

Appendix C.3 Mussel Species Richness Maps

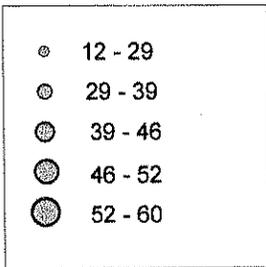
A Selection of various
Mussel Species Richness Maps as related to
certain Physical, Chemical, or Biological Parameters
and some
Individual Mussel Species Distribution Maps
from
the preliminary report of:
Trends in freshwater Mussel Populations in the
Big Darby Creek: A GIS Approach.
by
G.T. Watters and C.J. Myers Flaute, June 2003

Index of Biotic Integrity (IBI)

Big Darby Creek System

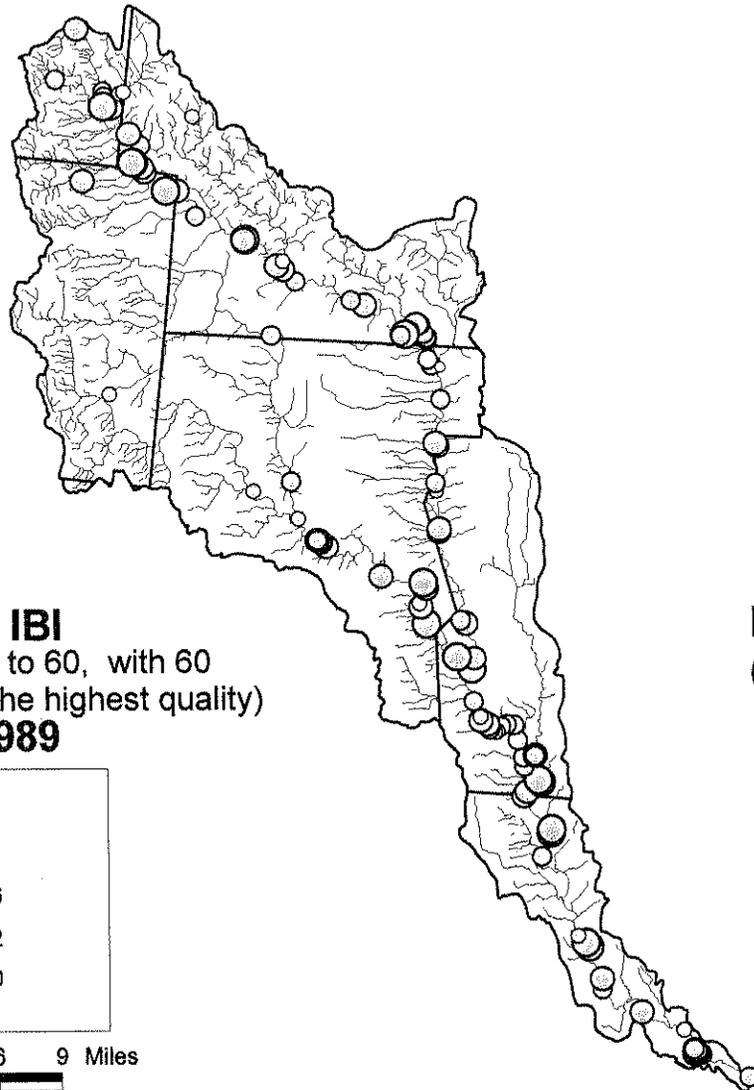
1980s

Average IBI
(Scale of 0 to 60, with 60 indicating the highest quality)
1979 - 1989



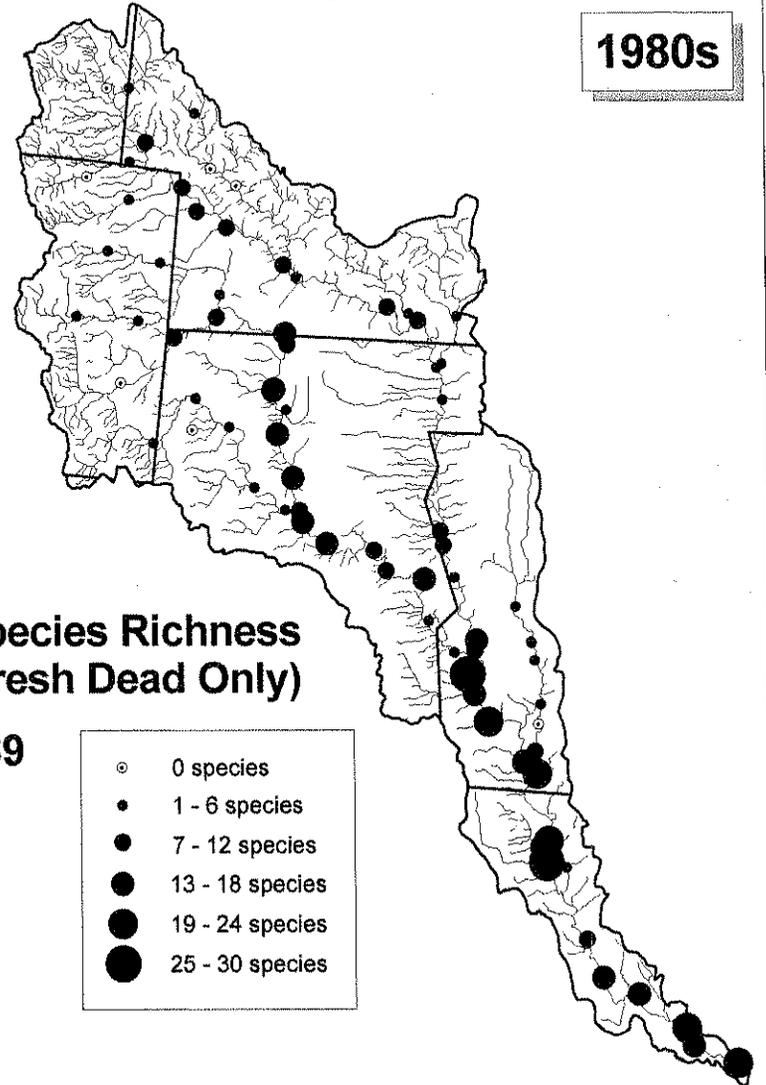
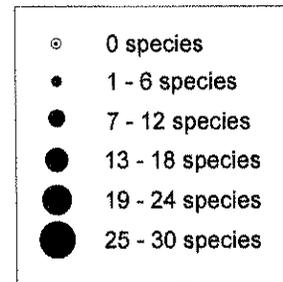
0 3 6 9 Miles

0 3 6 9 12 Kilometers



Mussel Species Richness
(Live or Fresh Dead Only)

1980 - 1989

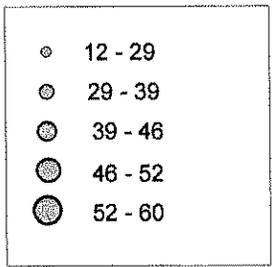


Index of Biotic Integrity (IBI)

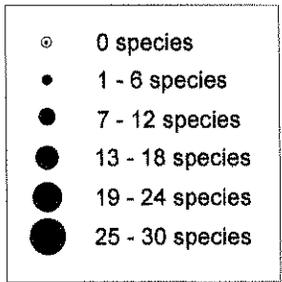
Big Darby Creek System

1990s

Average IBI
(Scale of 0 to 60, with 60 indicating the highest quality)
1990 - 2001

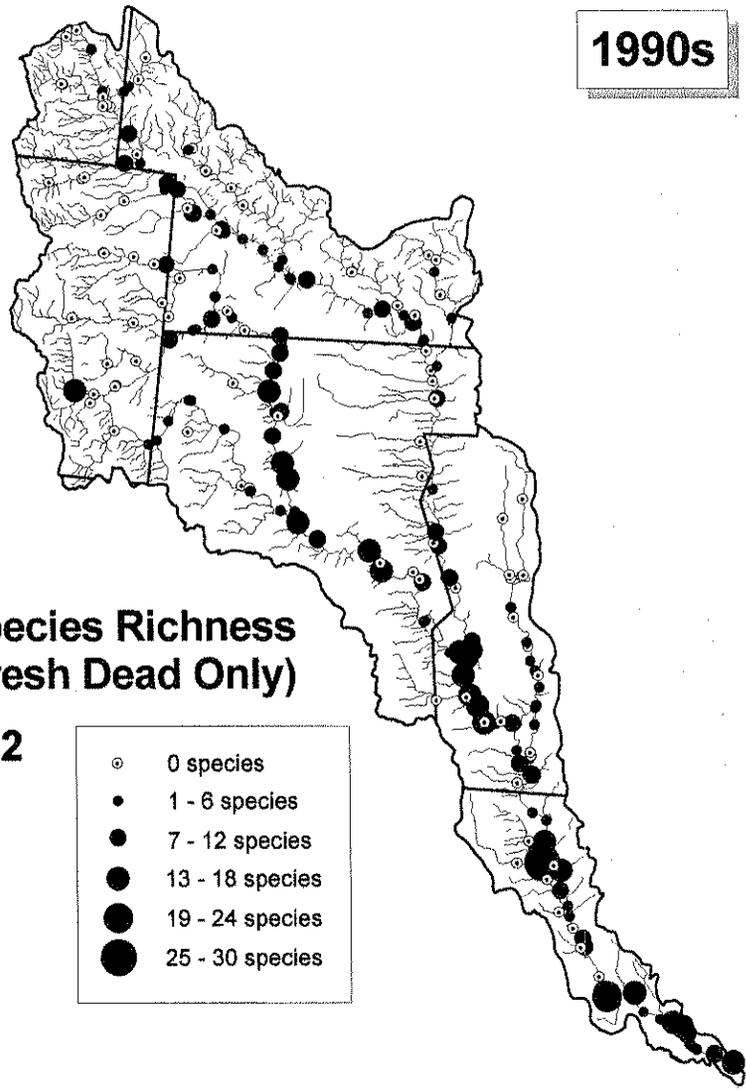
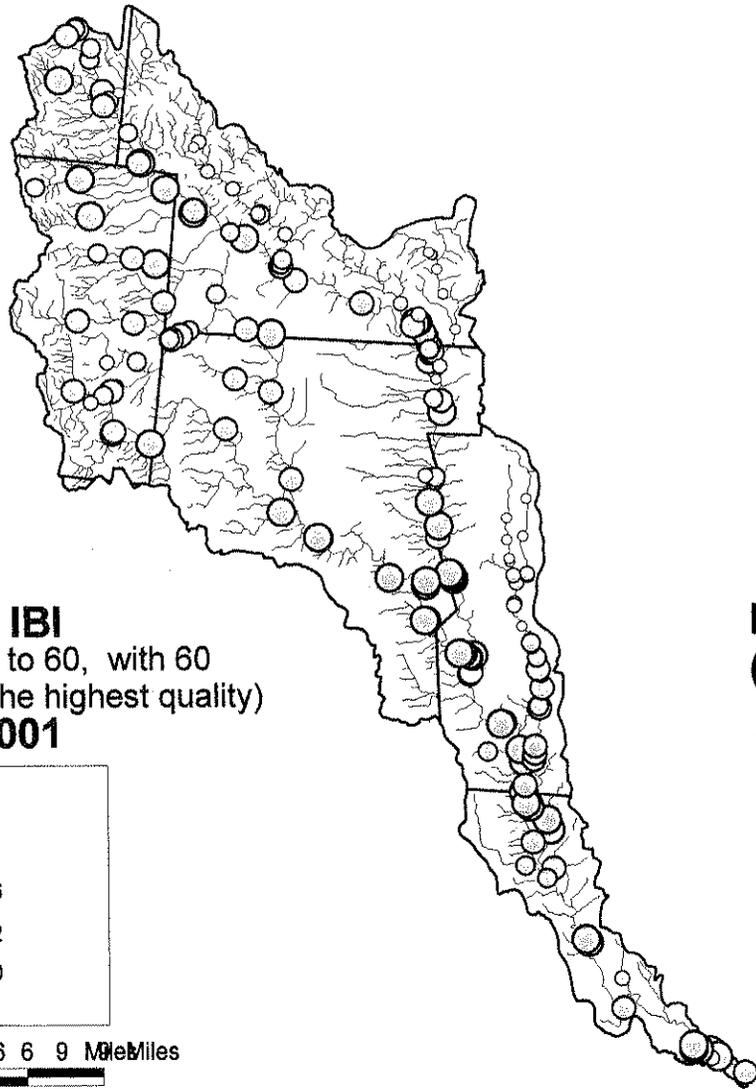


Mussel Species Richness
(Live or Fresh Dead Only)
1990 - 2002



0 3 6 9 Miles

0 3 6 9 12 Kilometers



Qualitative Habitat Evaluation Index (QHEI)

Big Darby Creek System

1990s

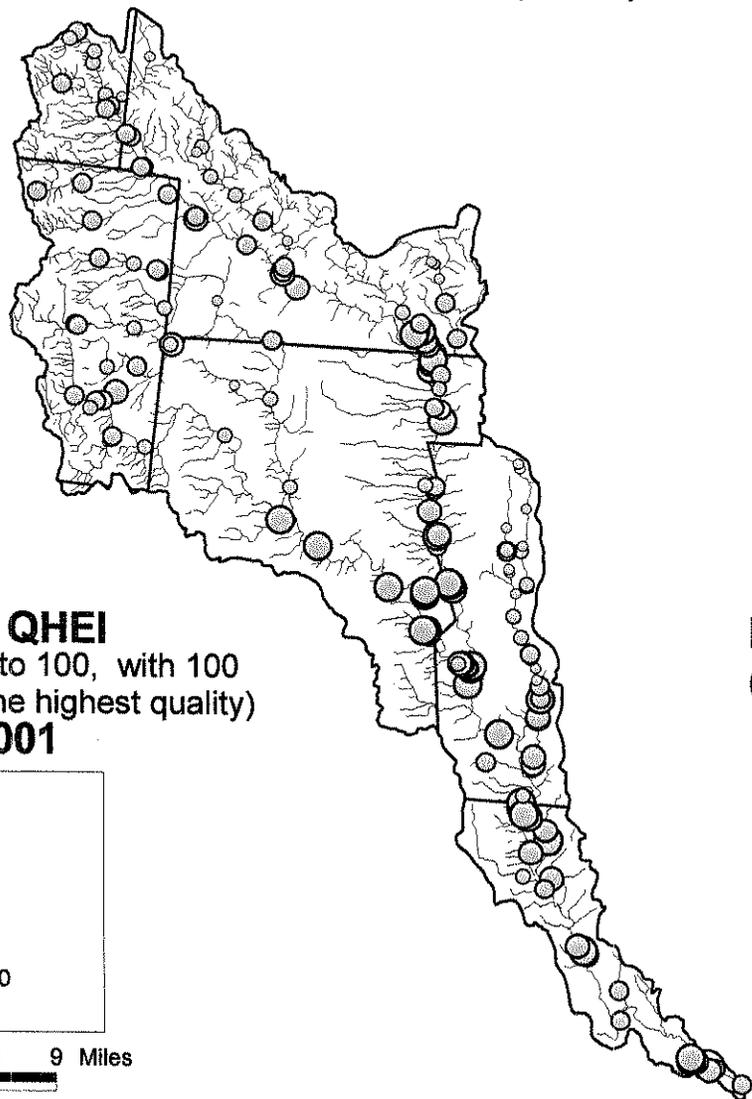
Average QHEI
(Scale of 0 to 100, with 100 indicating the highest quality)
1990 - 2001

- 26 - 46
- ◐ 46 - 65
- ◑ 65 - 76
- ◒ 76 - 86
- ◓ 86 - 100

0 3 6 9 Miles



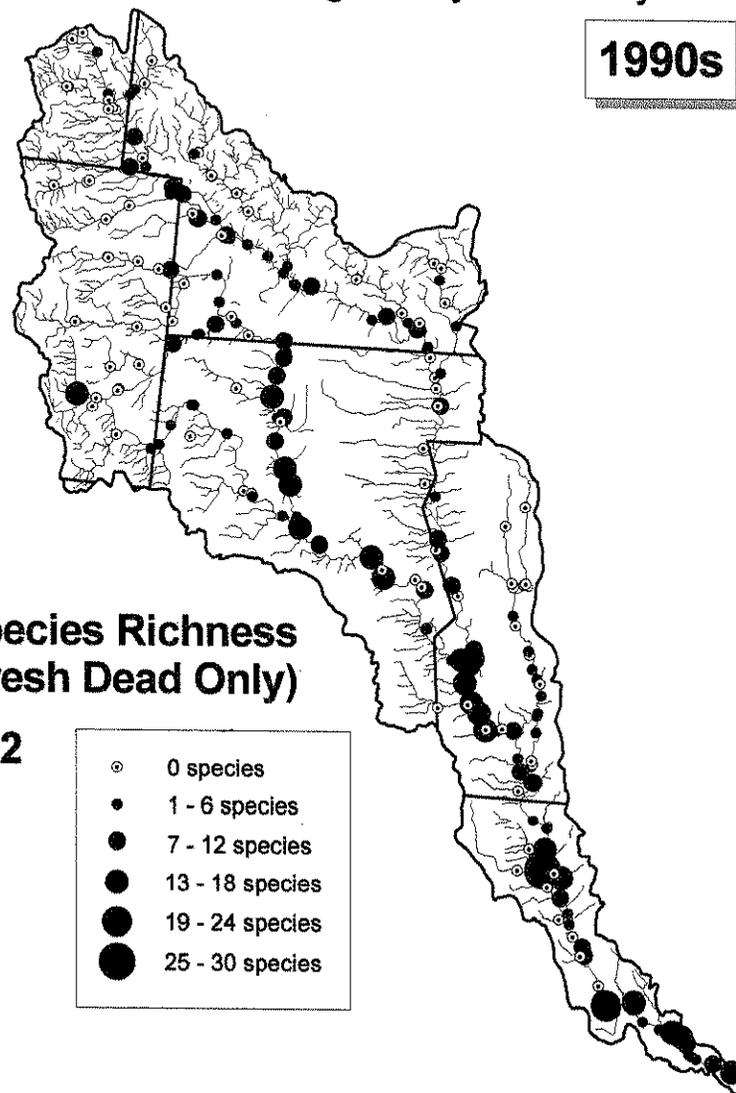
0 3 6 9 12 Kilometers



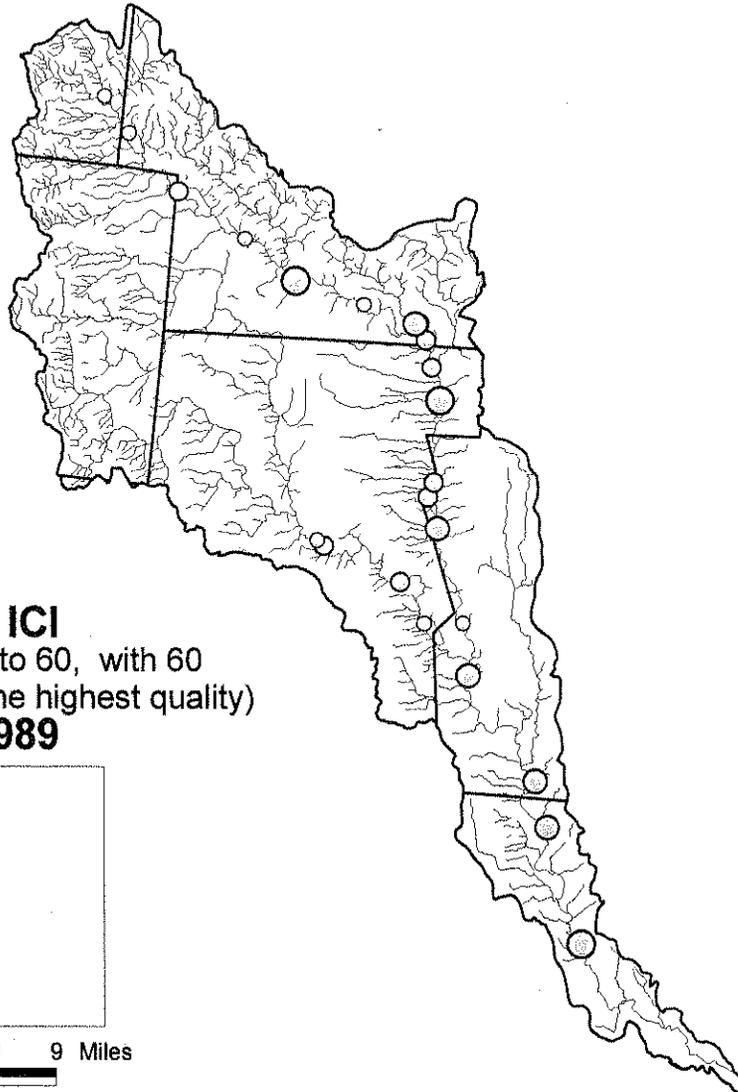
Mussel Species Richness
(Live or Fresh Dead Only)

1990 - 2002

- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species



Invertebrate Community Index (ICI)



0 3 6 9 Miles

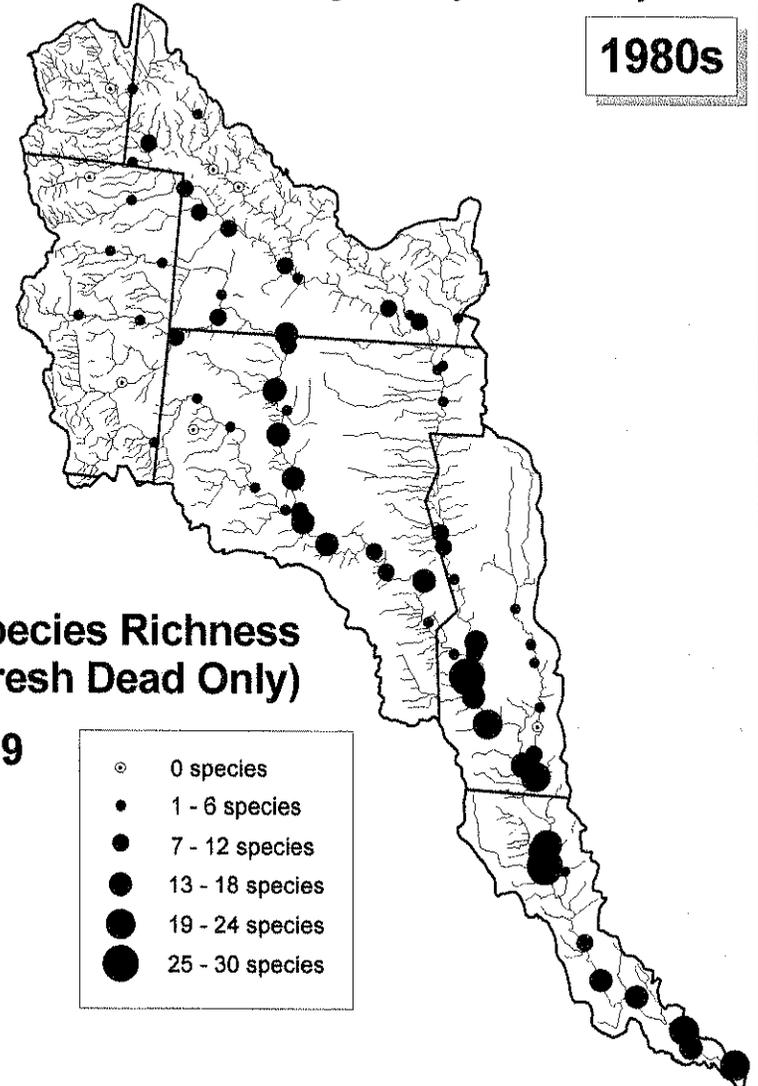
0 3 6 9 12 Kilometers

Big Darby Creek System

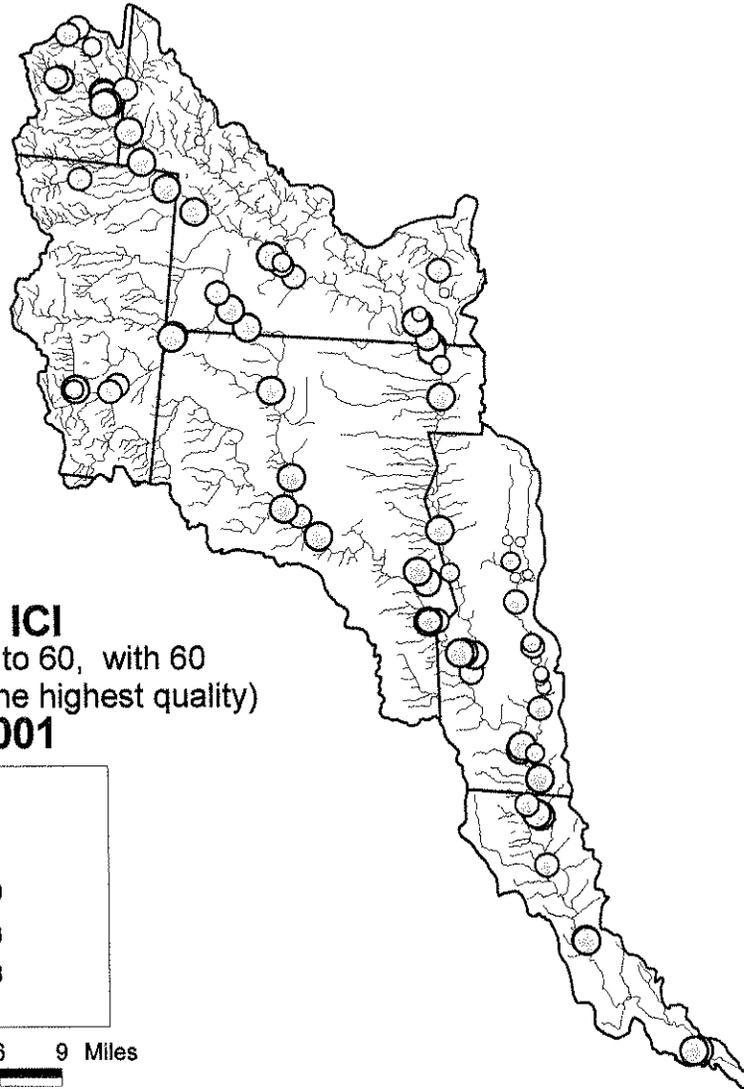
1980s

Mussel Species Richness (Live or Fresh Dead Only)

