site once every three years using *Systematic Random Sampling* techniques (2015)

- Trend-analysis of mussel communities using quantitative data and long-term water chemistry data

- Bio-accumulation studies at these sites (tissue analysis)??

Quantitative Sampling

- Phase I – simple random grid sampling (n=~10)

- Use random sampling data to calculate # of quadrats needed to achieve precision of the mean (35%)

- Phase II – Systematic Random Sampling
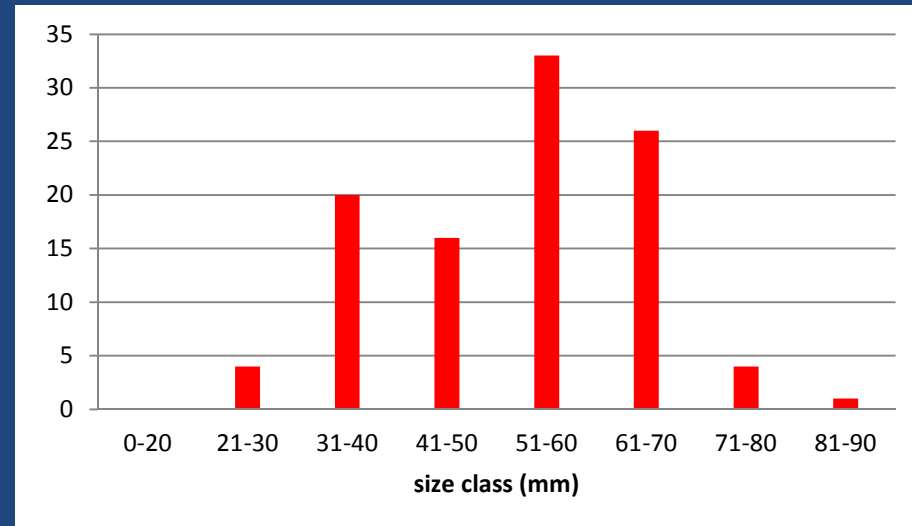
Systematic Random Sampling

(1,3)

(0, 1)

(4,0)

3 random starts

interval = $\sqrt{\dfrac{L \bullet W}{n/k}}$

Systematic Random Sampling

- No./m² (density)

- Species richness and evenness (relative abundance)