1980 - 1989



Invertebrate Community Index (ICI)

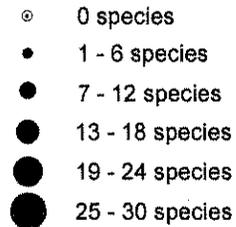


Big Darby Creek System

1990s

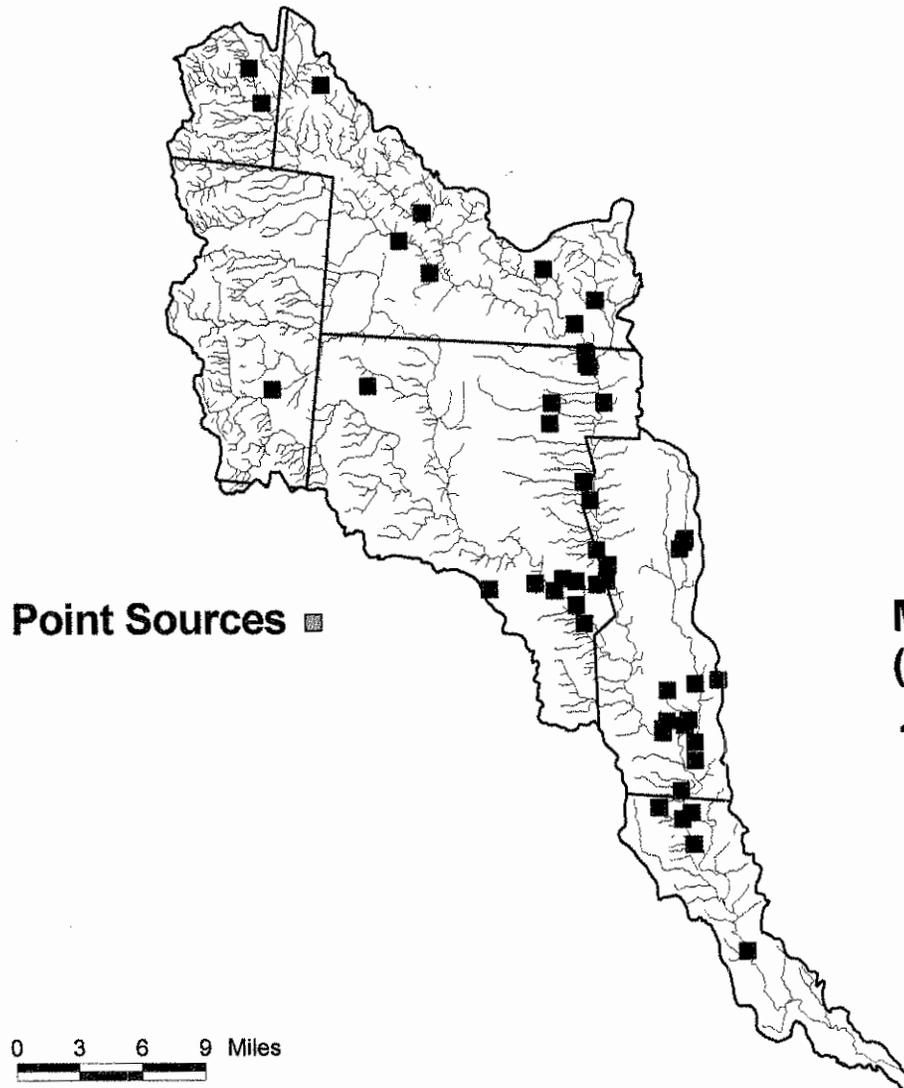
Mussel Species Richness (Live or Fresh Dead Only)

1990 - 2002



Location of NPDES Point Sources

Big Darby Creek System



0 3 6 9 Miles

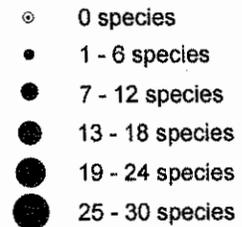


0 3 6 9 12 Kilometers



Mussel Species Richness (Live or Fresh Dead Only)

1990 - 2002



STORET Data

Big Darby Creek System

1970s

Biochemical Oxygen Demand - 5 Day (BOD₅)
(mg/L, at 20 C)

Average, 1968 - 1979

- 0.8 - 2.1
- 2.1 - 4.0
- 4.0 - 7.3
- 7.3 - 49.0
- 49.0 - 91.0

0 3 6 9 Miles

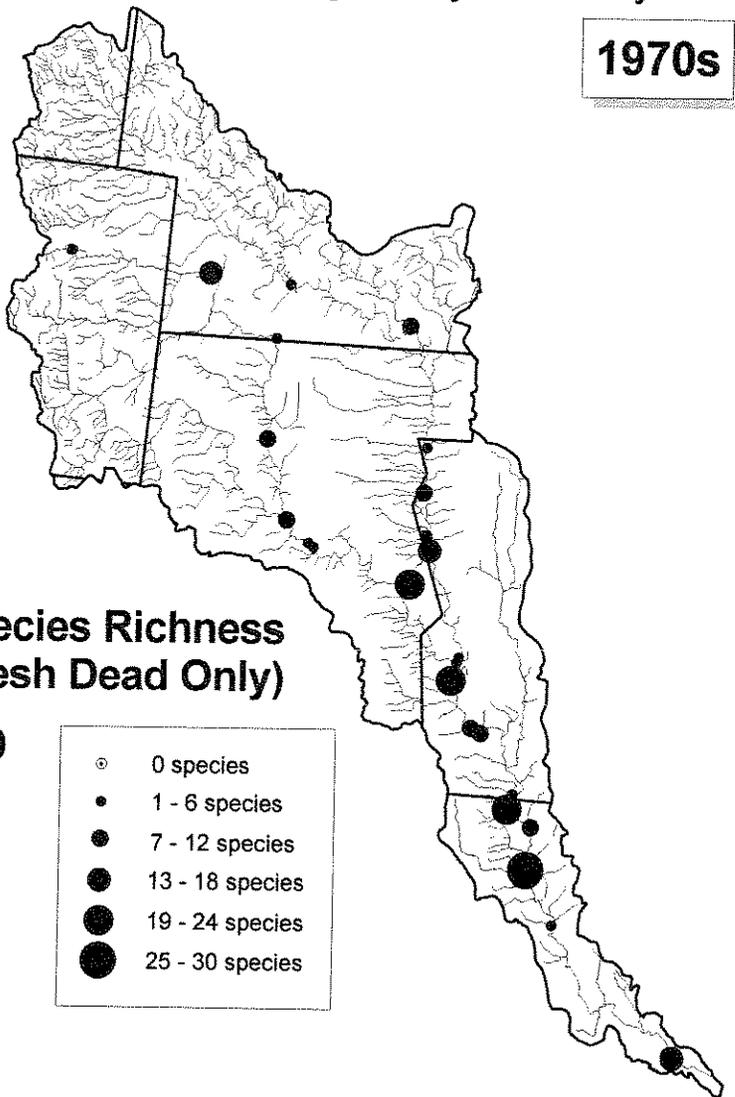
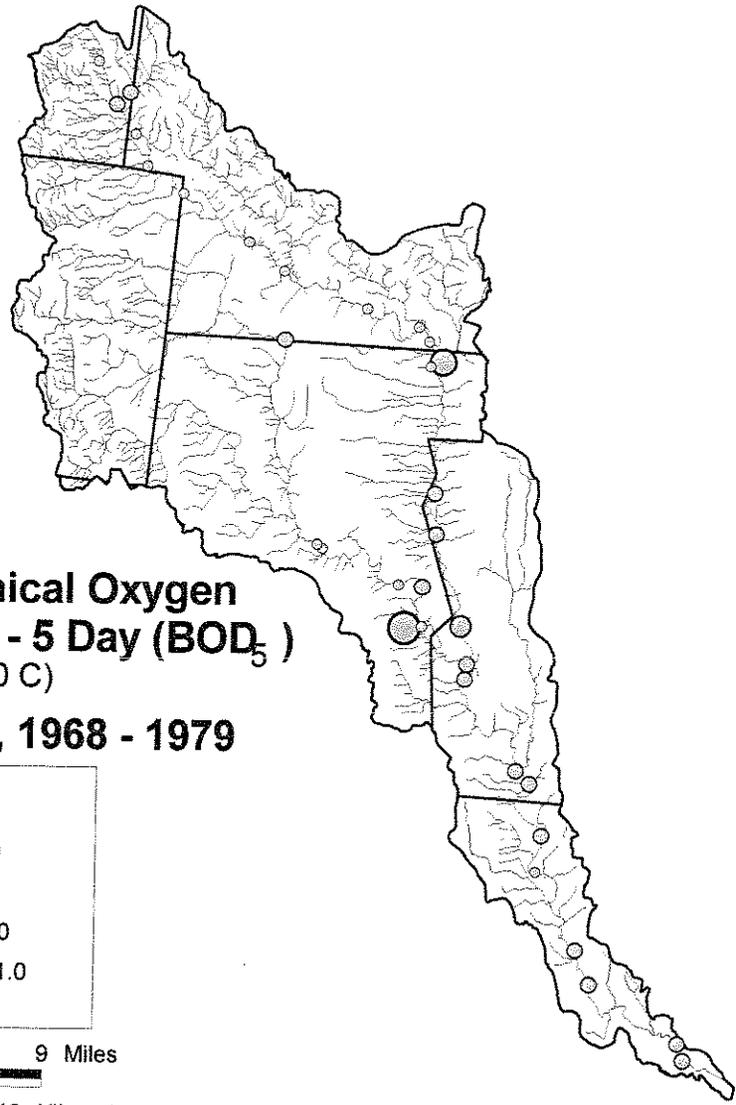
0 3 6 9 12 Kilometers

Mussel Species Richness
(Live or Fresh Dead Only)

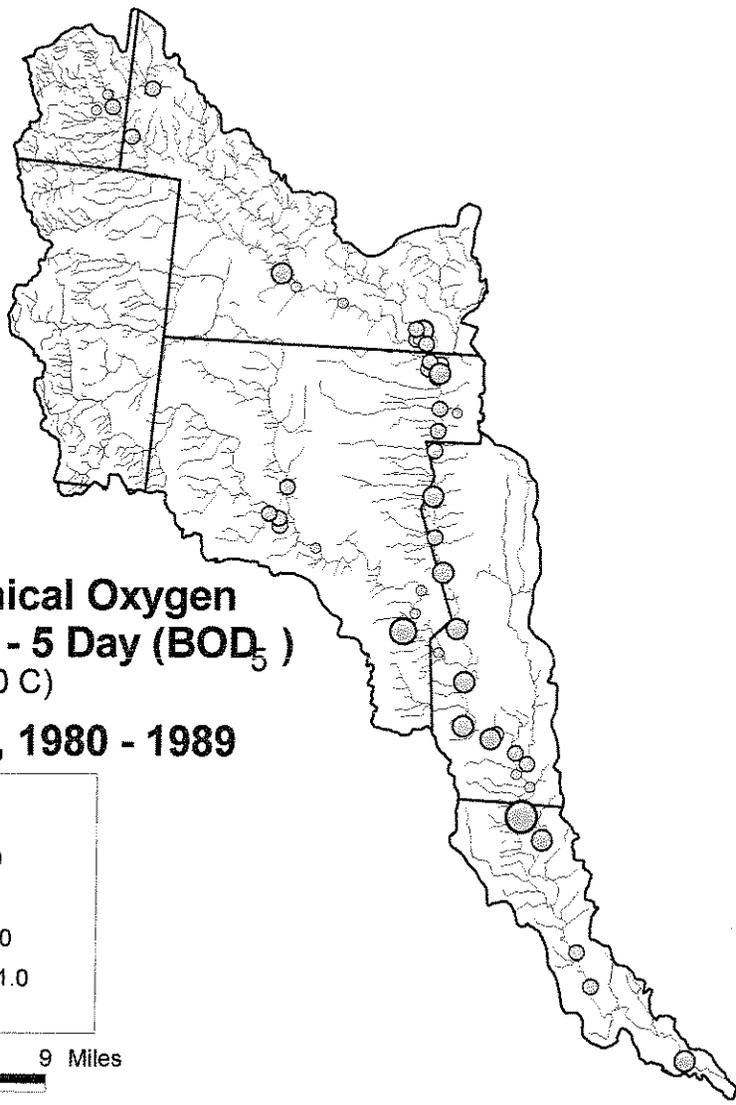
1970 - 1979

- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species

Preliminary report from Watters and Myers Flaute, June 2003



STORET Data

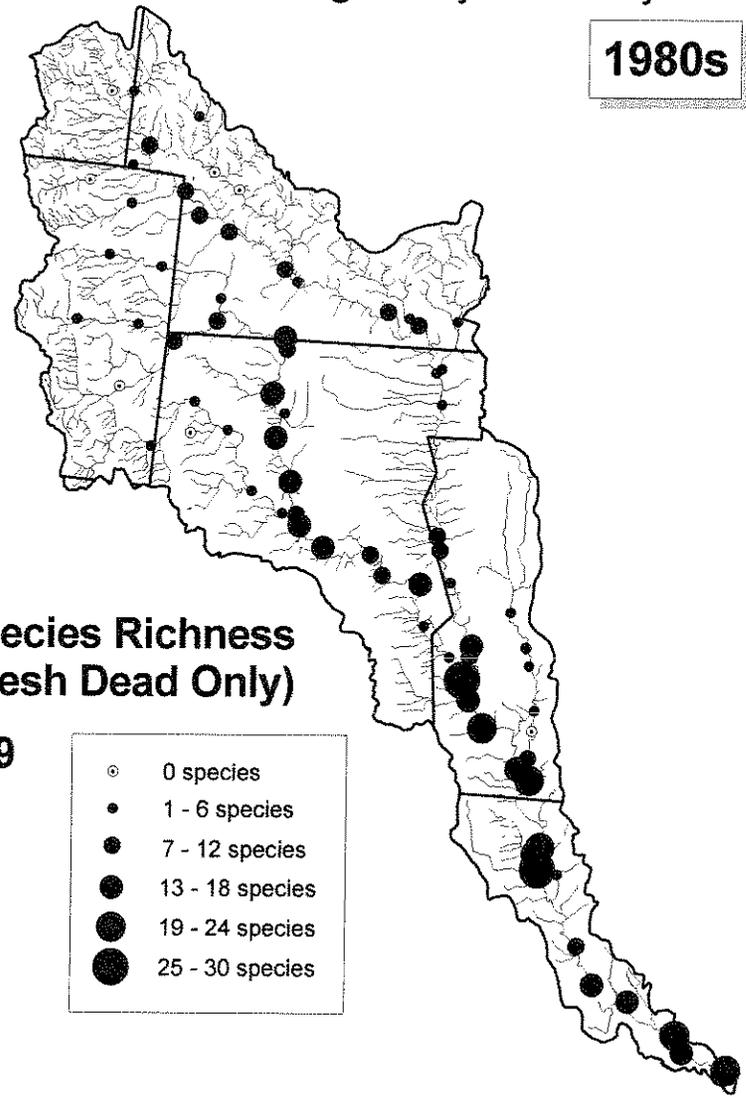


Big Darby Creek System

1980s

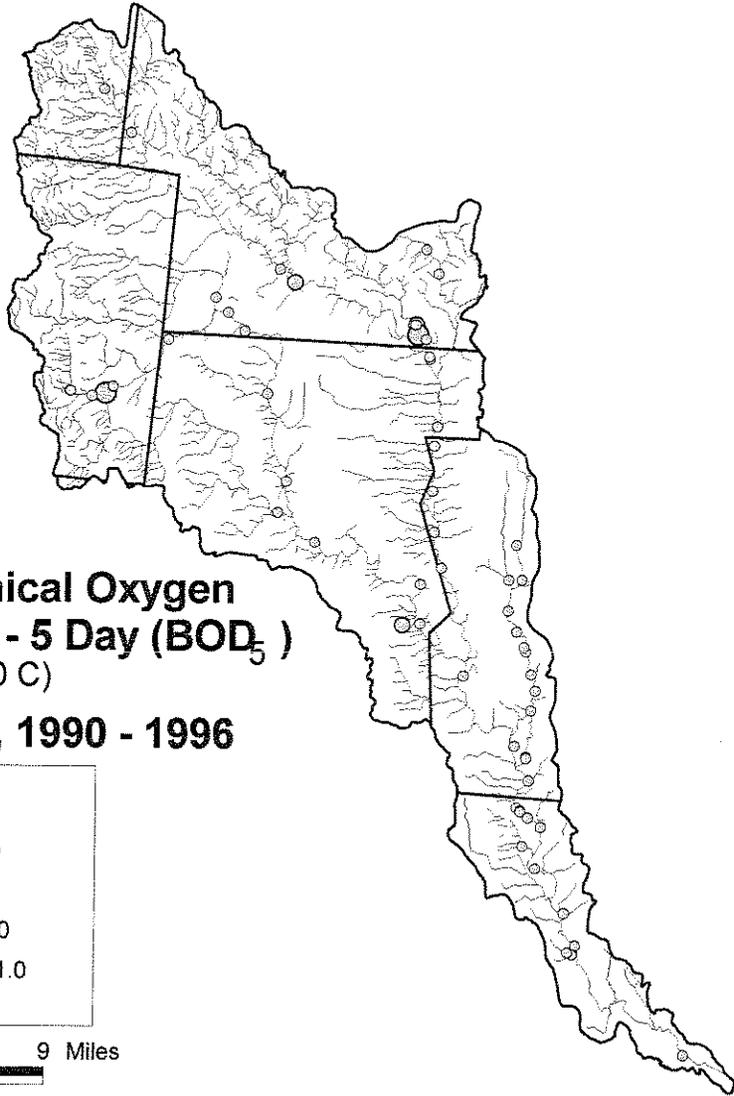
Mussel Species Richness (Live or Fresh Dead Only)

1980 - 1989



Preliminary report from Watters and Myers Flaute, June 2003

STORET Data

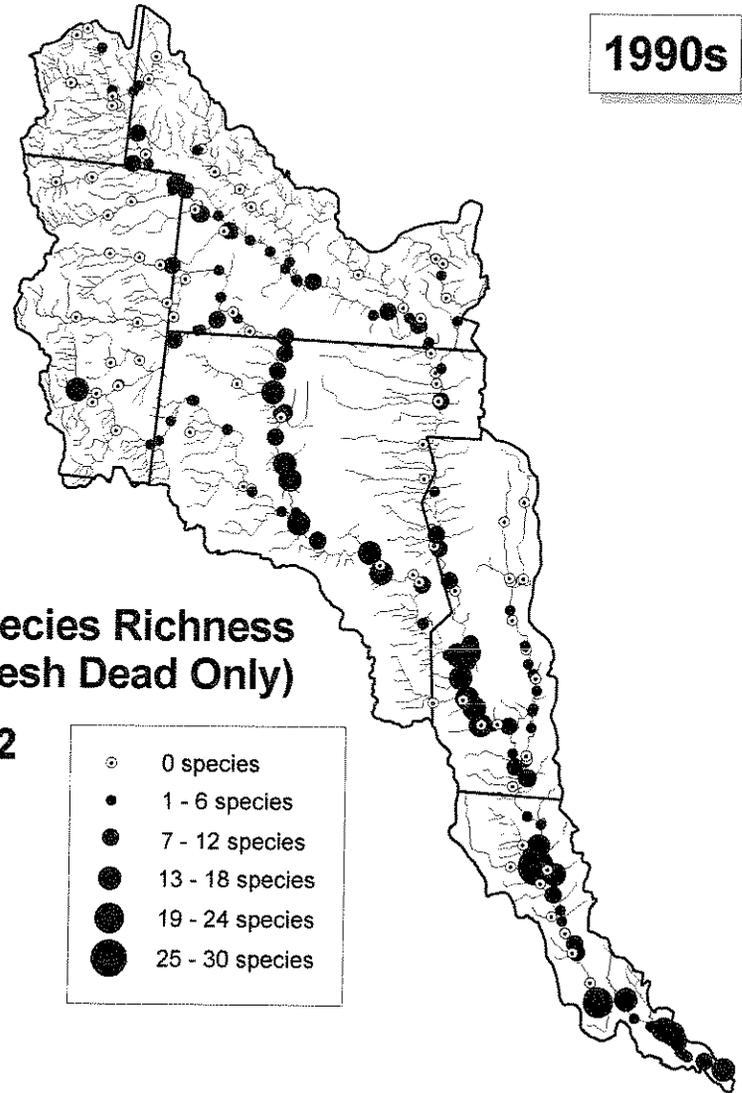


Big Darby Creek System

1990s

Mussel Species Richness (Live or Fresh Dead Only)

1990 - 2002



Preliminary report from Watters and Myers Flaute, June 2003

STORET Data

Big Darby Creek System

1970s

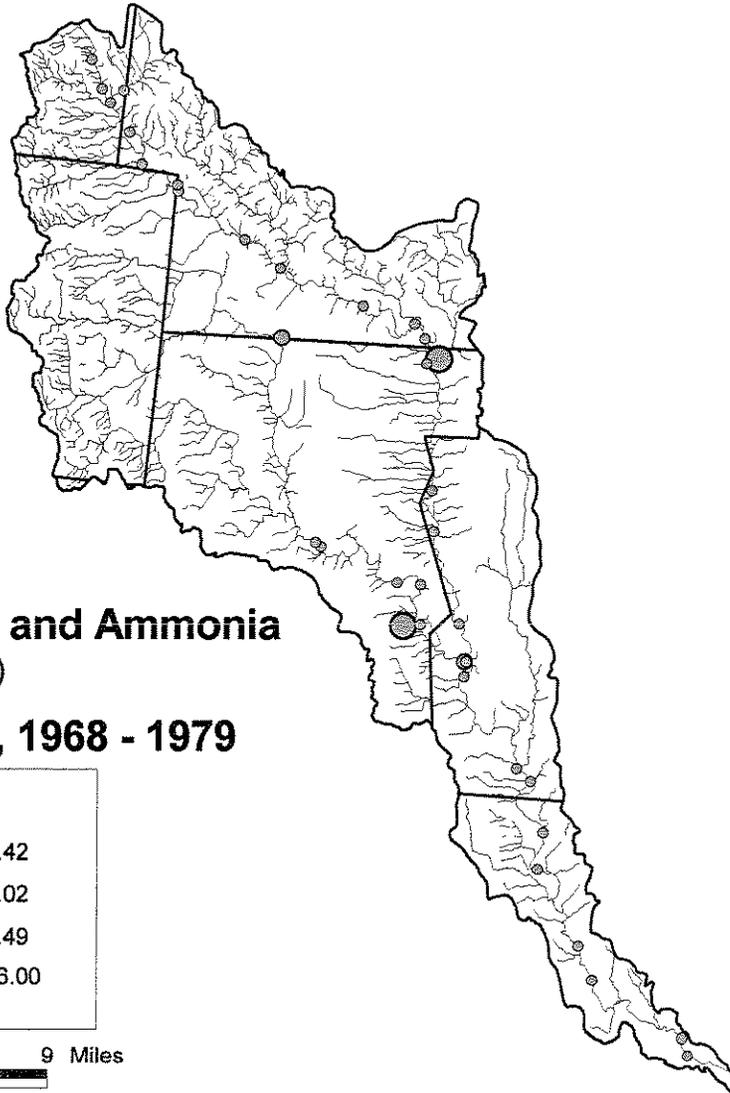
Nitrogen and Ammonia (mg/L as N)

Average, 1968 - 1979

- 0 - 0.14
- 0.14 - 0.42
- 0.42 - 1.02
- 1.02 - 6.49
- 6.49 - 16.00

0 3 6 9 Miles

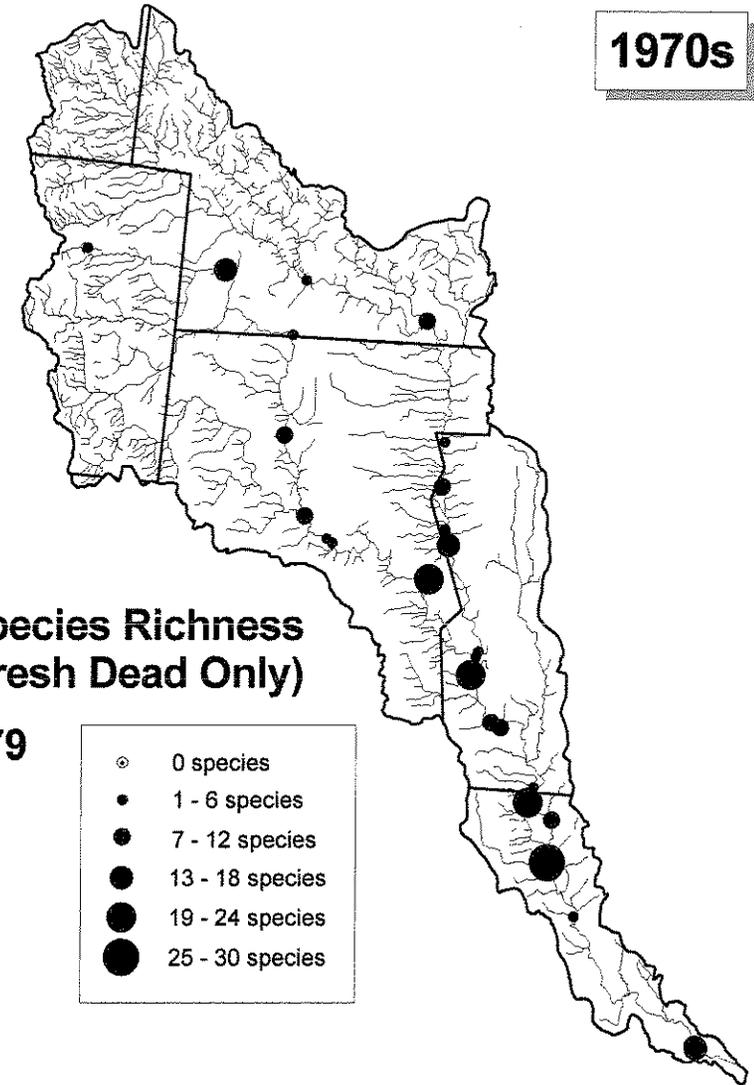
0 3 6 9 12 Kilometers



Mussel Species Richness (Live or Fresh Dead Only)

1970 - 1979

- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species



Preliminary report from Watters and Myers Flaute, June 2003

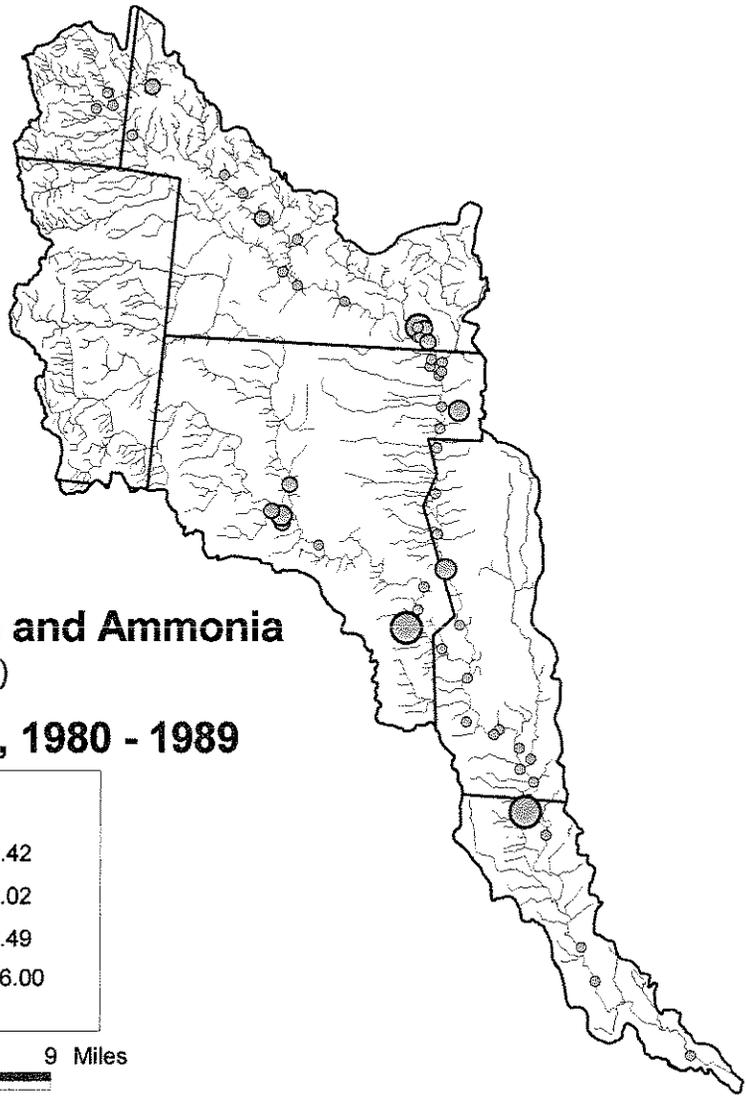
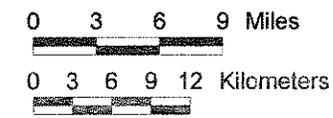
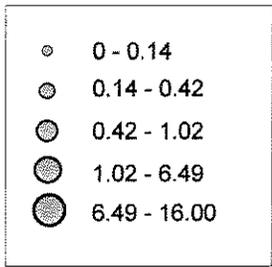
STORET Data

Big Darby Creek System

1980s

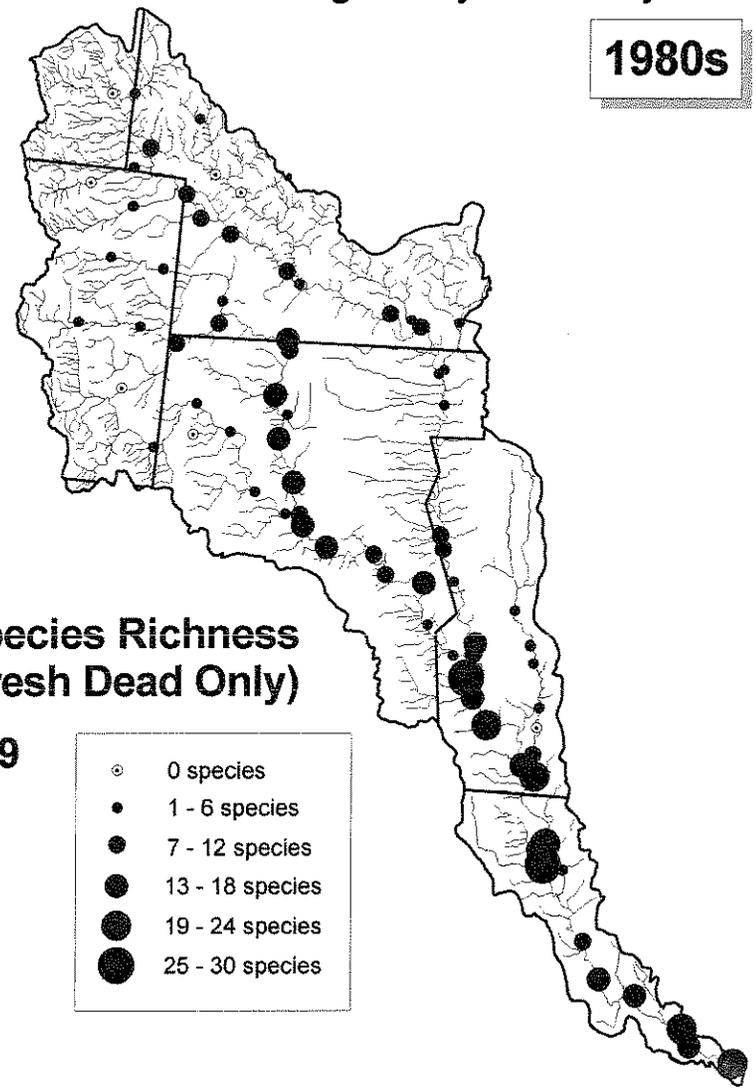
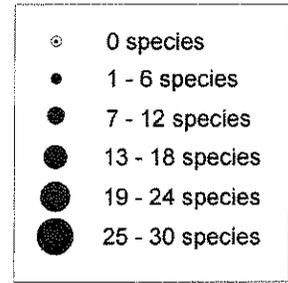
Nitrogen and Ammonia (mg/L as N)

Average, 1980 - 1989



Mussel Species Richness (Live or Fresh Dead Only)

1980 - 1989



Preliminary report from Watters and Myers Flaute, June 2003

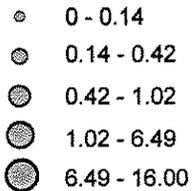
STORET Data

Big Darby Creek System

1990s

Nitrogen and Ammonia (mg/L as N)

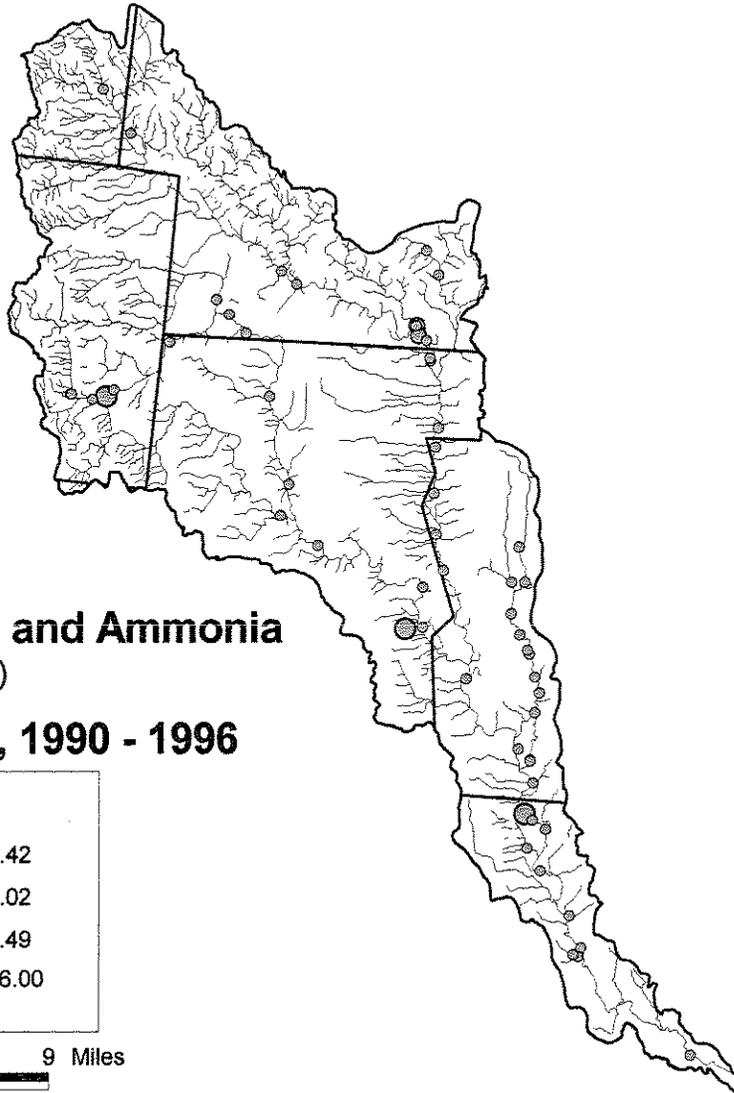
Average, 1990 - 1996



0 3 6 9 Miles

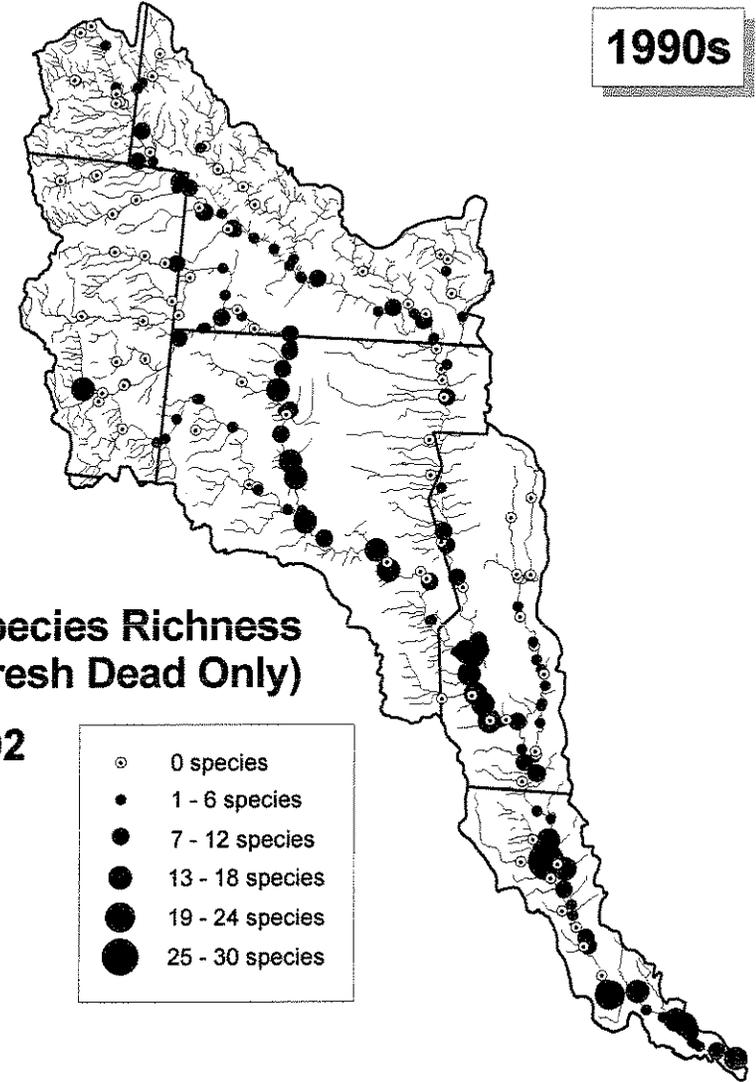
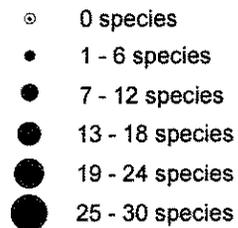


0 3 6 9 12 Kilometers



Mussel Species Richness (Live or Fresh Dead Only)

1990 - 2002



Preliminary report from Watters and Myers Flaute, June 2003

STORET Data

Big Darby Creek System

1970s

Nitrite Nitrogen (mg/L as N)

Average, 1968 - 1979

- 0.01 - 0.05
- 0.05 - 0.11
- 0.11 - 0.23
- 0.23 - 0.54
- 0.54 - 1.36

Mussel Species Richness (Live or Fresh Dead Only)

1970 - 1979

- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species

0 3 6 9 Miles

0 3 6 9 12 Kilometers

Preliminary report from Watters and Myers Flaute, June 2003

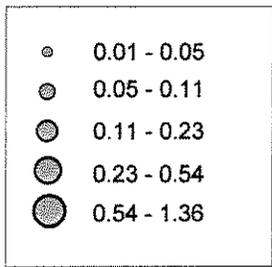
STORET Data

Big Darby Creek System

1980s

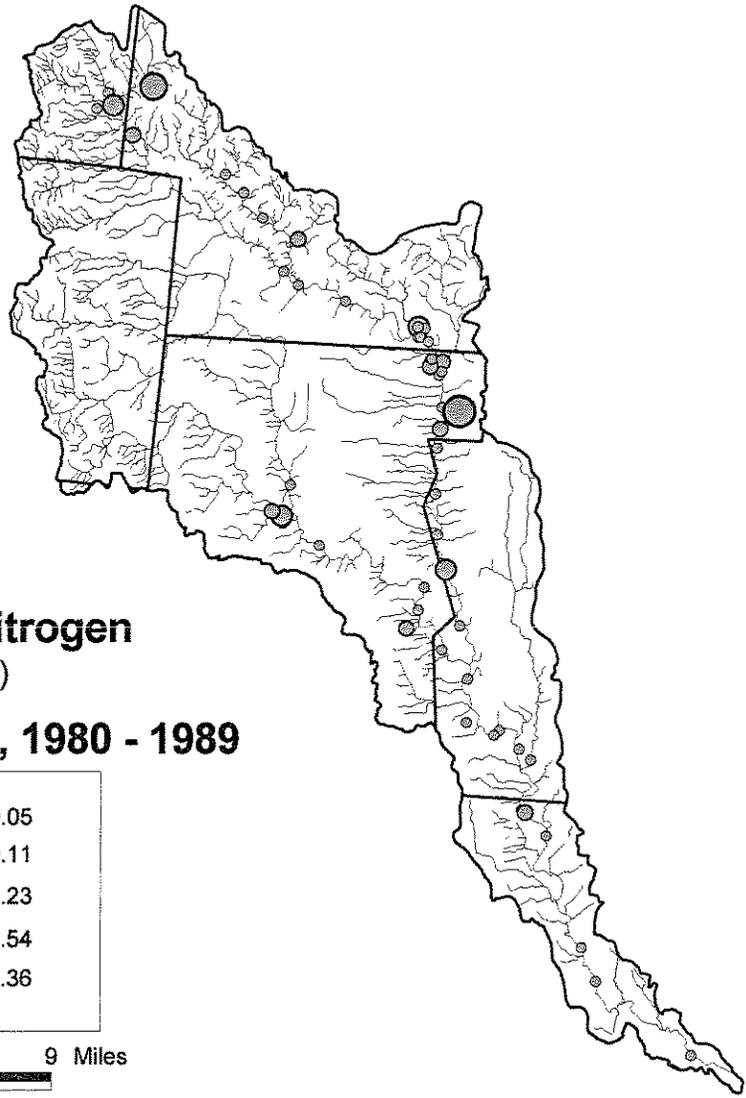
Nitrite Nitrogen (mg/L as N)

Average, 1980 - 1989



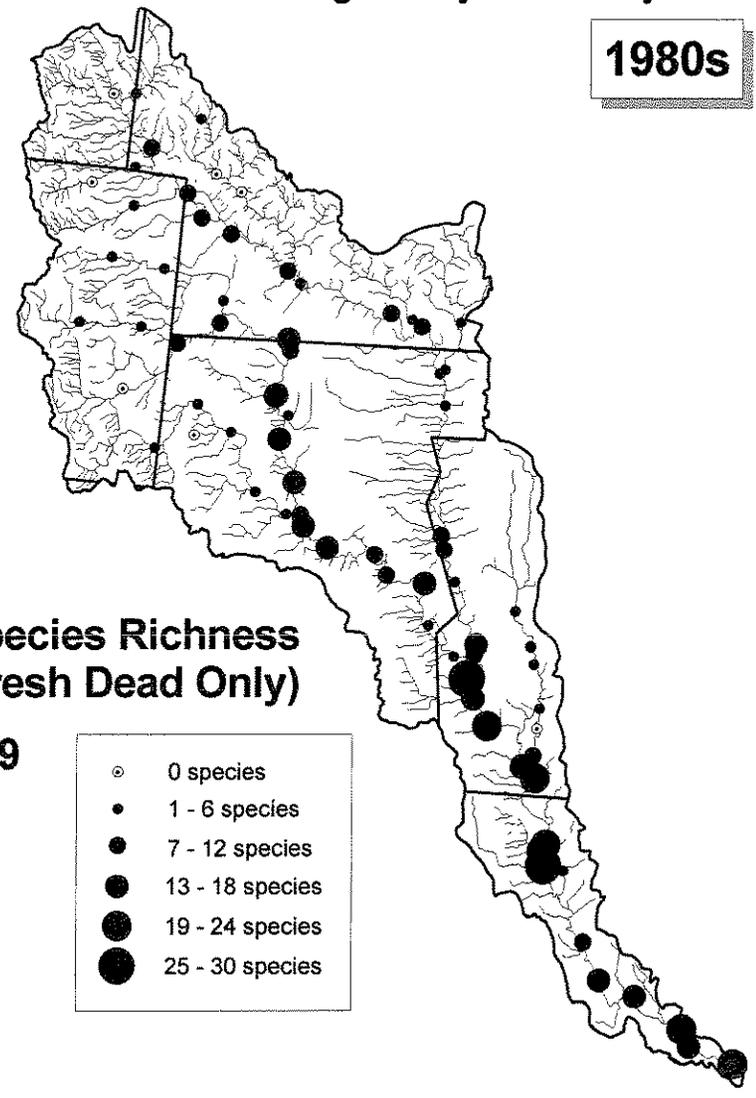
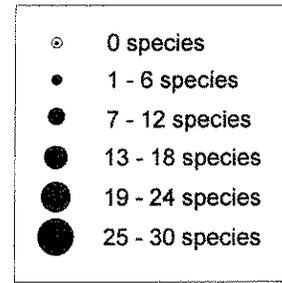
0 3 6 9 Miles

0 3 6 9 12 Kilometers



Mussel Species Richness (Live or Fresh Dead Only)

1980 - 1989

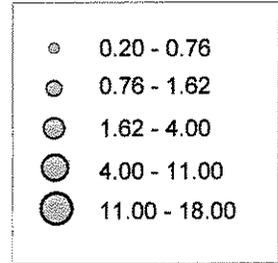


Preliminary report from Watters and Myers Flaute, June 2003

STORET Data

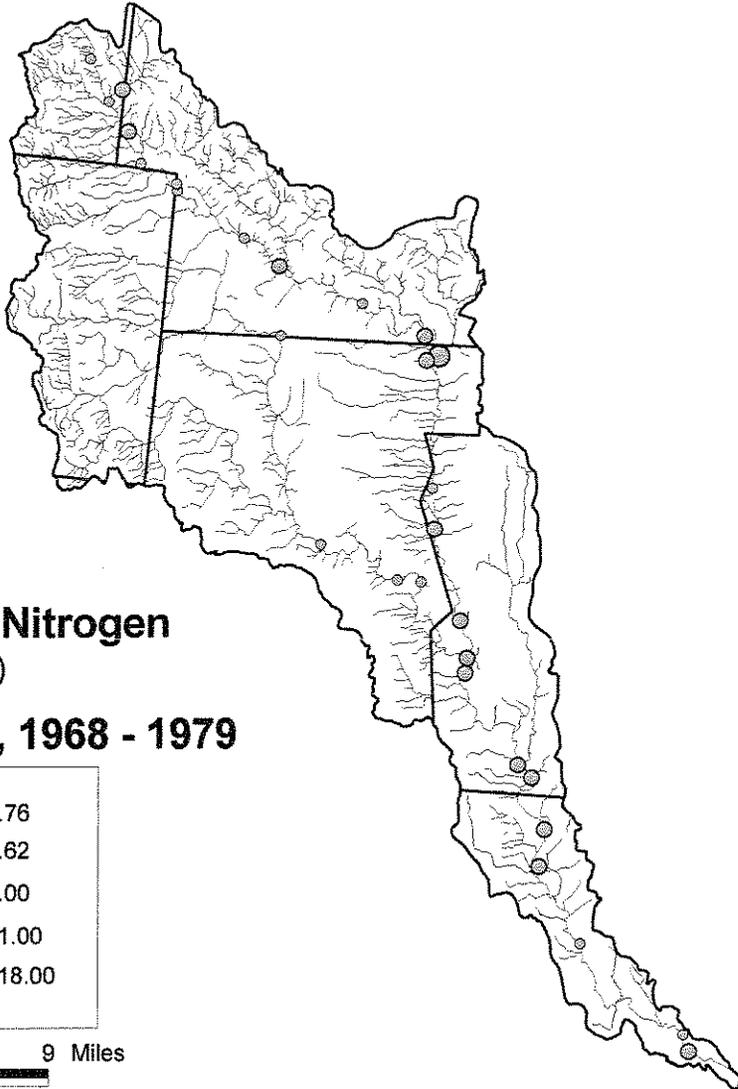
Kjeldahl Nitrogen (mg/L as N)

Average, 1968 - 1979



0 3 6 9 Miles

0 3 6 9 12 Kilometers

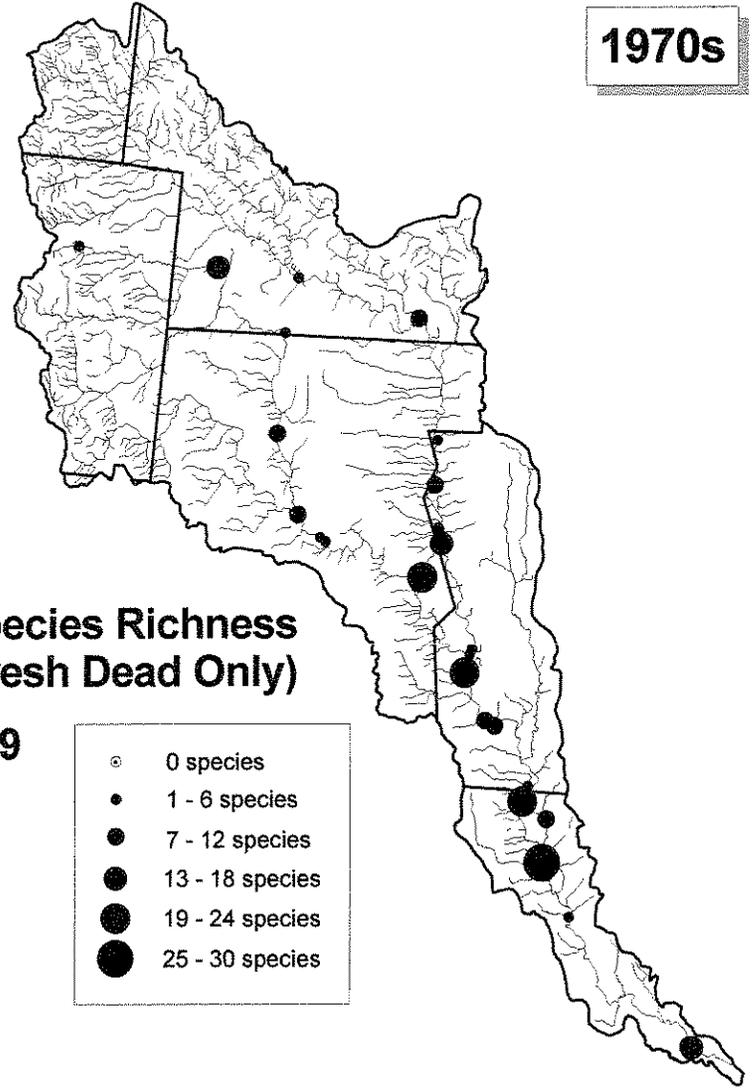
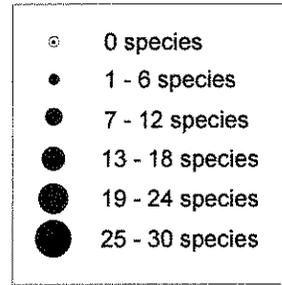