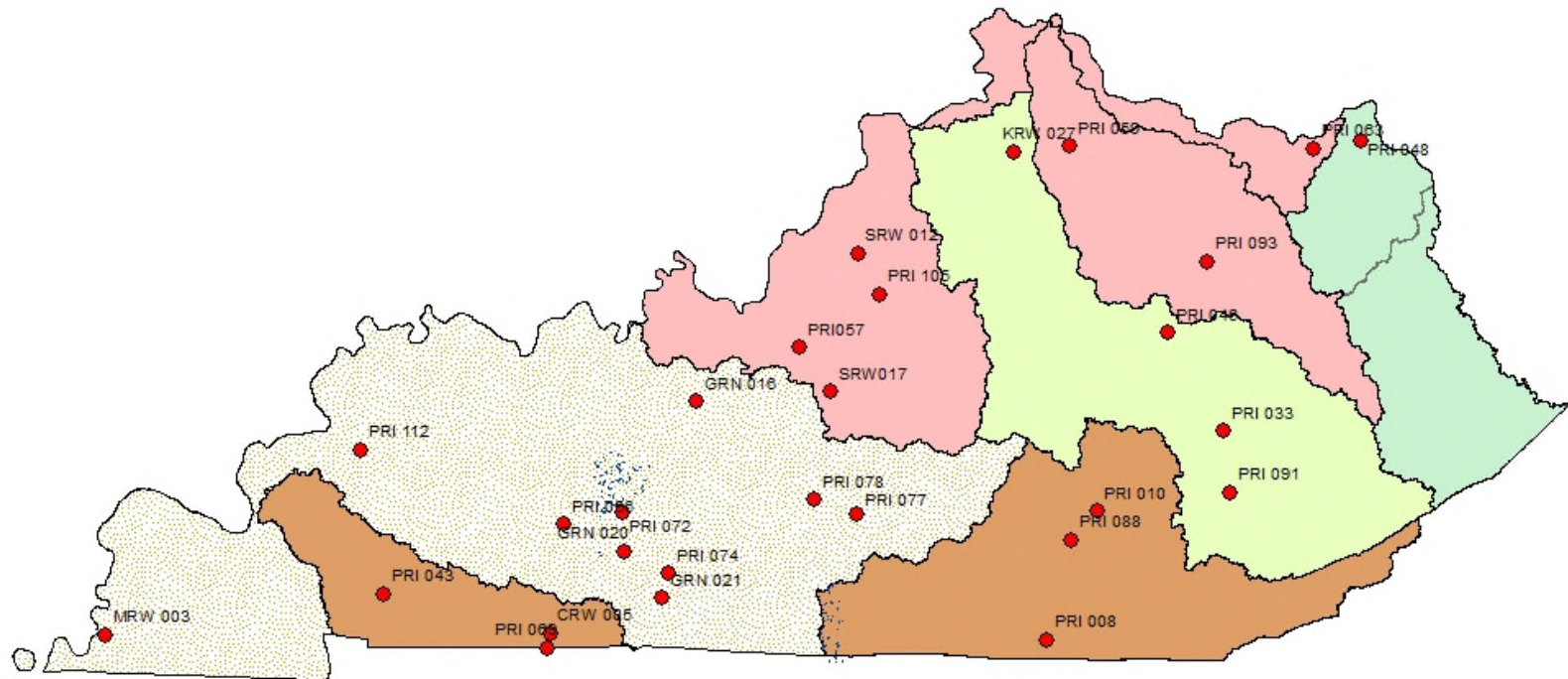- Size and age class structure (evidence of recruitment)
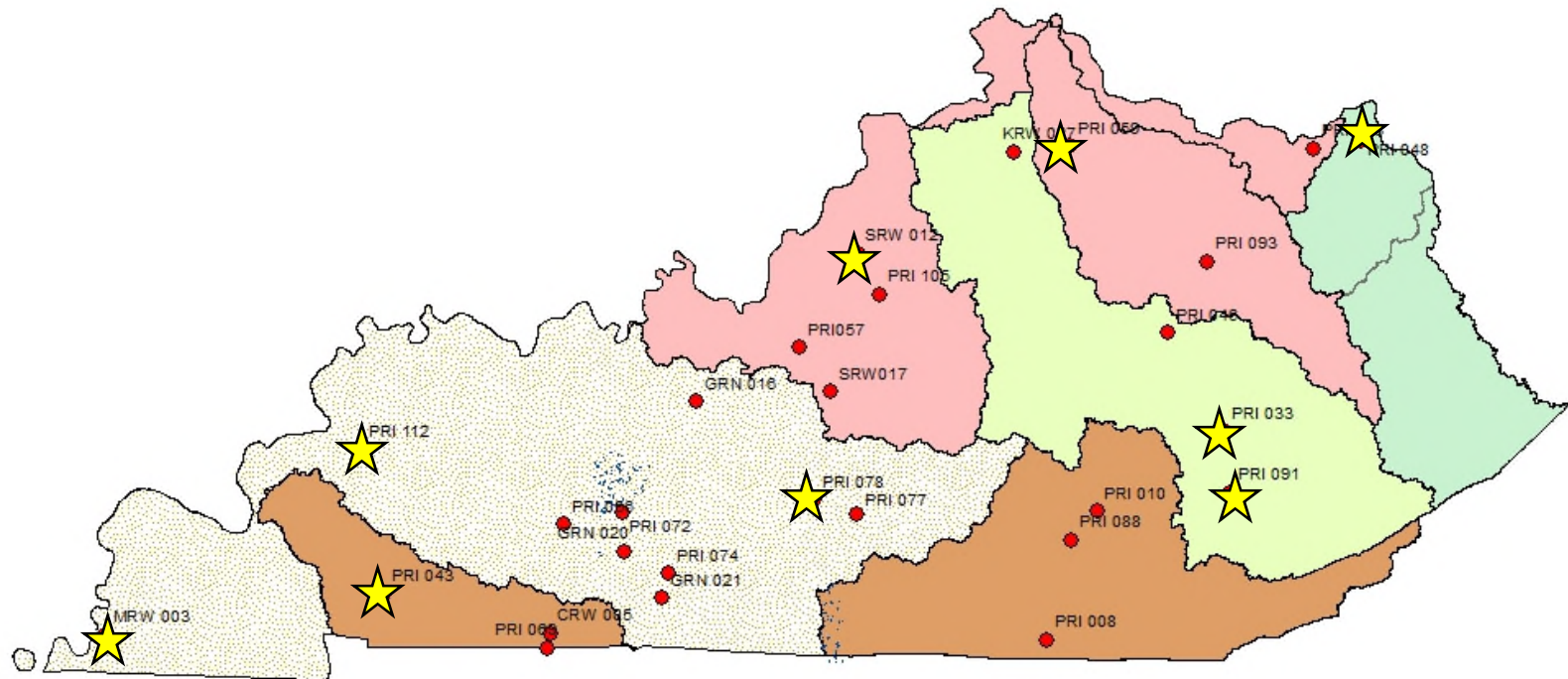
Bioaccumulation of Toxins

- 2015 Pilot study

  -multi-agency collaboration

  -placement of juvenile mussels at Ambient Water sites

  -water chemistry collections during juvenile exposure

  -tissue analysis

2014 Goals

2014 Goals

Work in Progress

- Questions we still have

    - How will quantitative data/trend-analysis be interpreted?

        - look for statistically significant declines/changes in populations, size classes, etc.

    - How will data be used to make assessments on rivers in KY?

        - Metric index development?

        - toxicity guidelines (current and future)

Questions? Feedback?

- A Guide to Sampling Freshwater Mussel Populations. American Fisheries Society Monograph 8 (2003). DL Strayer and DR Smith