Big Darby Creek System

1970s

Mussel Species Richness (Live or Fresh Dead Only)

1970 - 1979

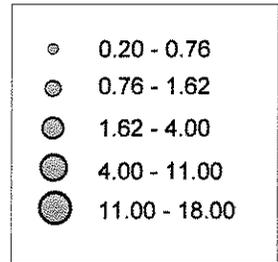


Preliminary report from Watters and Myers Flaute, June 2003

STORET Data

Kjeldahl Nitrogen (mg/L as N)

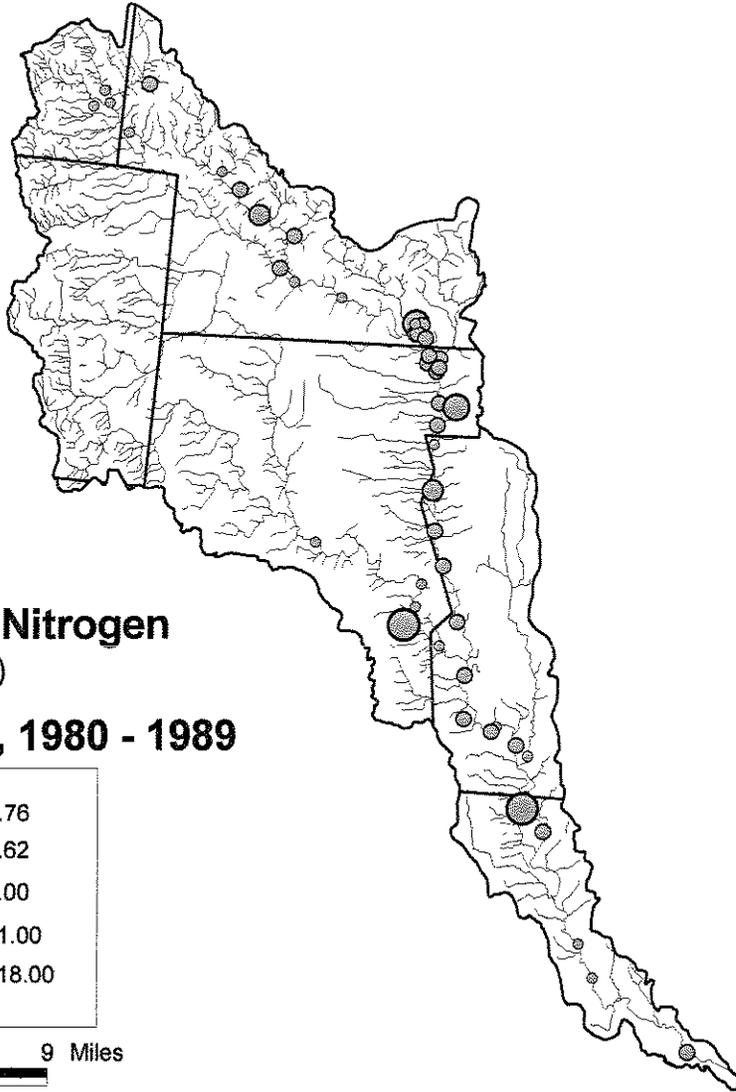
Average, 1980 - 1989



0 3 6 9 Miles



0 3 6 9 12 Kilometers

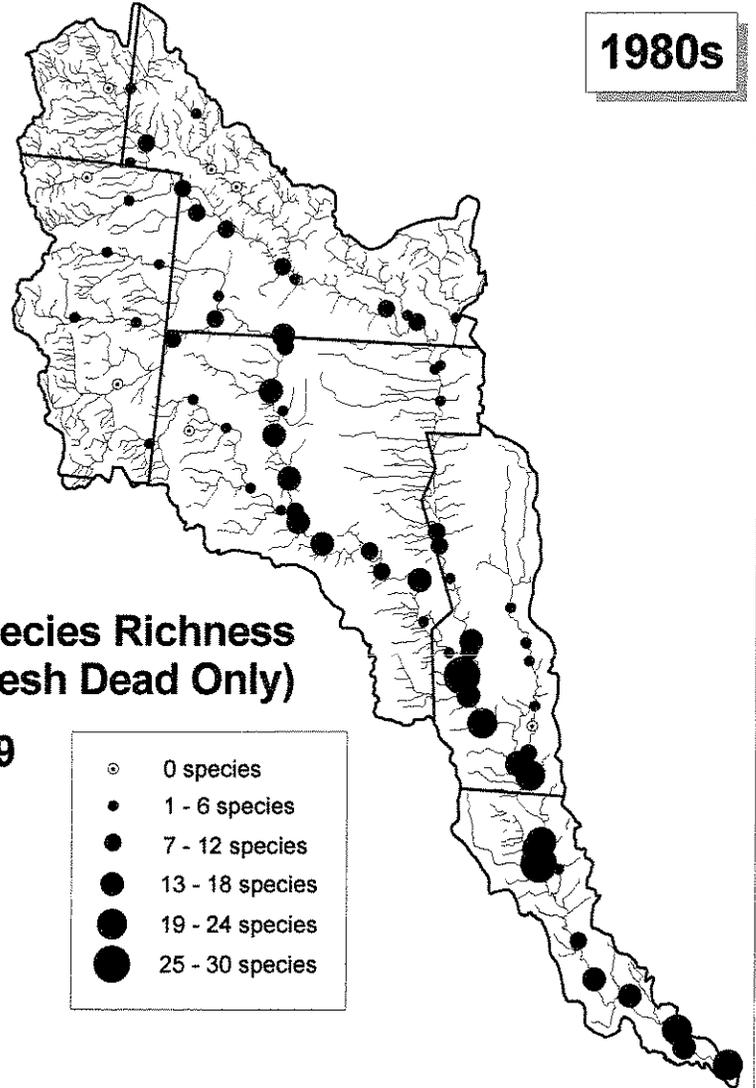
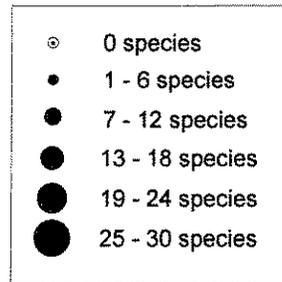


Big Darby Creek System

1980s

Mussel Species Richness (Live or Fresh Dead Only)

1980 - 1989



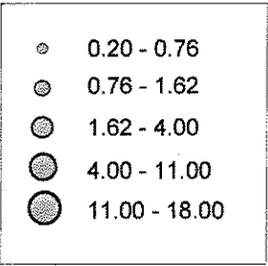
Preliminary report from Watters and Myers Flaute, June 2003

STORET Data

Big Darby Creek System

1990s

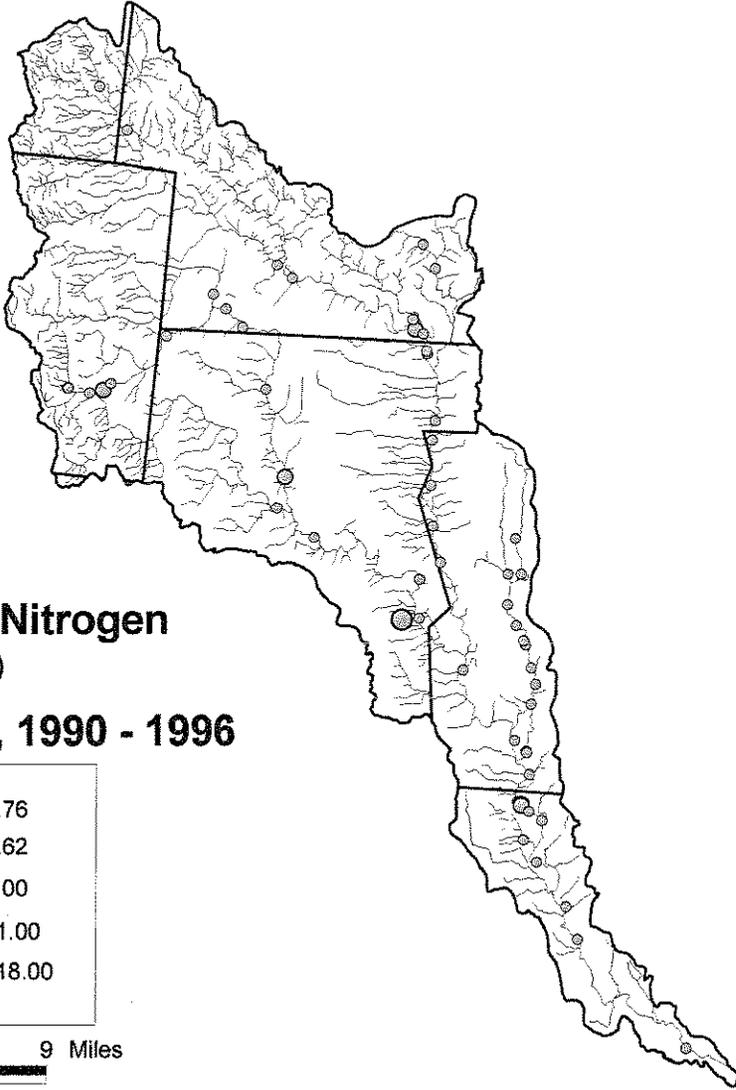
Kjeldahl Nitrogen (mg/L as N) Average, 1990 - 1996



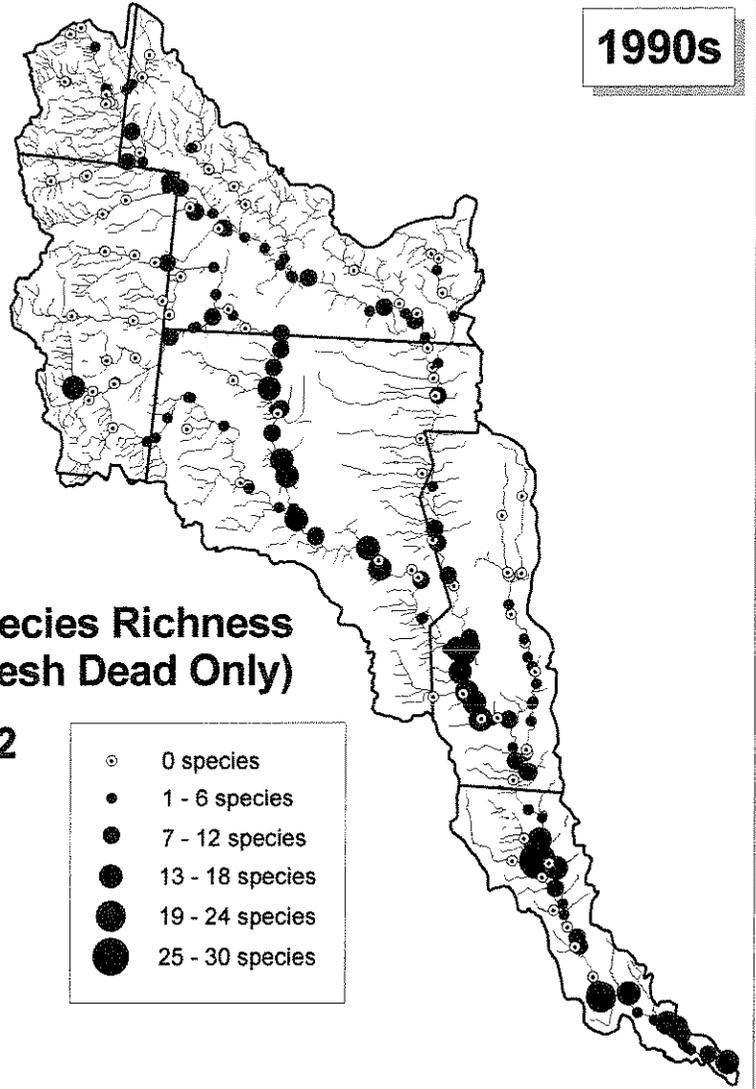
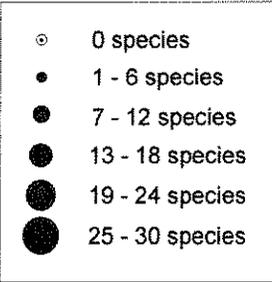
0 3 6 9 Miles



0 3 6 9 12 Kilometers

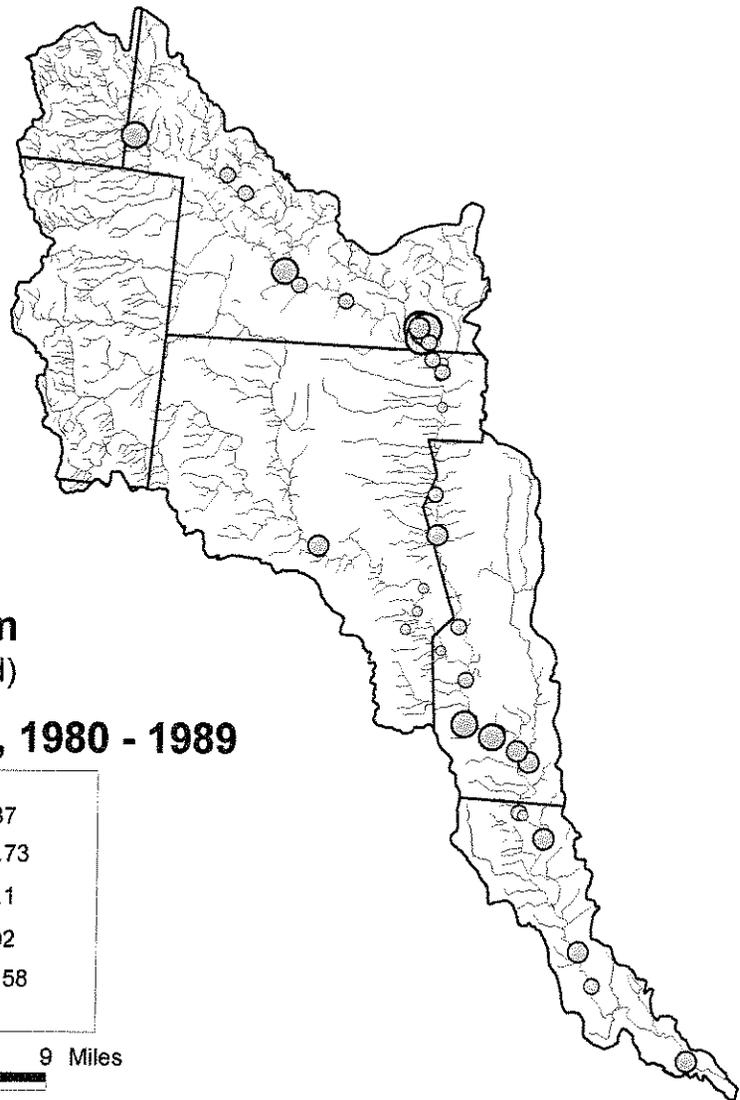


Mussel Species Richness (Live or Fresh Dead Only) 1990 - 2002



Preliminary report from Watters and Myers Flaute, June 2003

STORET Data



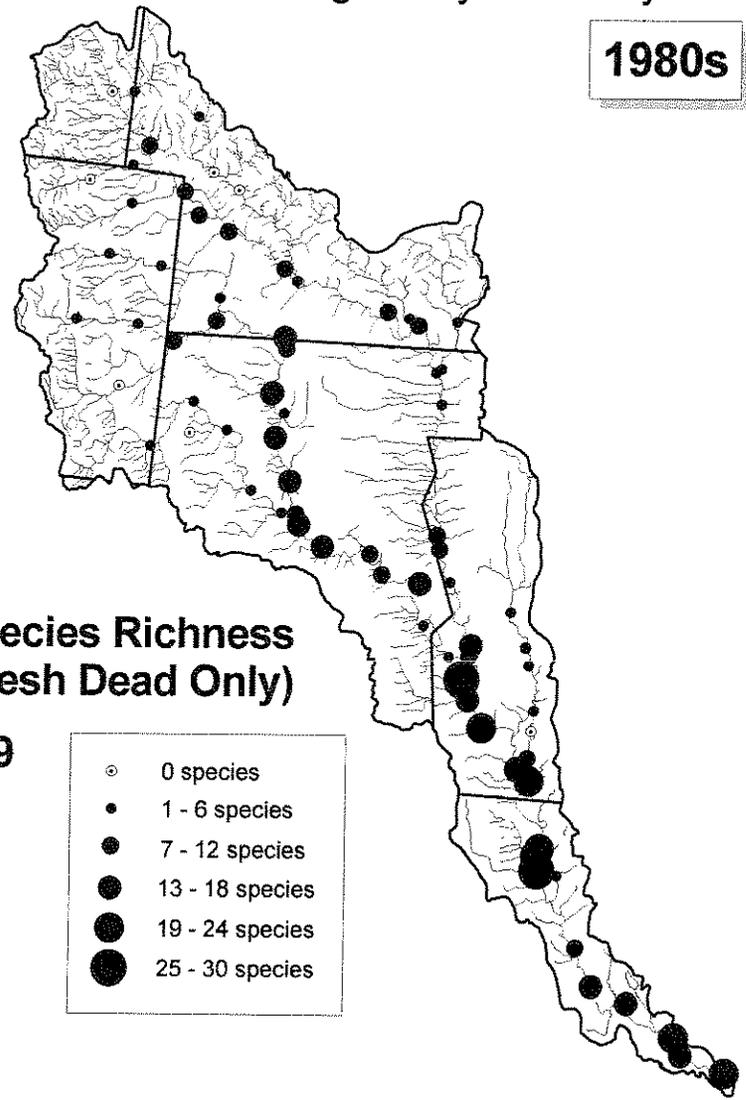
Cadmium
(µg/L as Cd)
Average, 1980 - 1989

- 0.2 - 0.37
- 0.37 - 0.73
- 0.73 - 1.1
- 1.1 - 1.92
- 1.92 - 9.58



Big Darby Creek System

1980s

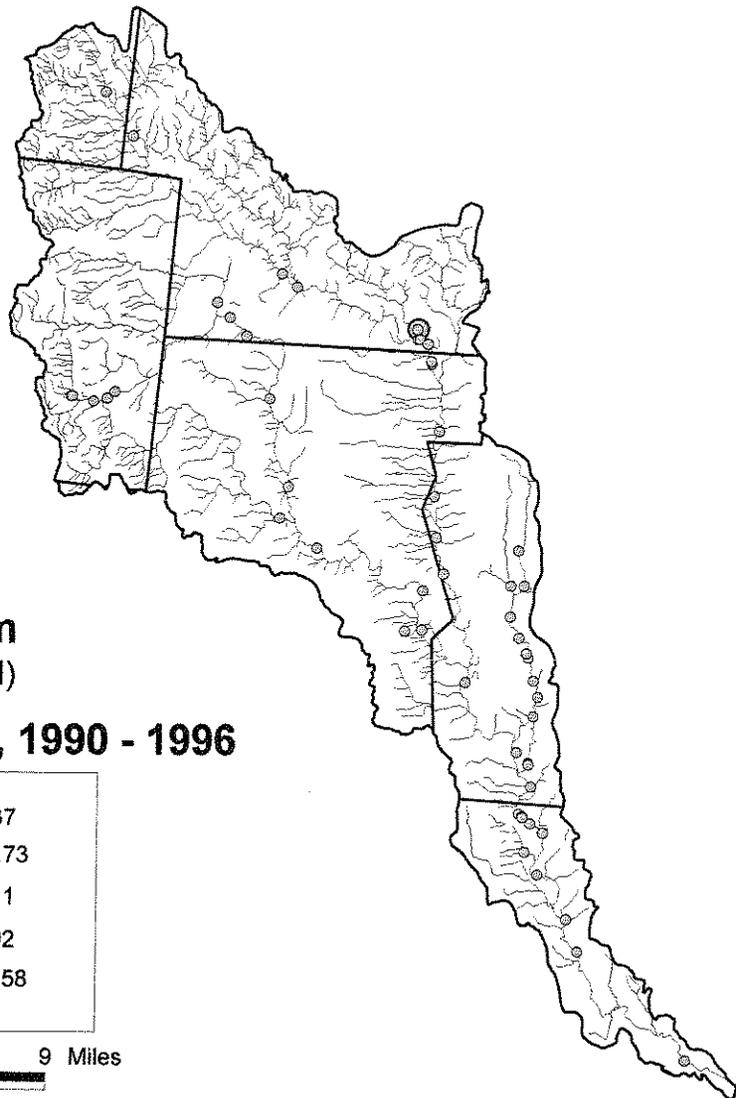


Mussel Species Richness
(Live or Fresh Dead Only)
1980 - 1989

- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species

Preliminary report from Watters and Myers Flaute, June 2003

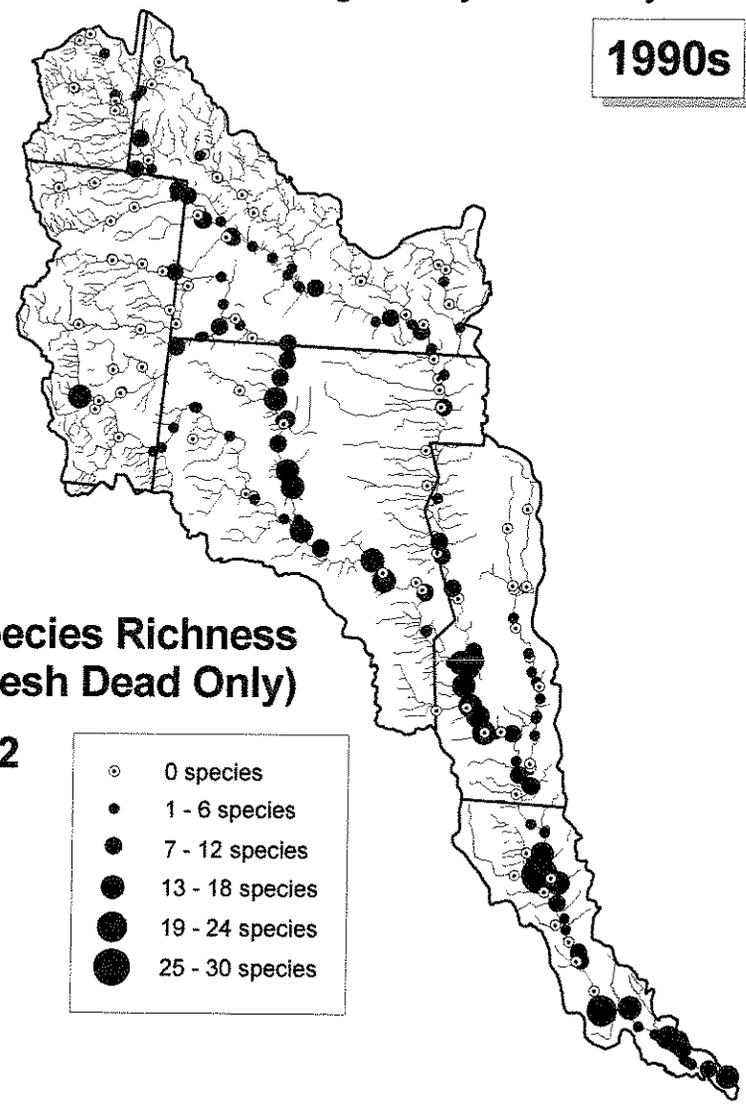
STORET Data



Big Darby Creek System

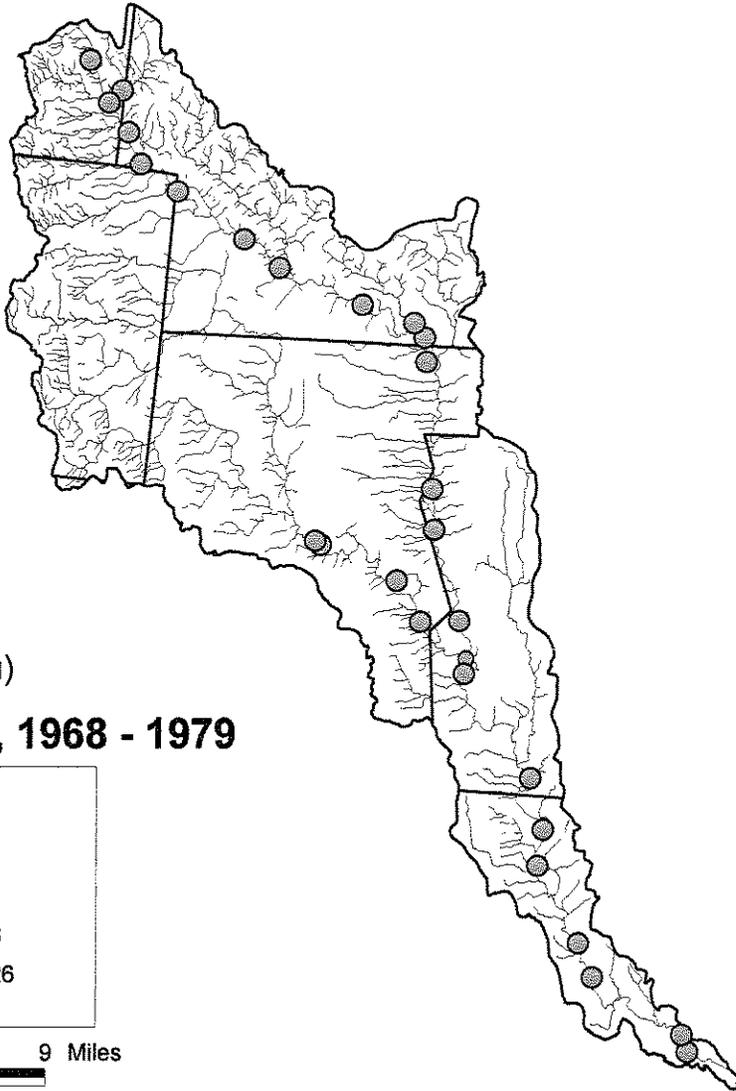
1990s

Mussel Species Richness (Live or Fresh Dead Only) 1990 - 2002



Preliminary report from Watters and Myers Flaute, June 2003

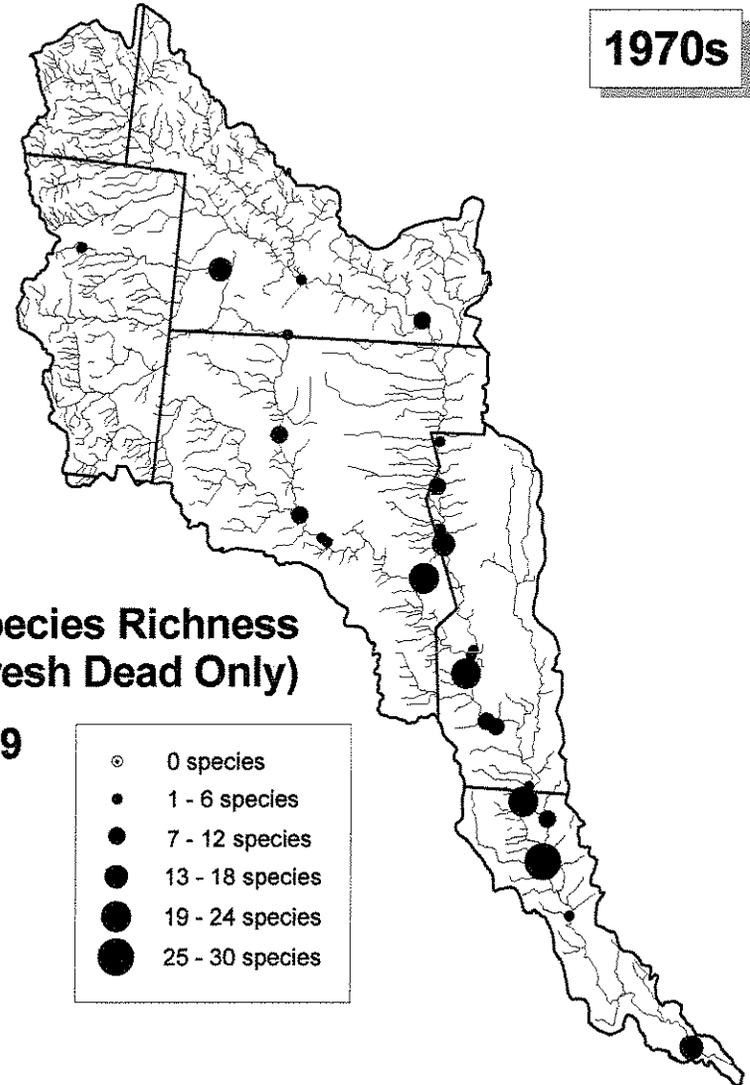
STORET Data



Big Darby Creek System

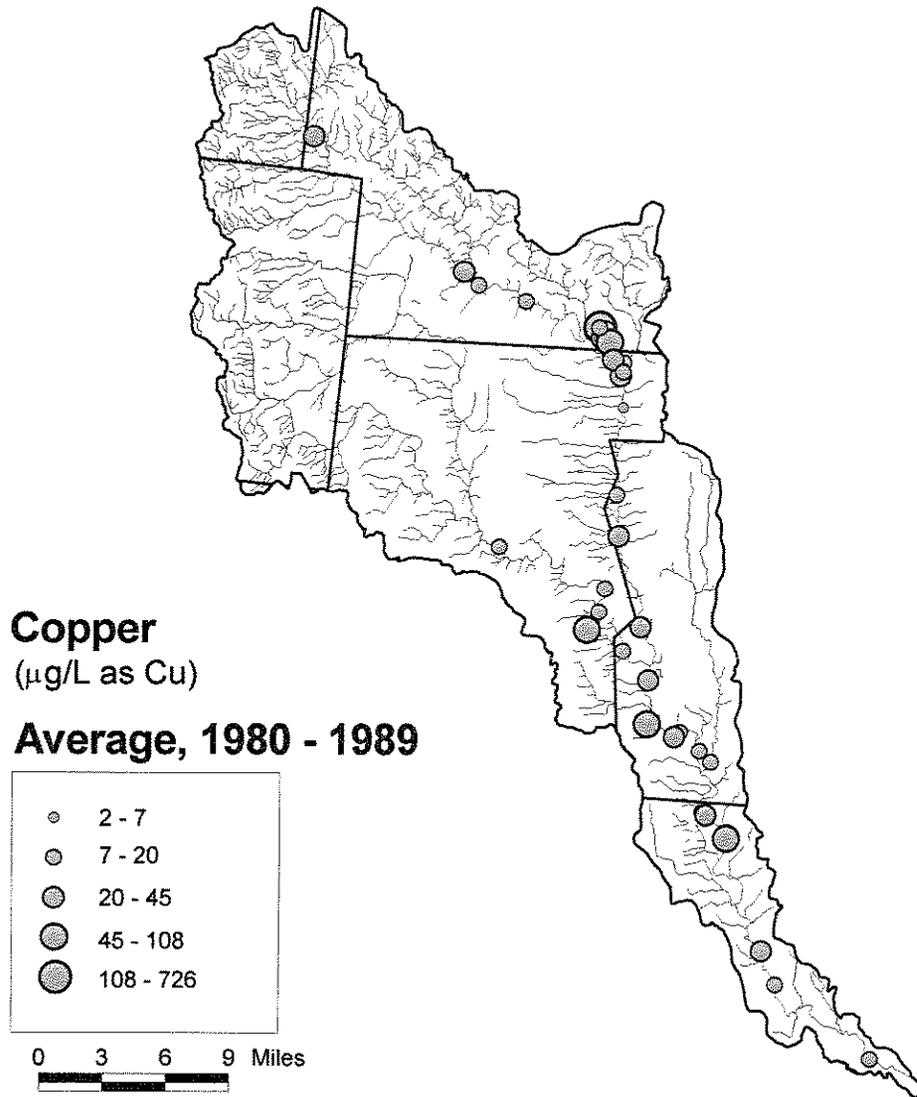
1970s

Mussel Species Richness (Live or Fresh Dead Only) 1970 - 1979



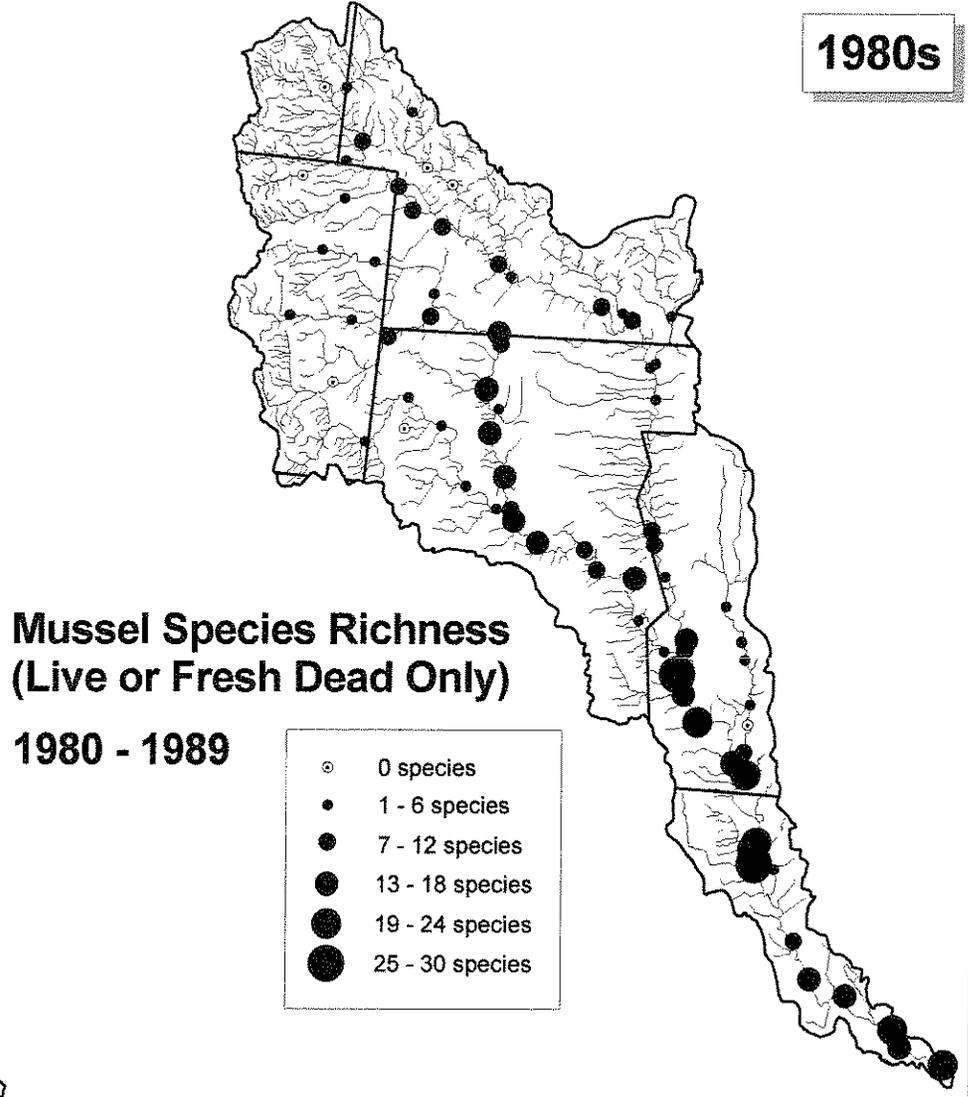
Preliminary report from Watters and Myers Flaute, June 2003

STORET Data



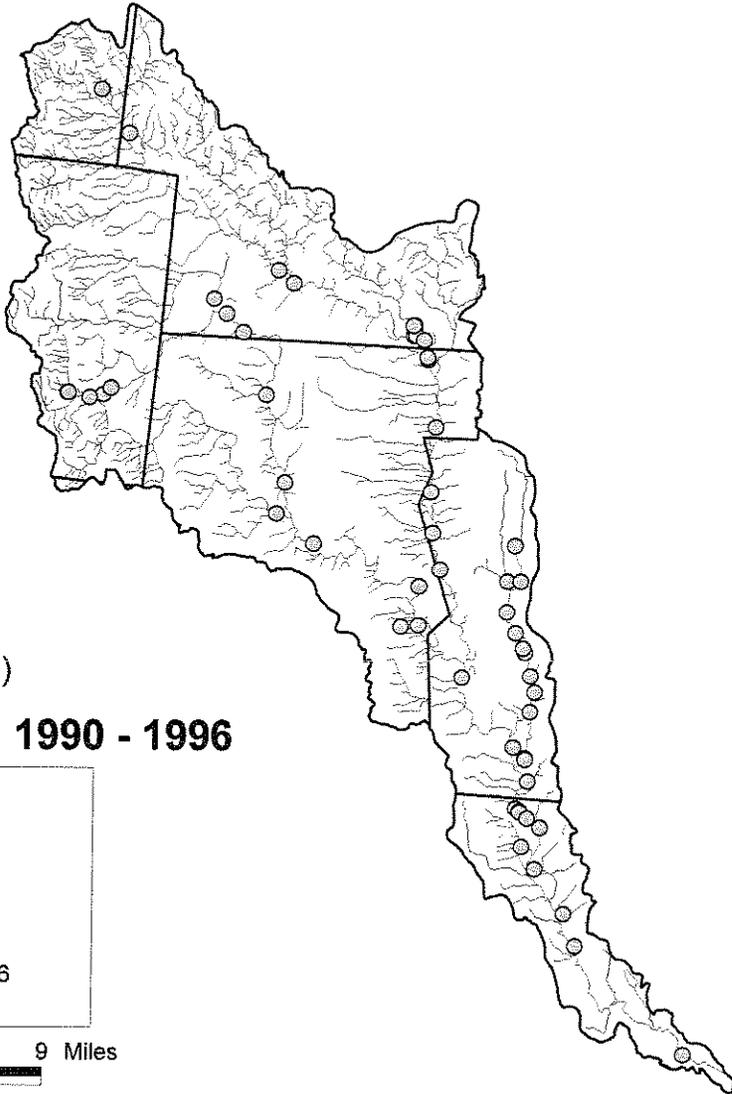
Big Darby Creek System

1980s



Preliminary report from Watters and Myers Flaute, June 2003

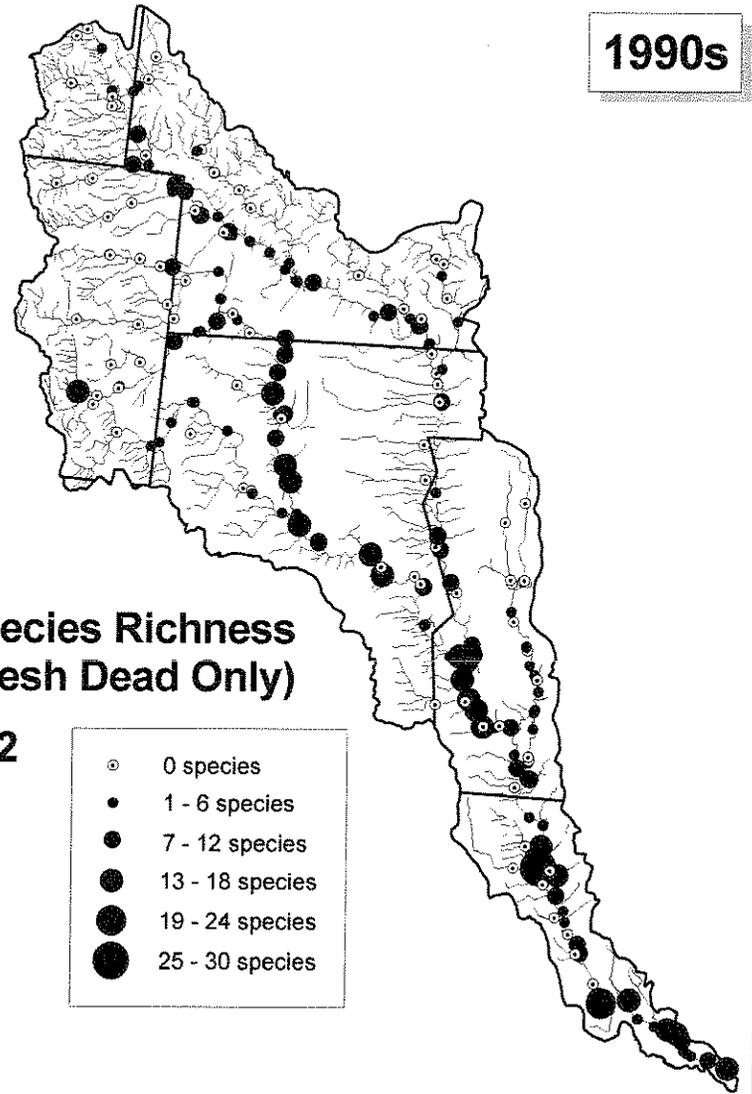
STORET Data



Big Darby Creek System

1990s

Mussel Species Richness (Live or Fresh Dead Only) 1990 - 2002



Preliminary report from Watters and Myers Flaute, June 2003

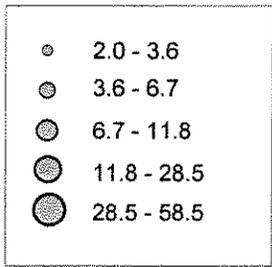
STORET Data

Big Darby Creek System

1970s

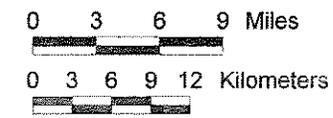
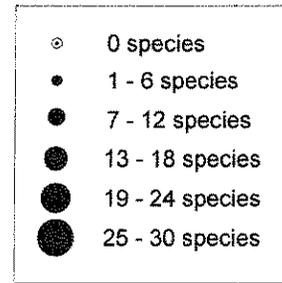
Lead
($\mu\text{g/L}$ as Pb)

Average, 1968 - 1979



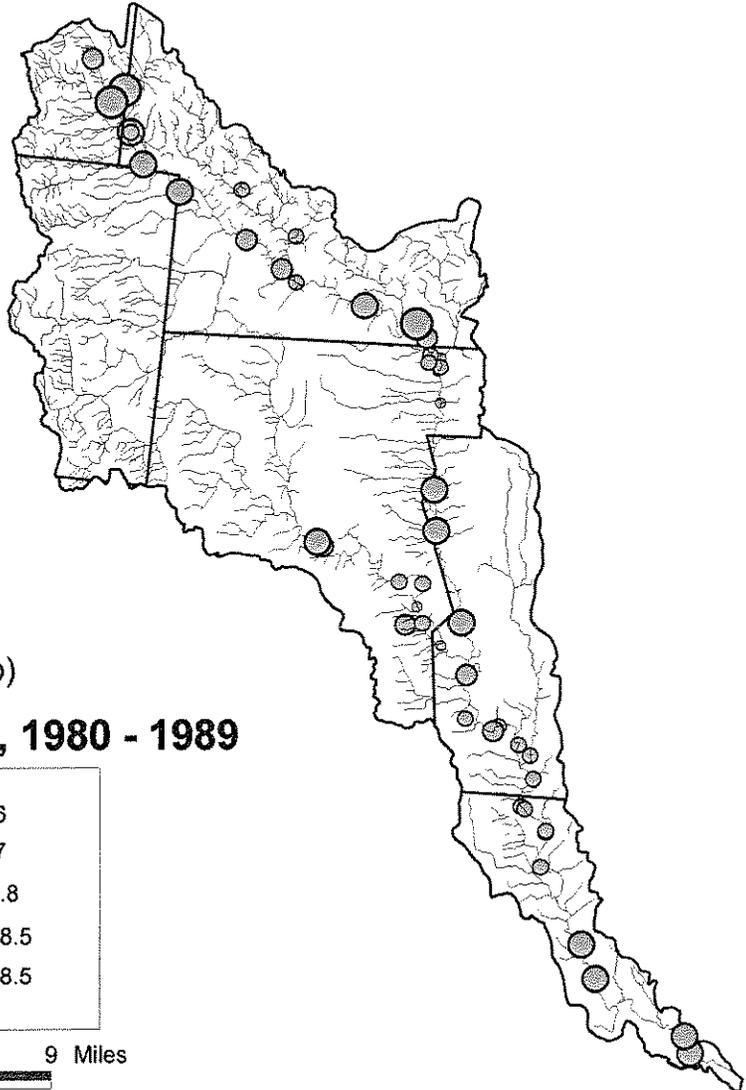
Mussel Species Richness
(Live or Fresh Dead Only)

1970 - 1979



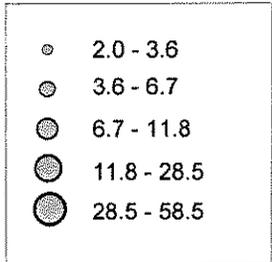
Preliminary report from Watters and Myers Flaute, June 2003

STORET Data



Lead
($\mu\text{g/L}$ as Pb)

Average, 1980 - 1989



0 3 6 9 Miles

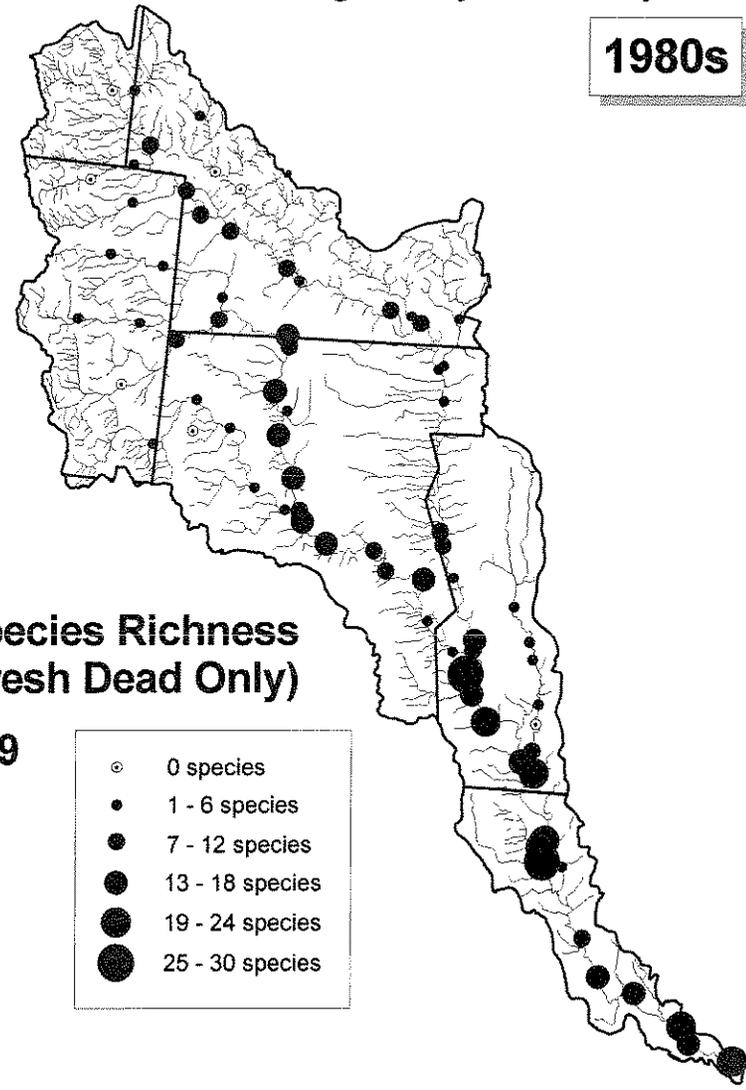


0 3 6 9 12 Kilometers



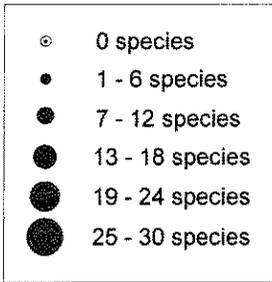
Big Darby Creek System

1980s



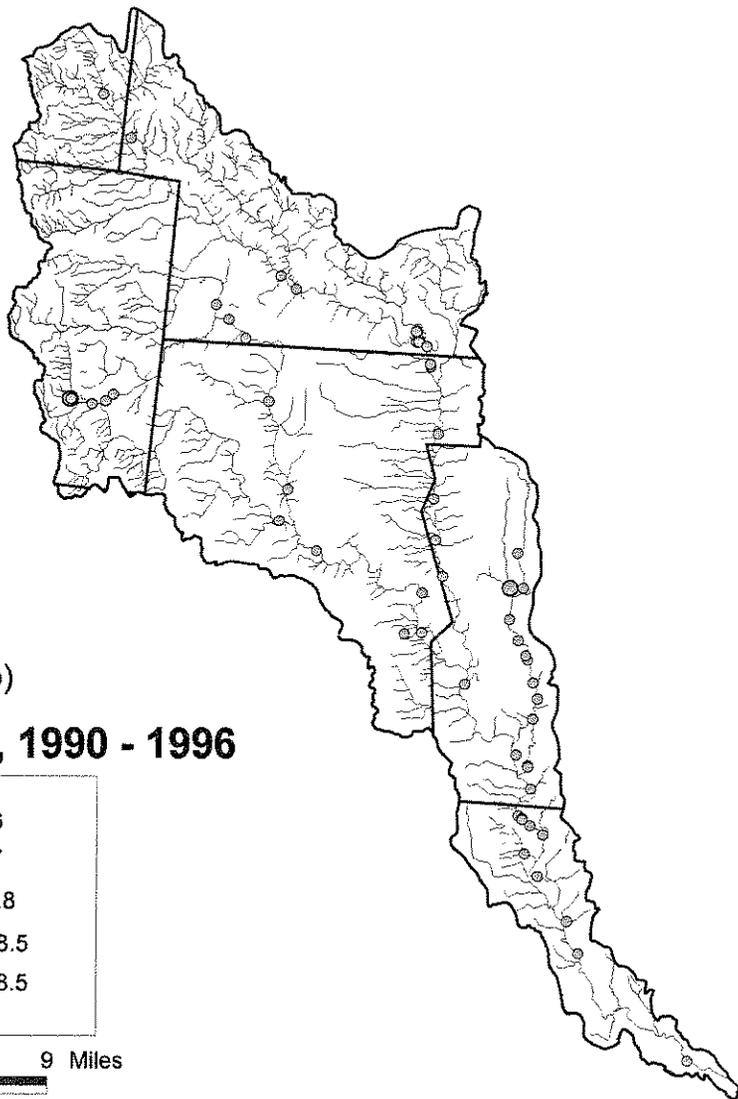
Mussel Species Richness
(Live or Fresh Dead Only)

1980 - 1989



Preliminary report from Watters and Myers Flaute, June 2003

STORET Data



Lead
($\mu\text{g/L}$ as Pb)

Average, 1990 - 1996

- 2.0 - 3.6
- 3.6 - 6.7
- 6.7 - 11.8
- 11.8 - 28.5
- 28.5 - 58.5

0 3 6 9 Miles

0 3 6 9 12 Kilometers

Big Darby Creek System

1990s

Mussel Species Richness
(Live or Fresh Dead Only)

1990 - 2002

- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species

Preliminary report from Watters and Myers Flaute, June 2003

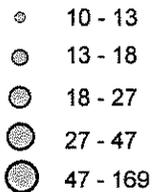
STORET Data

Big Darby Creek System

1970s

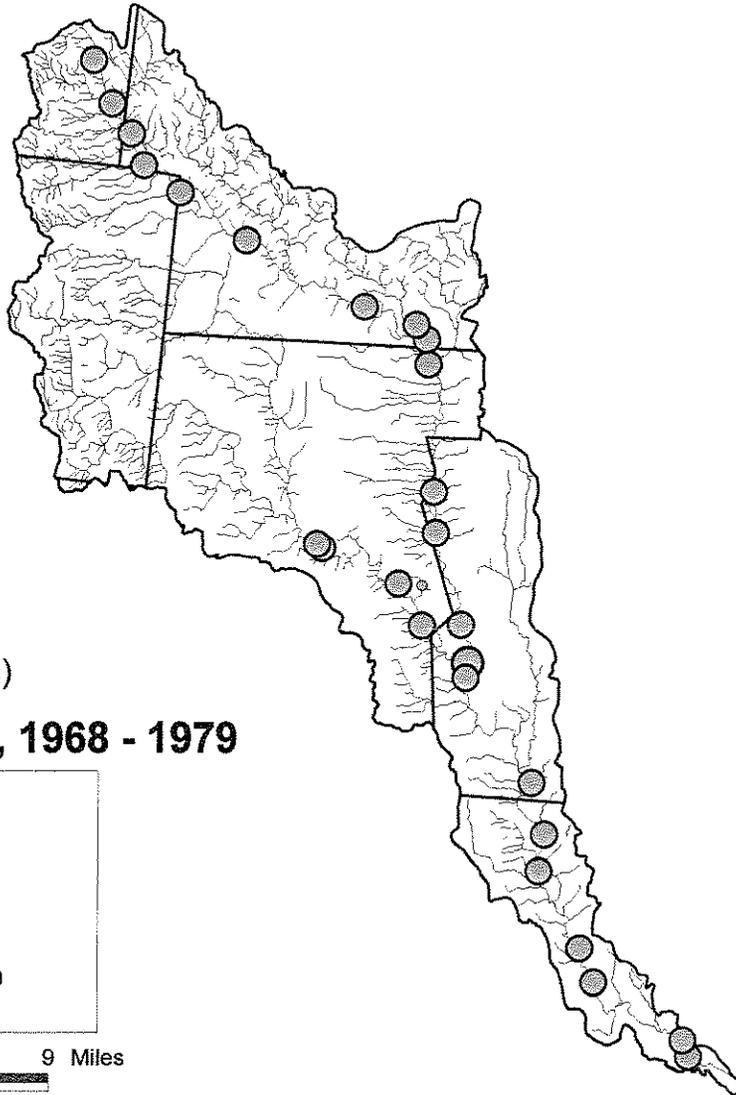
Zinc
($\mu\text{g/L}$ as Zn)

Average, 1968 - 1979



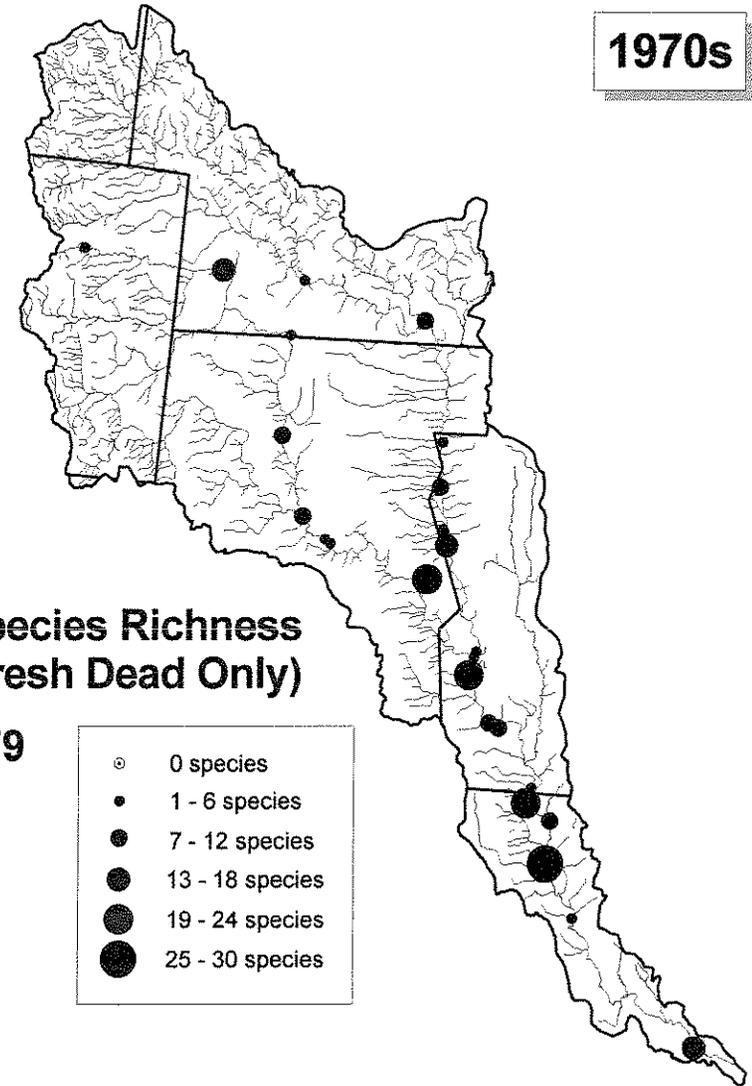
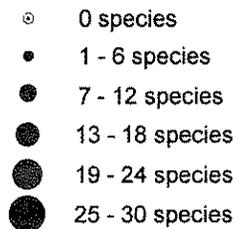
0 3 6 9 Miles

0 3 6 9 12 Kilometers



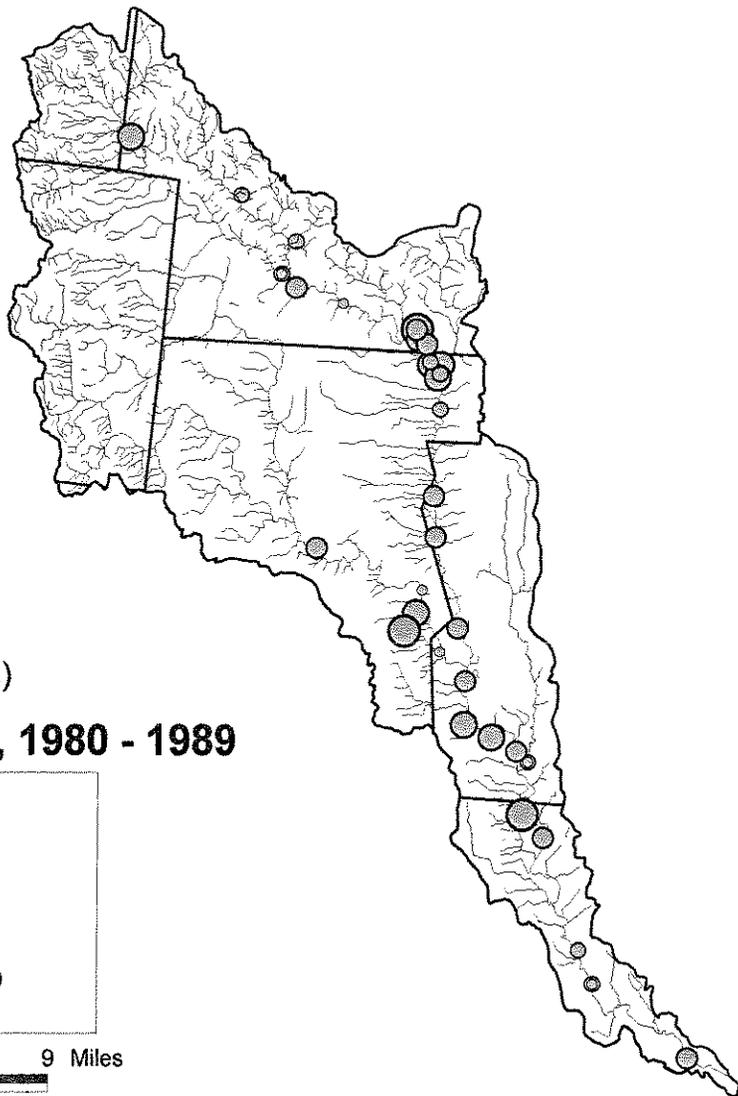
Mussel Species Richness
(Live or Fresh Dead Only)

1970 - 1979



Preliminary report from Watters and Myers Flaute, June 2003

STORET Data



Zinc
($\mu\text{g/L}$ as Zn)

Average, 1980 - 1989

- 10 - 13
- 13 - 18
- 18 - 27
- 27 - 47
- 47 - 169

0 3 6 9 Miles

0 3 6 9 12 Kilometers

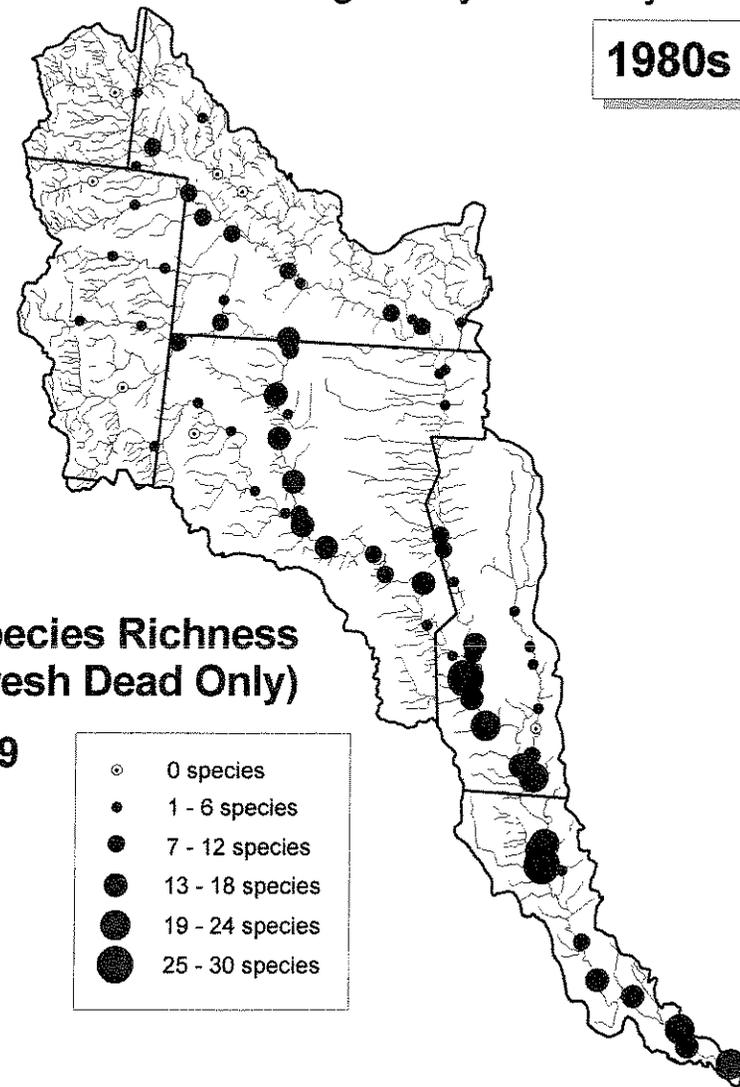
Big Darby Creek System

1980s

Mussel Species Richness
(Live or Fresh Dead Only)

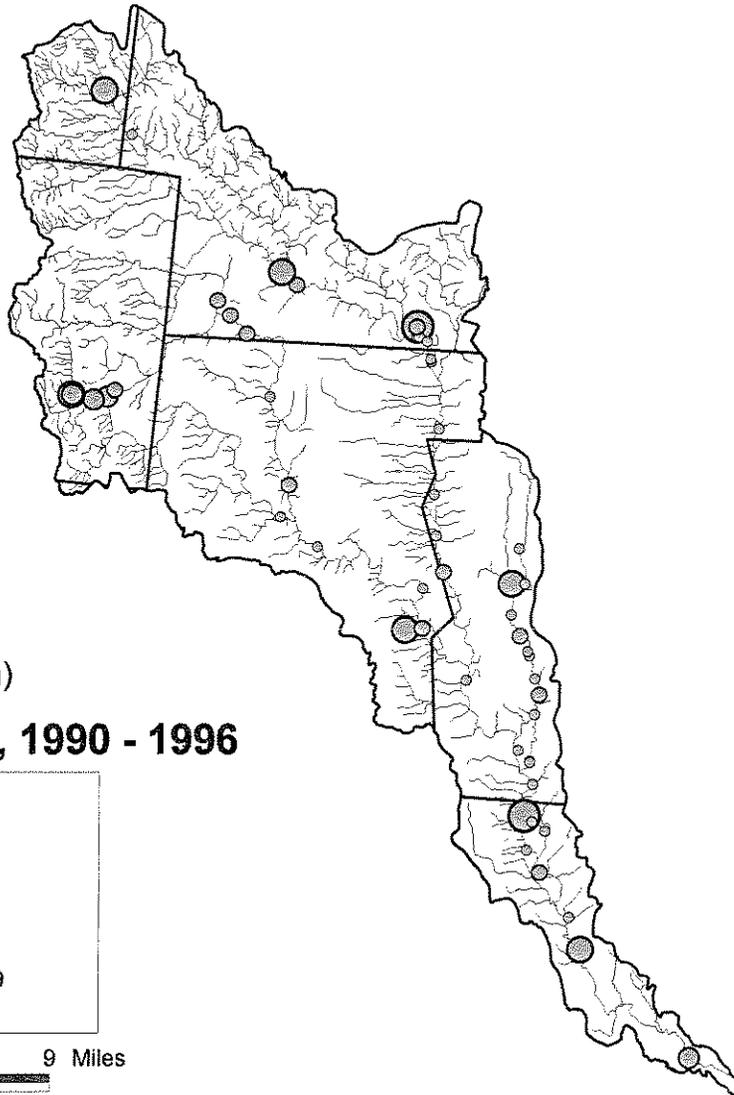
1980 - 1989

- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species



Preliminary report from Watters and Myers Flaute, June 2003

STORET Data



0 3 6 9 Miles

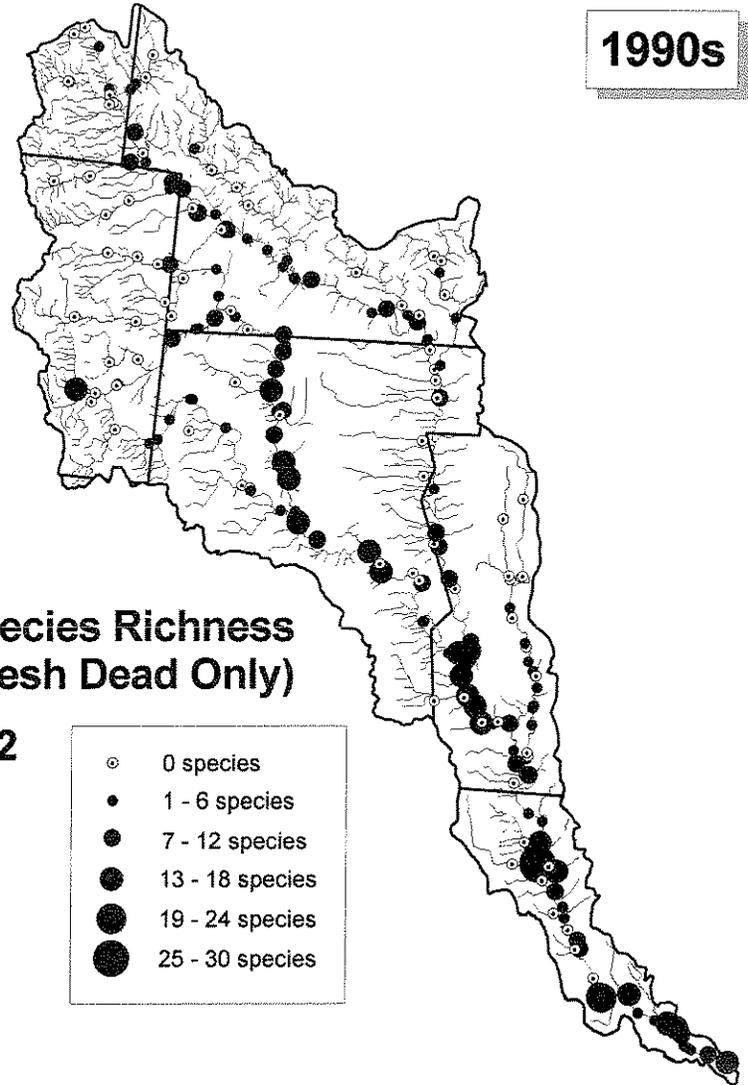
0 3 6 9 12 Kilometers

Big Darby Creek System

1990s

Mussel Species Richness (Live or Fresh Dead Only)

1990 - 2002



Preliminary report from Watters and Myers Flaute, June 2003

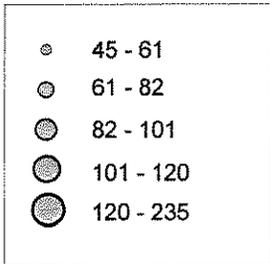
STORET Data

Big Darby Creek System

1970s

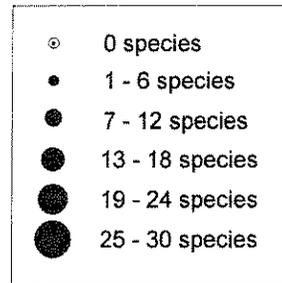
Sulfate
(mg/L as SO_4)

Average, 1968 - 1979



Mussel Species Richness
(Live or Fresh Dead Only)

1970 - 1979



0 3 6 9 Miles

0 3 6 9 12 Kilometers

Preliminary report from Watters and Myers Flaute, June 2003

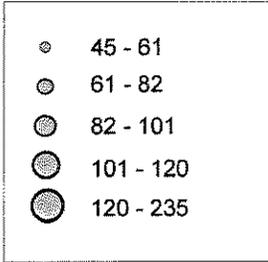
STORET Data

Big Darby Creek System

1990s

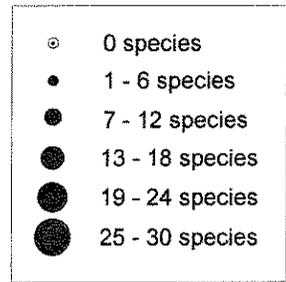
Sulfate
(mg/L as SO_4)

Average, 1990 - 1996



Mussel Species Richness
(Live or Fresh Dead Only)

1990 - 2002

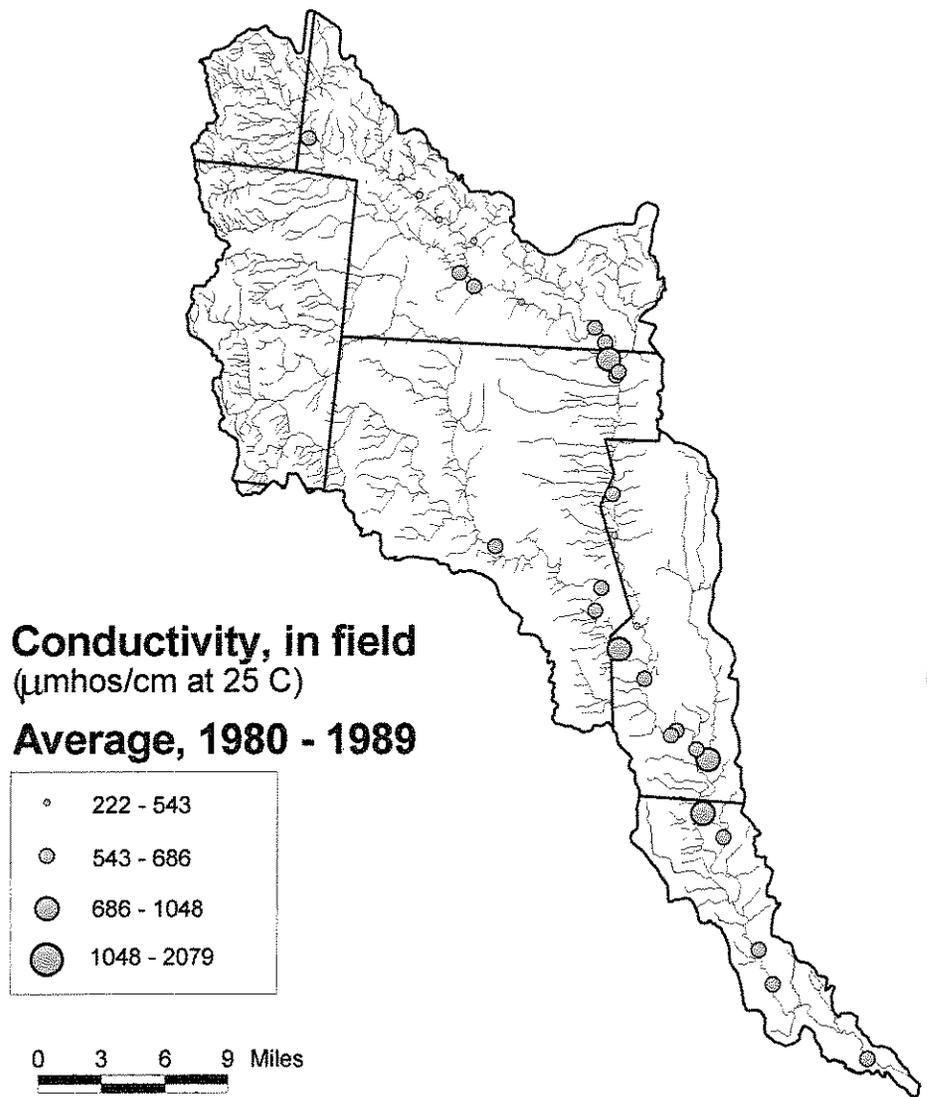


0 3 6 9 Miles

0 3 6 9 12 Kilometers

Preliminary report from Watters and Myers Flaute, June 2003

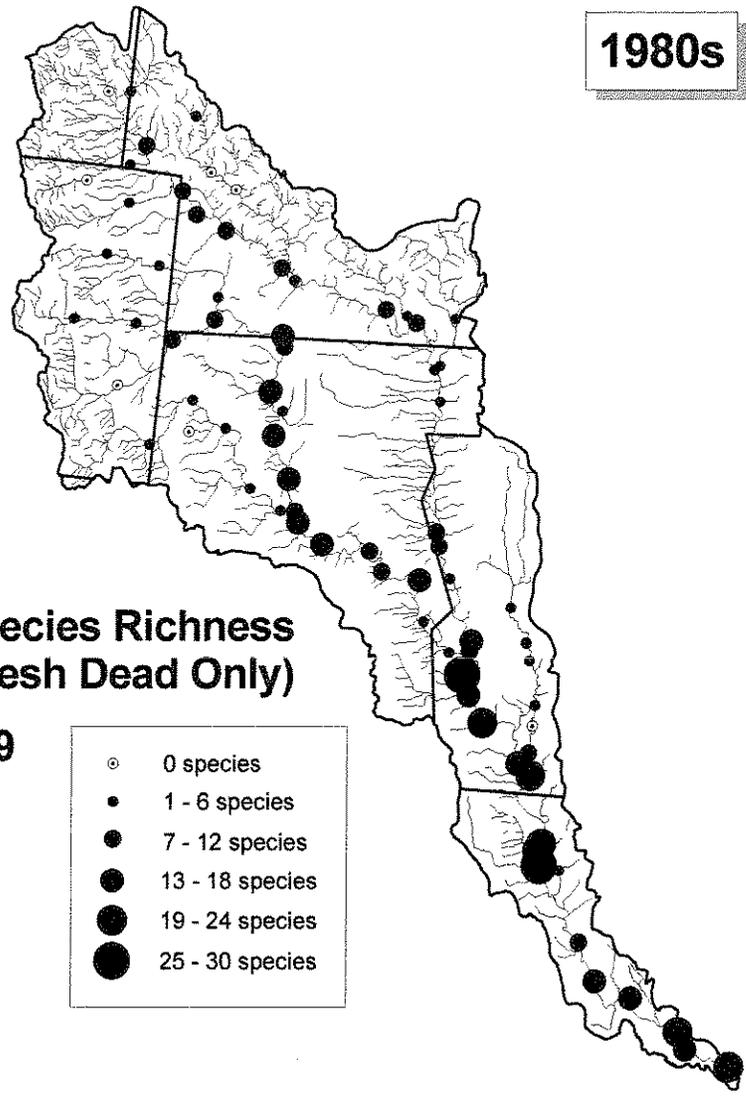
STORET Data



Big Darby Creek System

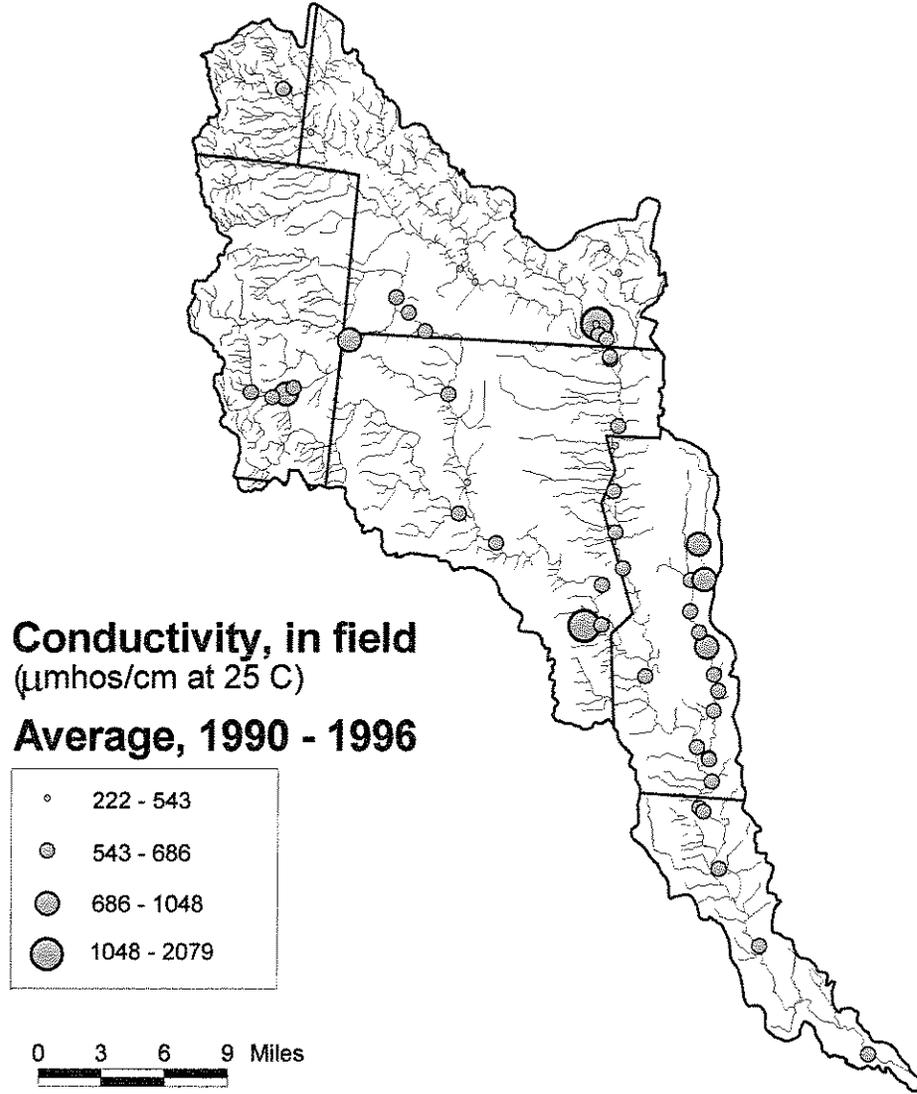
1980s

Mussel Species Richness (Live or Fresh Dead Only) 1980 - 1989



Preliminary report from Watters and Myers Flaute, June 2003

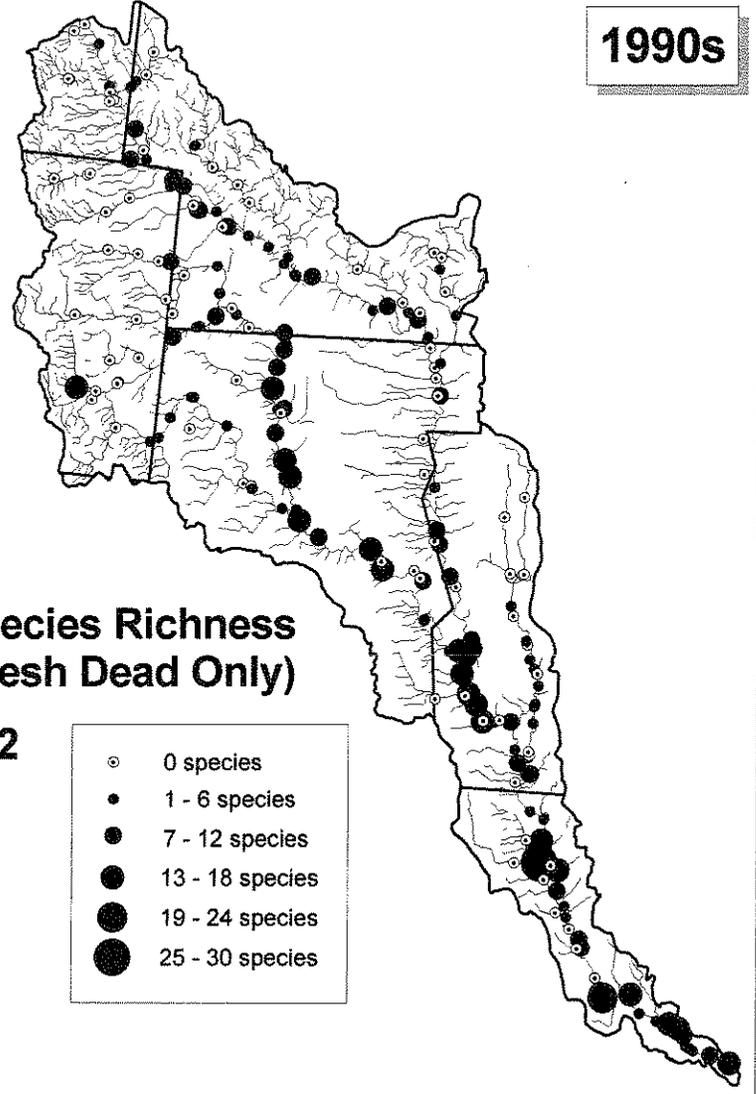
STORET Data



Big Darby Creek System

1990s

Mussel Species Richness (Live or Fresh Dead Only) 1990 - 2002



Preliminary report from Watters and Myers Flaute, June 2003

STORET Data

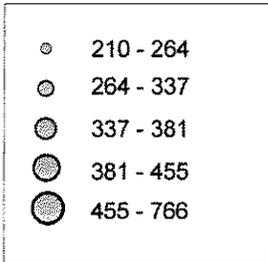
Big Darby Creek System

1970s

Water Hardness

(mg/L as CaCO₃)

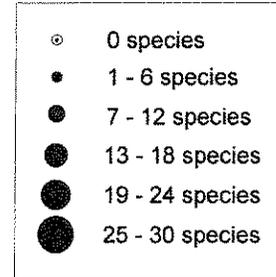
Average, 1968 - 1979



Mussel Species Richness

(Live or Fresh Dead Only)

1970 - 1979



0 3 6 9 Miles

0 3 6 9 12 Kilometers

Preliminary report from Watters and Myers Flaute, June 2003

STORET Data

Big Darby Creek System

1980s

Water Hardness

(mg/L as CaCO₃)

Average, 1980 - 1989

- 210 - 264
- 264 - 337
- 337 - 381
- 381 - 455
- 455 - 766

Mussel Species Richness

(Live or Fresh Dead Only)

1980 - 1989

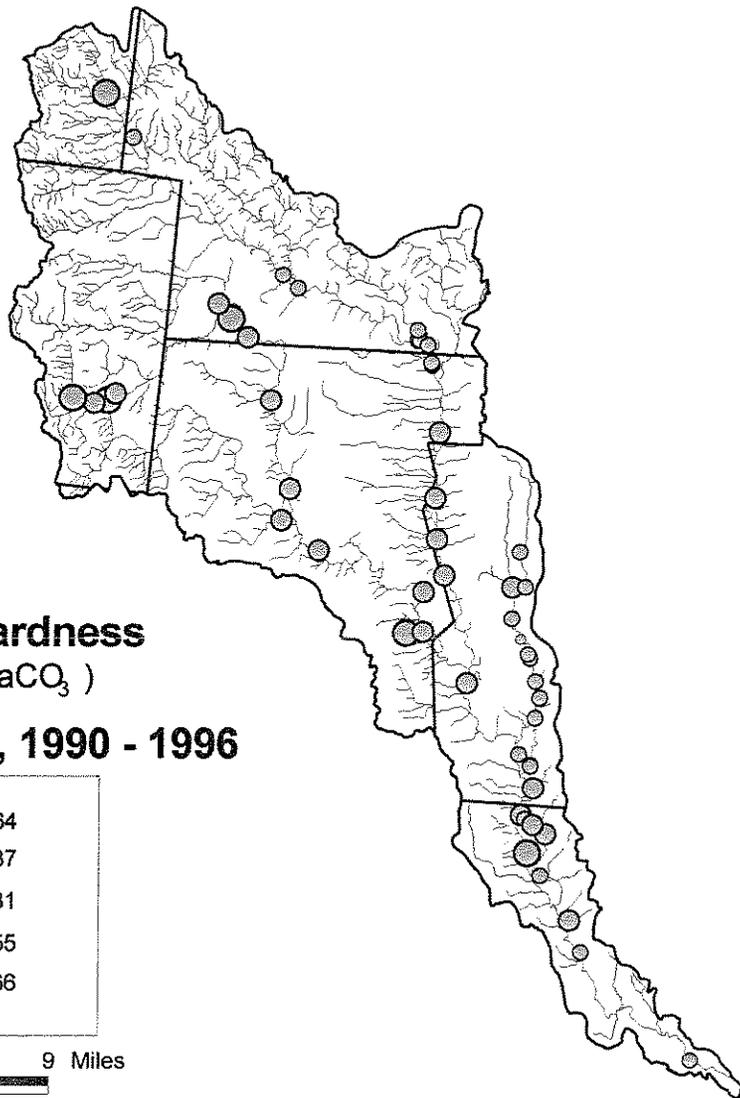
- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species

0 3 6 9 Miles

0 3 6 9 12 Kilometers

Preliminary report from Watters and Myers Flaute, June 2003

STORET Data



Water Hardness
(mg/L as CaCO₃)

Average, 1990 - 1996

- 210 - 264
- 264 - 337
- 337 - 381
- 381 - 455
- 455 - 766

0 3 6 9 Miles

0 3 6 9 12 Kilometers

Big Darby Creek System

1990s

Mussel Species Richness
(Live or Fresh Dead Only)

1990 - 2002

- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species

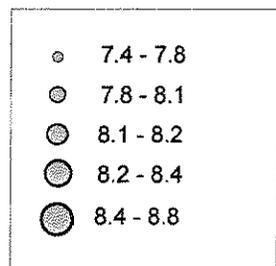
Preliminary report from Watters and Myers Flaute, June 2003

STORET Data

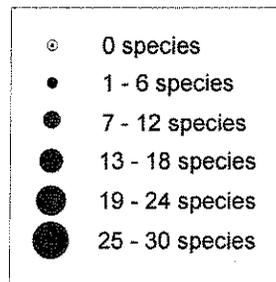
Big Darby Creek System

1970s

pH Average, 1968 - 1979

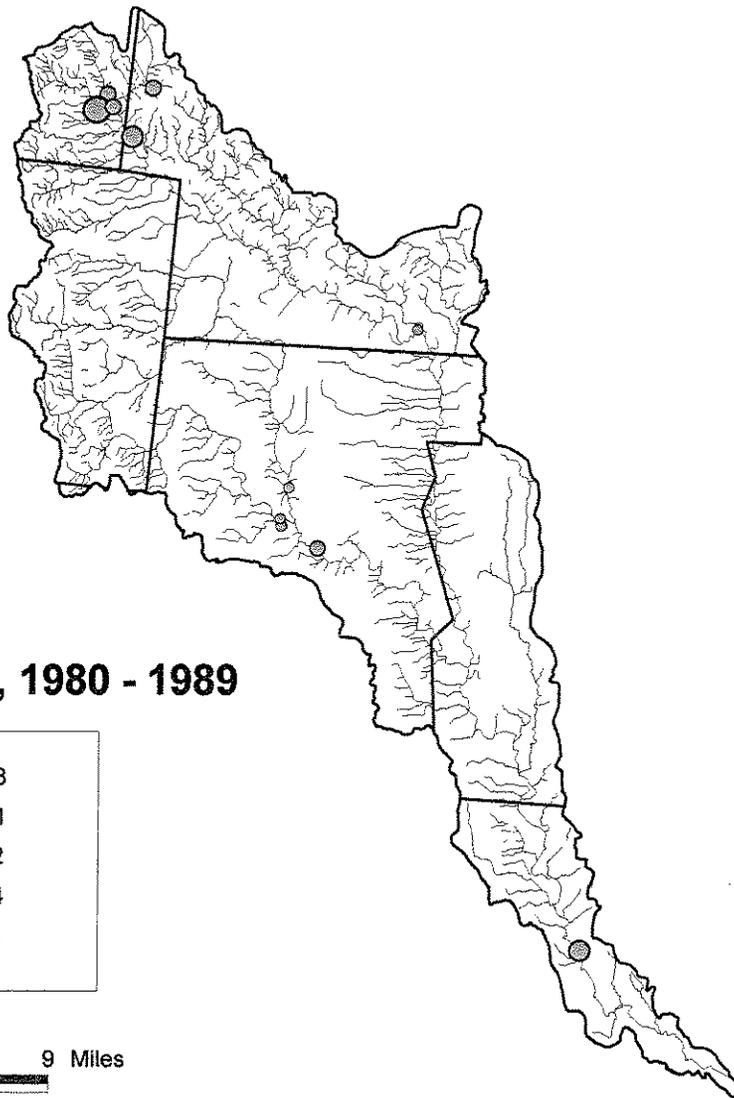


Mussel Species Richness (Live or Fresh Dead Only) 1970 - 1979



Preliminary report from Watters and Myers Flaute, June 2003

STORET Data



pH
Average, 1980 - 1989

- 7.4 - 7.8
- 7.8 - 8.1
- 8.1 - 8.2
- 8.2 - 8.4
- 8.4 - 8.8

0 3 6 9 Miles

0 3 6 9 12 Kilometers

Big Darby Creek System

1980s

Mussel Species Richness
(Live or Fresh Dead Only)
1980 - 1989

- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species

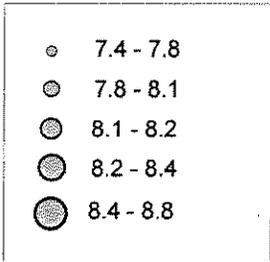
Preliminary report from Watters and Myers Flaute, June 2003

STORET Data

Big Darby Creek System

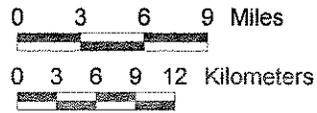
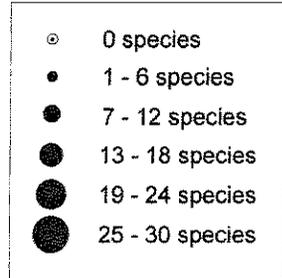
1990s

pH Average, 1990 - 1996



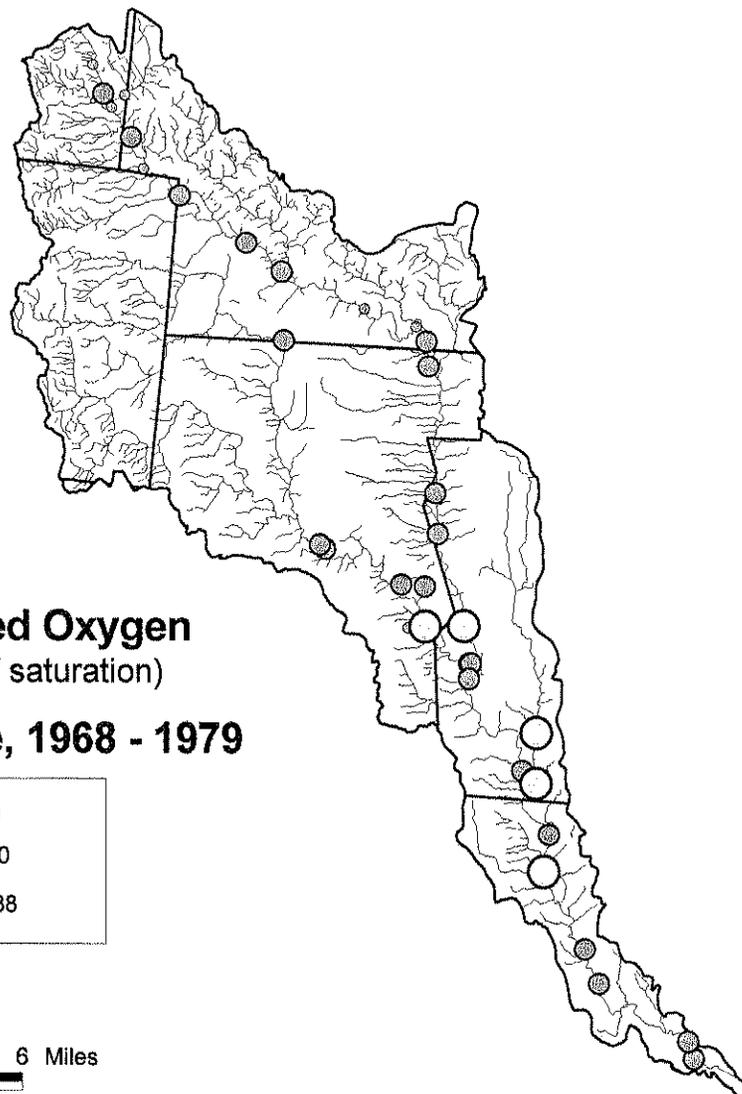
Mussel Species Richness (Live or Fresh Dead Only)

1990 - 2002



Preliminary report from Watters and Myers Flaute, June 2003

STORET Data



Dissolved Oxygen
(percent of saturation)

Average, 1968 - 1979

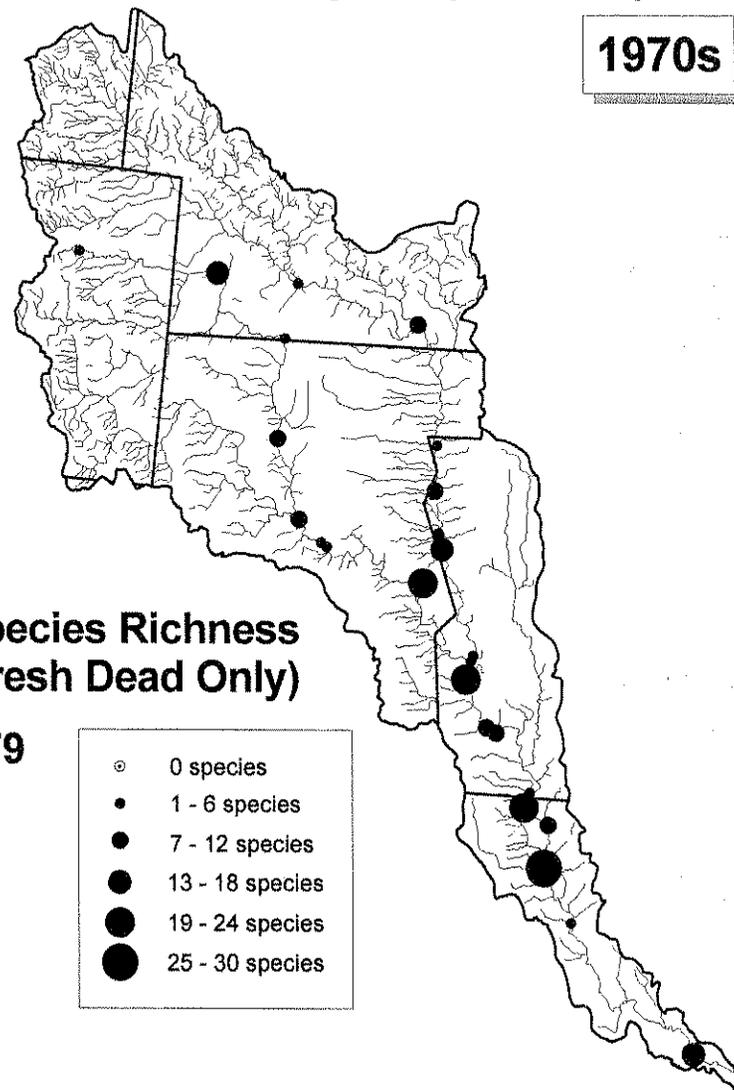
- ◉ 36 - 80
- ◐ 80 - 100
- 100 - 138

0 2 4 6 Miles

0 3 6 9 12 Kilometers

Big Darby Creek System

1970s

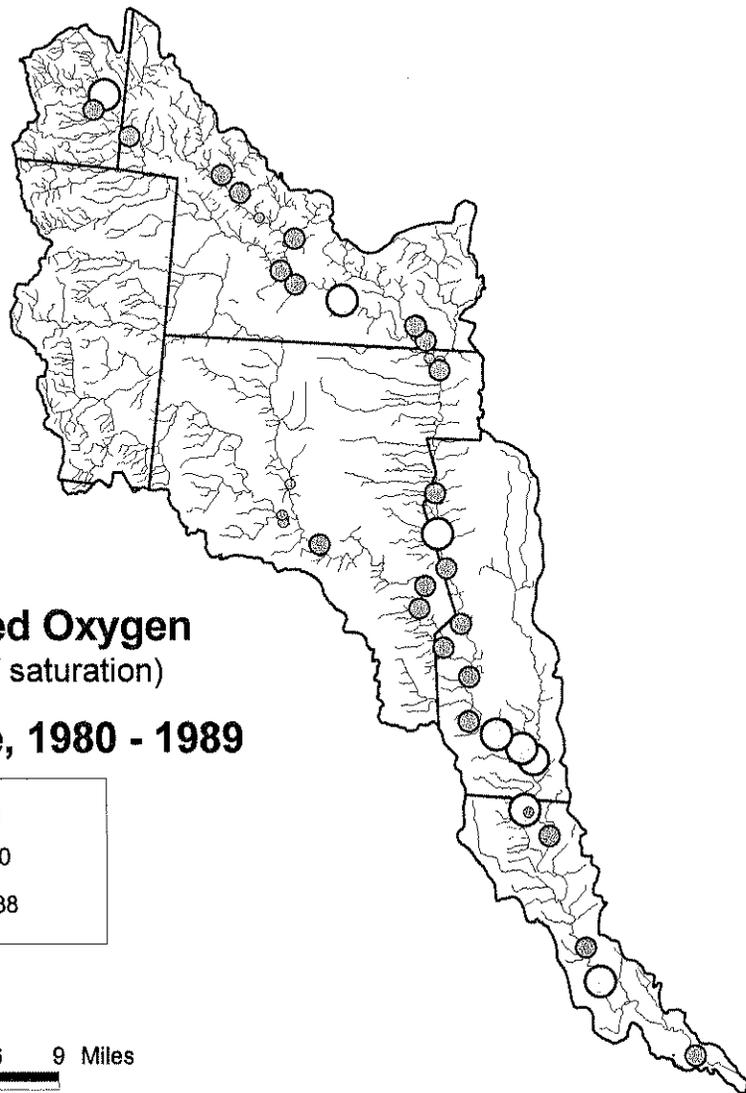


Mussel Species Richness
(Live or Fresh Dead Only)

1970 - 1979

- ◉ 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species

STORET Data



Dissolved Oxygen
(percent of saturation)

Average, 1980 - 1989

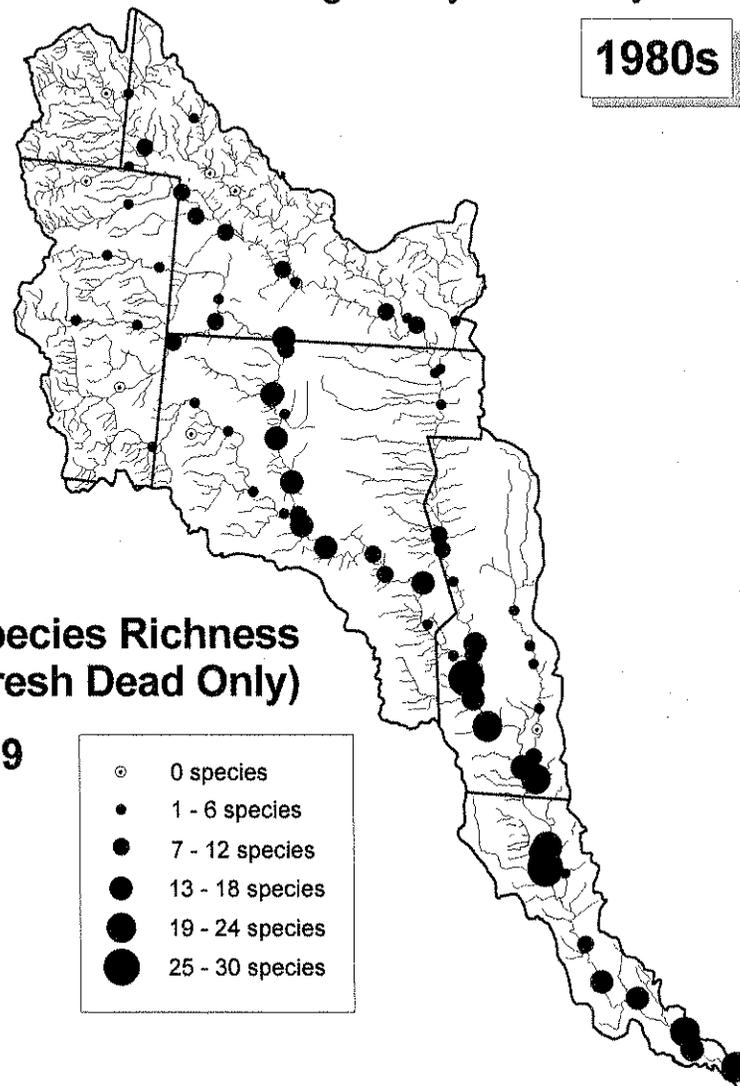
- 36 - 80
- 80 - 100
- 100 - 138

0 3 6 9 Miles

0 3 6 9 12 Kilometers

Big Darby Creek System

1980s



Mussel Species Richness
(Live or Fresh Dead Only)

1980 - 1989

- 0 species
- 1 - 6 species
- 7 - 12 species
- 13 - 18 species
- 19 - 24 species
- 25 - 30 species

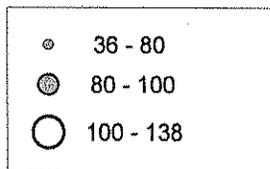
STORET Data

Big Darby Creek System

1990s

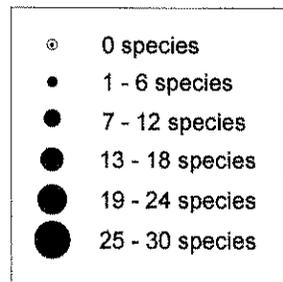
Dissolved Oxygen
(percent of saturation)

Average, 1990 - 1996



Mussel Species Richness
(Live or Fresh Dead Only)

1990 - 2002



0 3 6 9 Miles

0 3 6 9 12 Kilometers

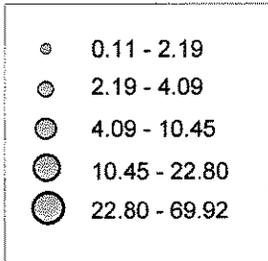
STORET Data

Big Darby Creek System

1970s

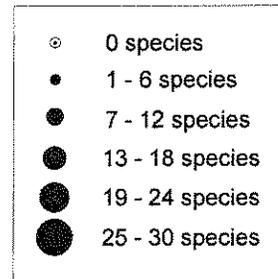
Nitrite and Nitrate (mg/L as N)

Average, 1968 - 1979



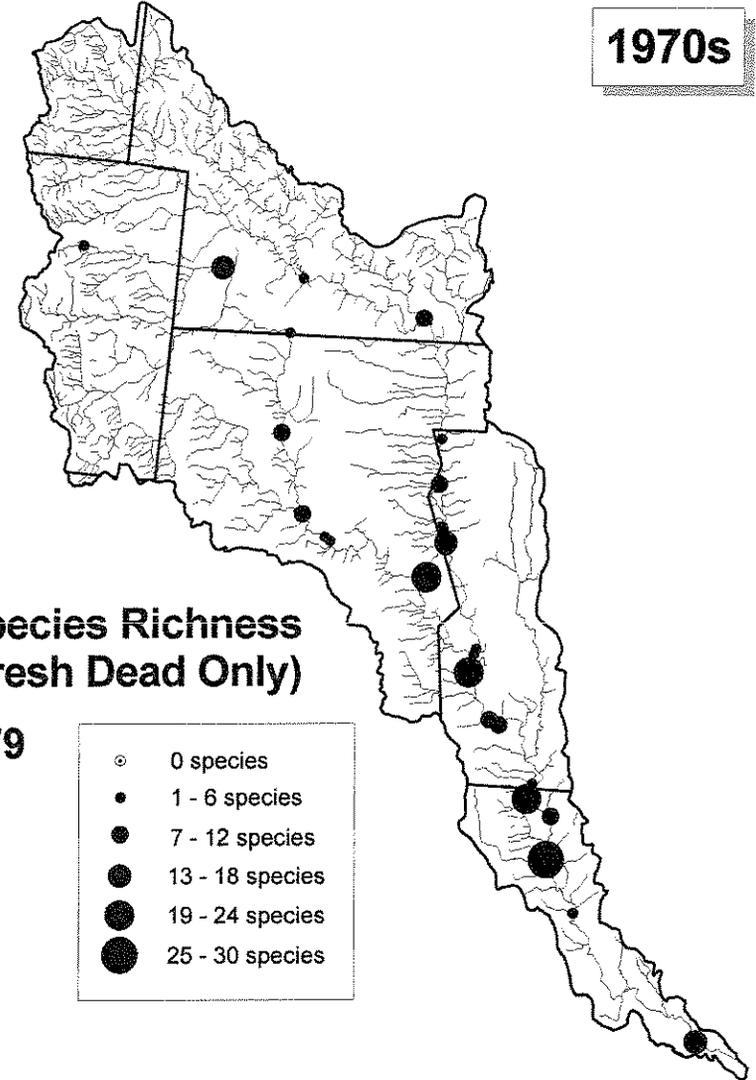
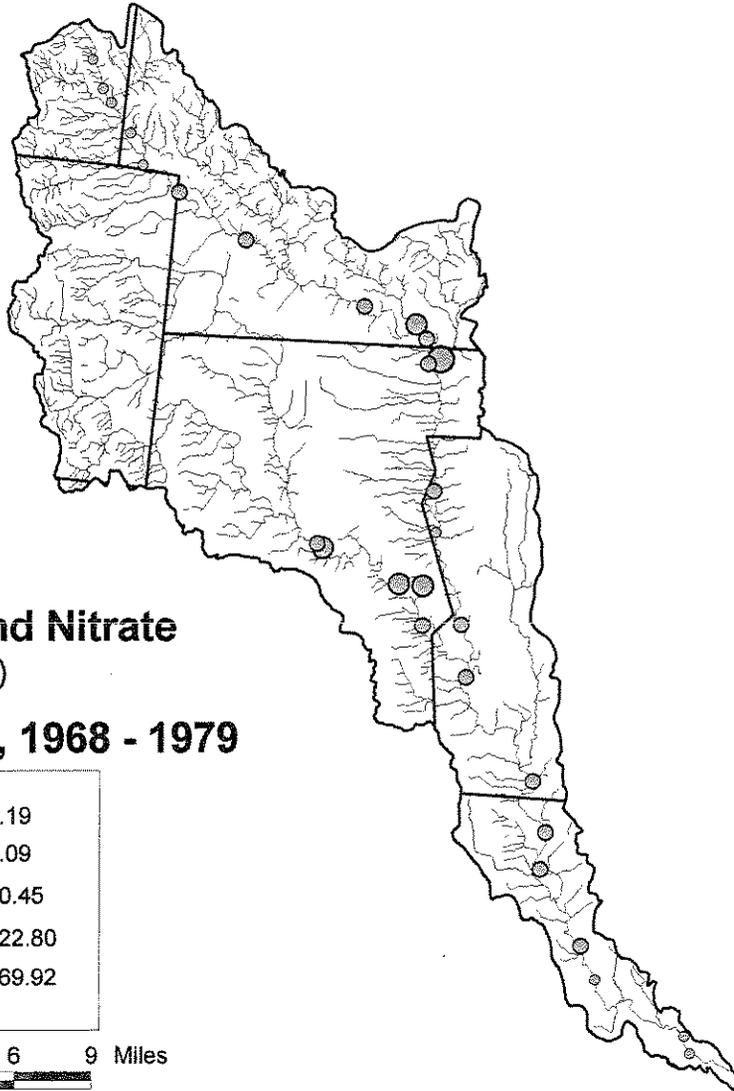
Mussel Species Richness (Live or Fresh Dead Only)

1970 - 1979



0 3 6 9 Miles

0 3 6 9 12 Kilometers



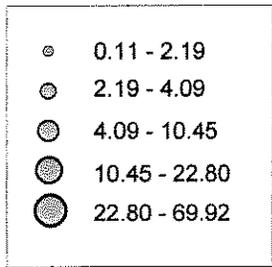
STORET Data

Big Darby Creek System

1980s

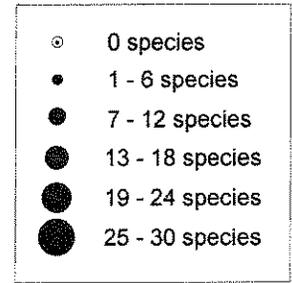
Nitrite and Nitrate (mg/L as N)

Average, 1980 - 1989



Mussel Species Richness (Live or Fresh Dead Only)

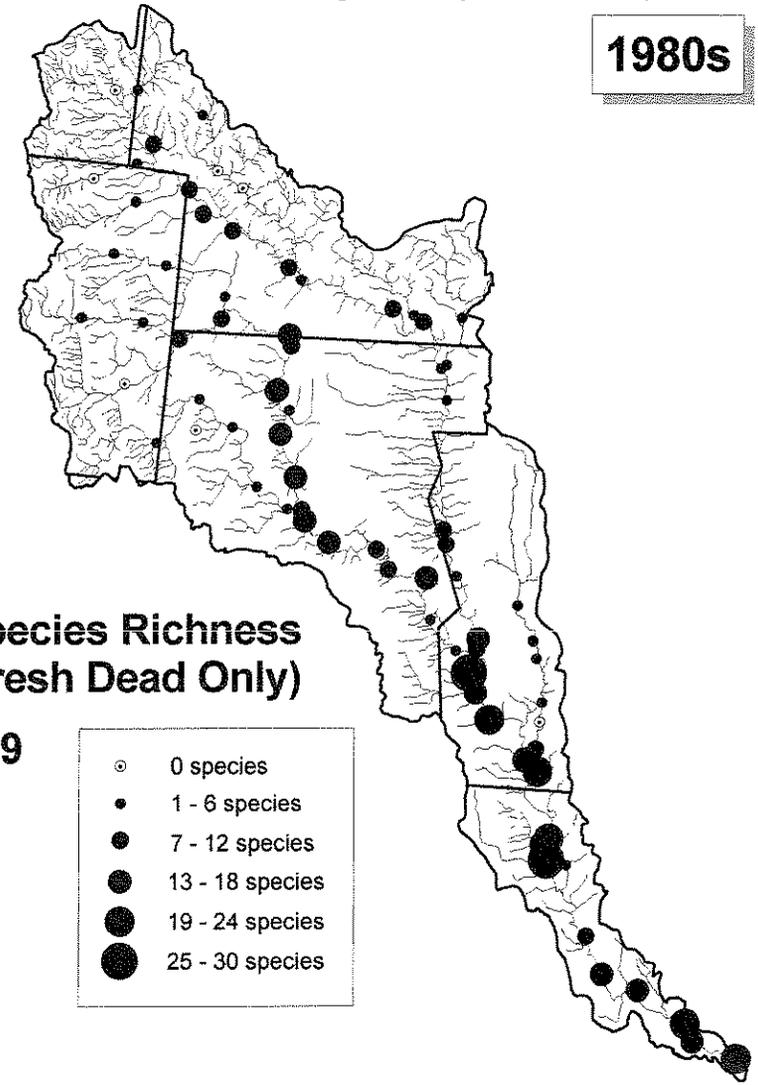
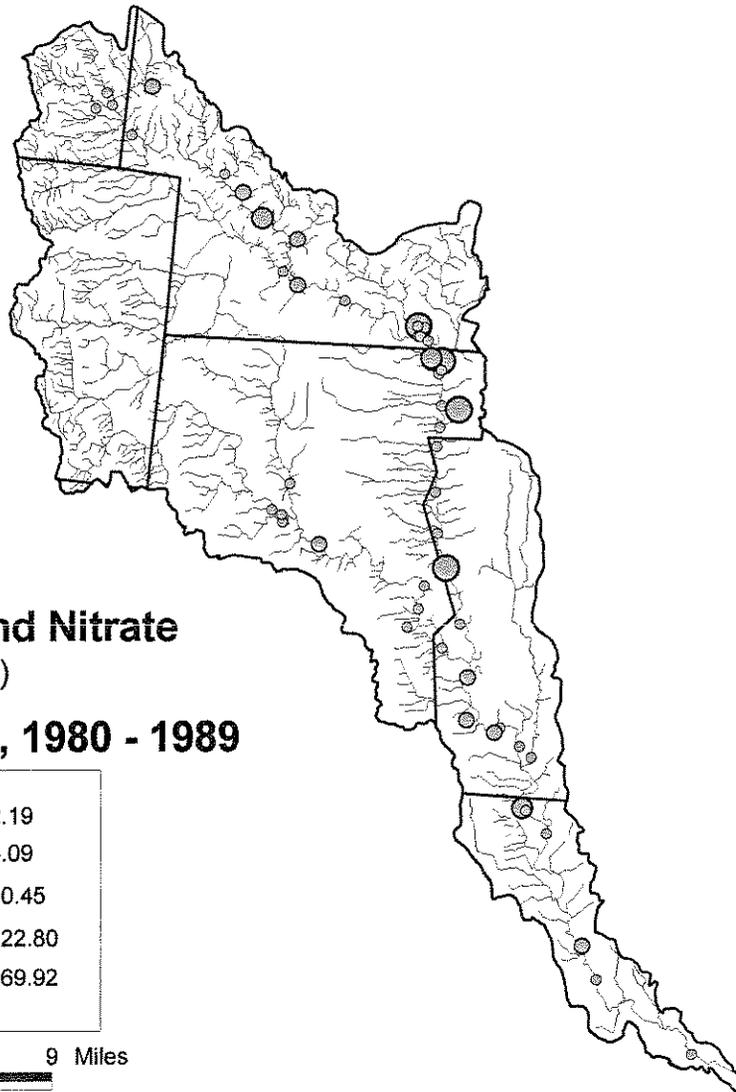
1980 - 1989



0 3 6 9 Miles



0 3 6 9 12 Kilometers



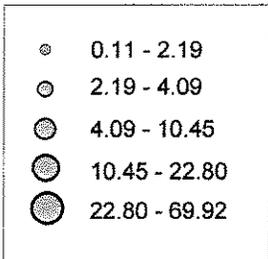
STORET Data

Big Darby Creek System

1990s

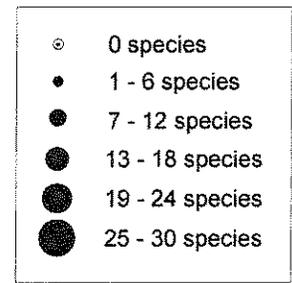
Nitrite and Nitrate
(mg/L as N)

Average, 1990 - 1996



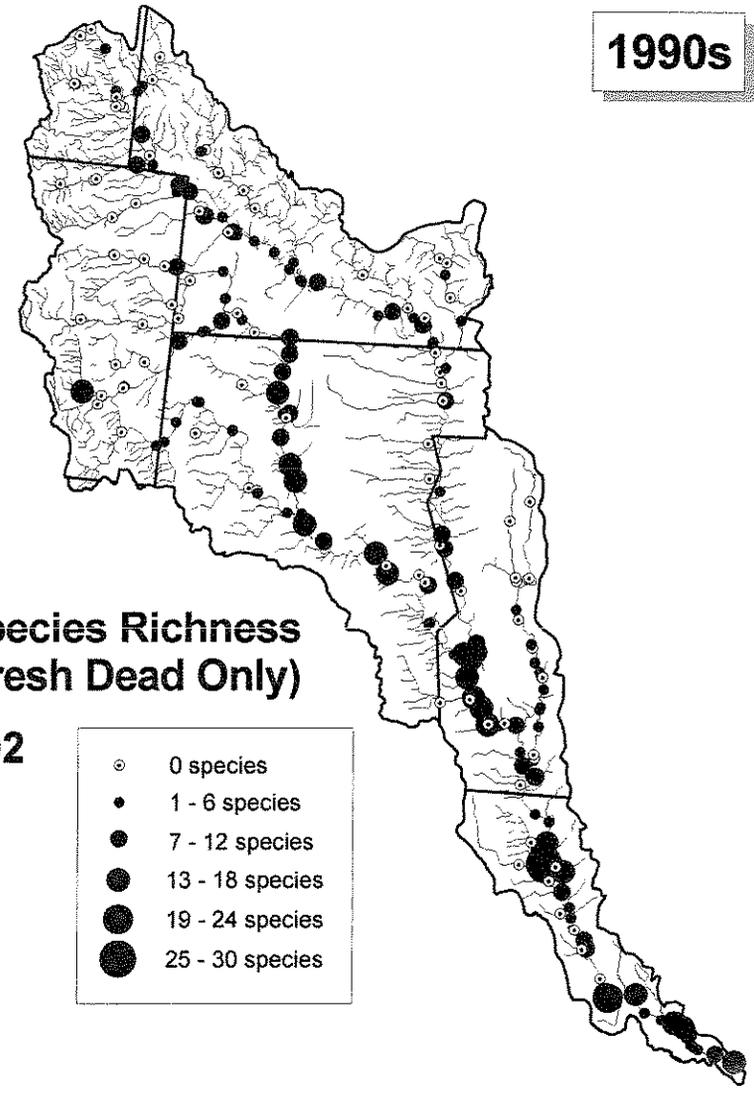
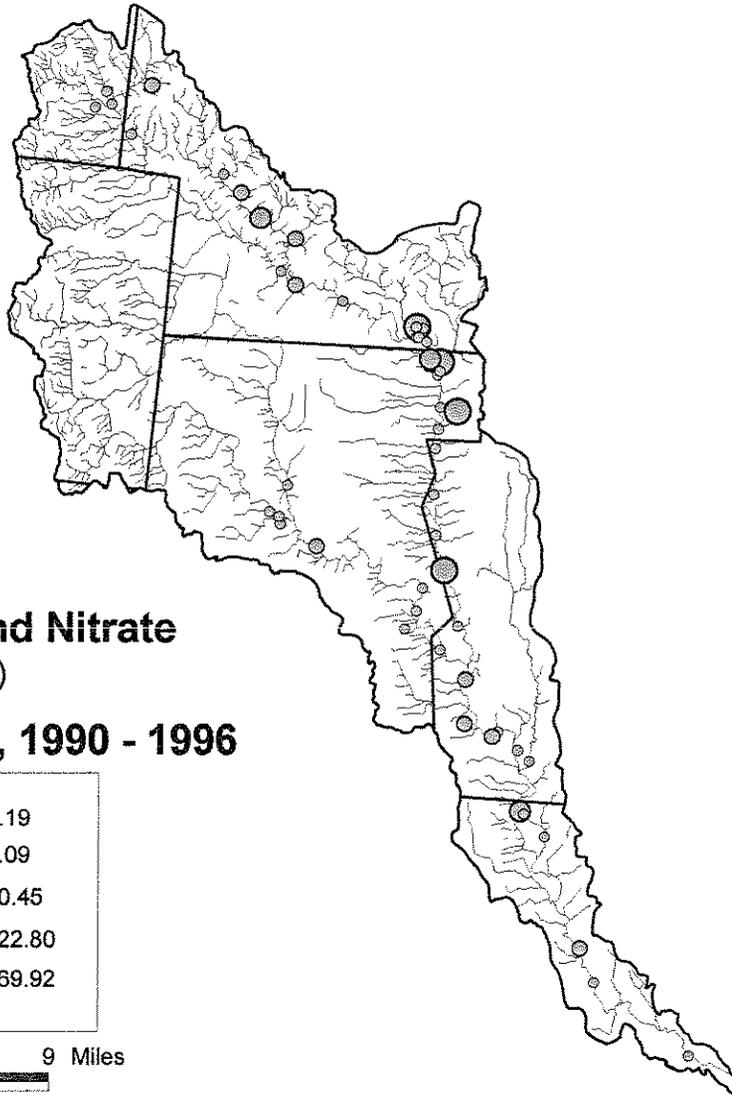
Mussel Species Richness
(Live or Fresh Dead Only)

1990 - 2002



0 3 6 9 Miles

0 3 6 9 12 Kilometers



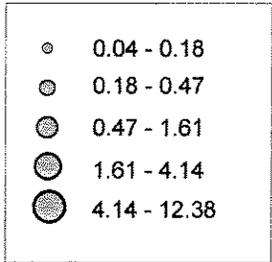
STORET Data

Big Darby Creek System

1990s

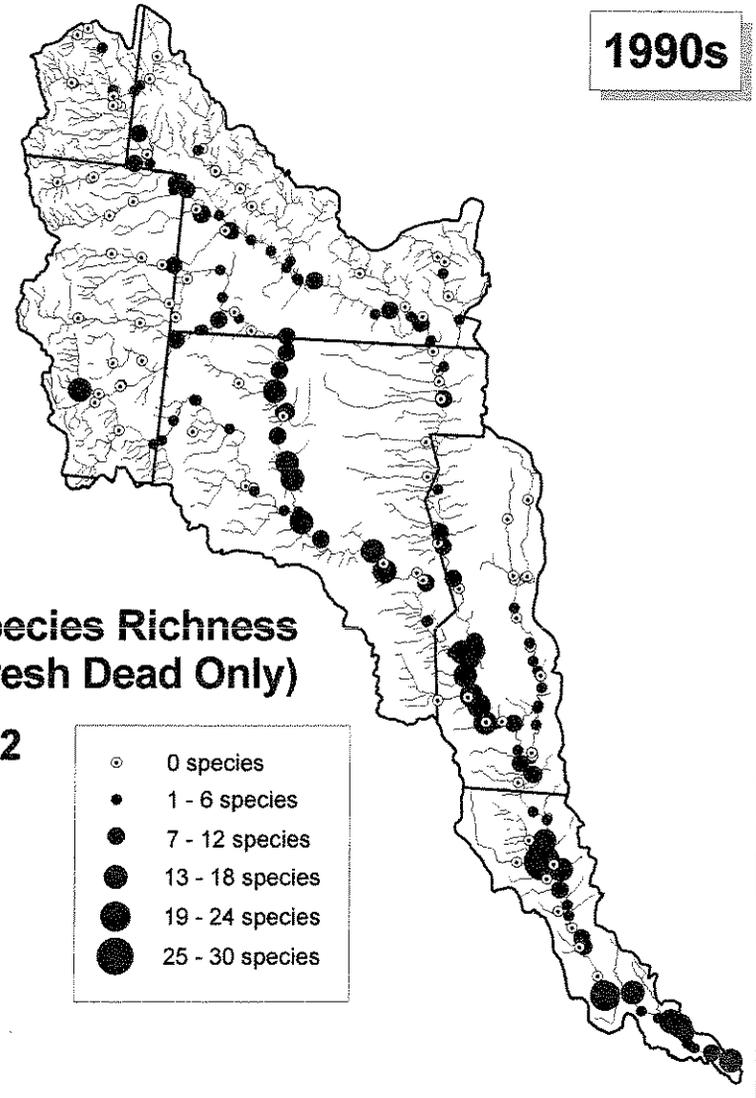
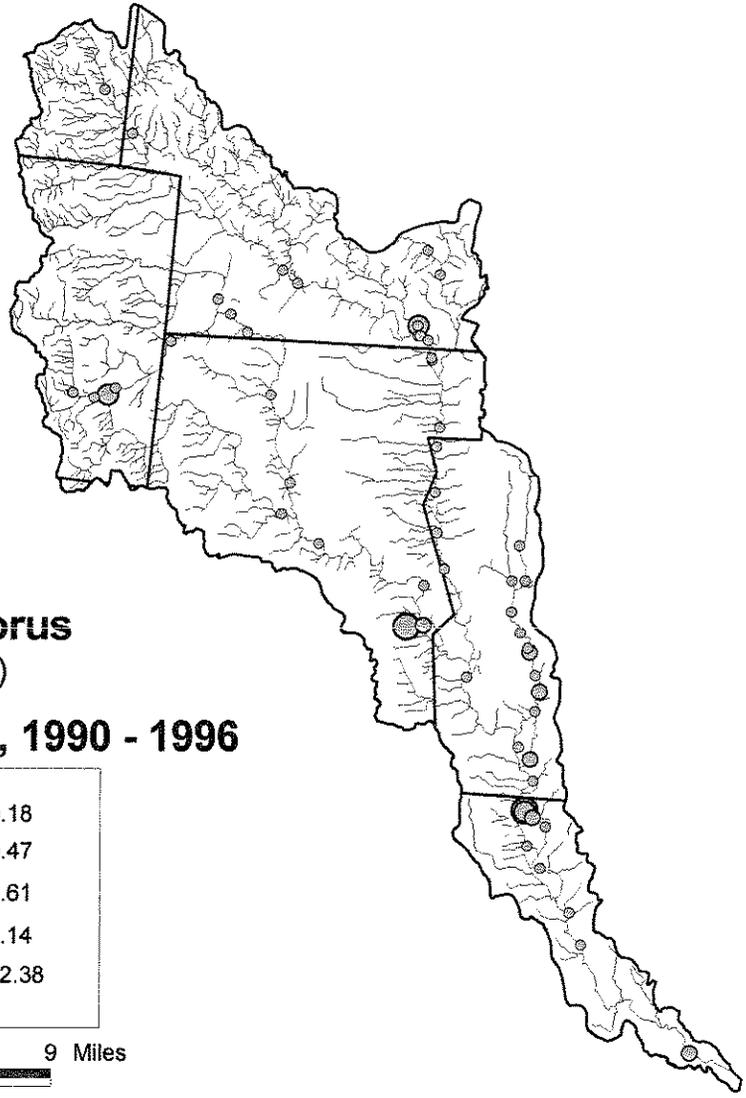
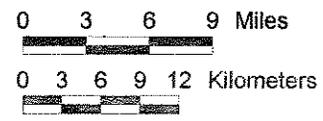
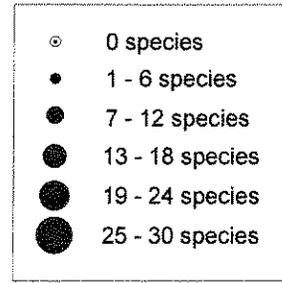
Phosphorus
(mg/L as P)

Average, 1990 - 1996



Mussel Species Richness
(Live or Fresh Dead Only)

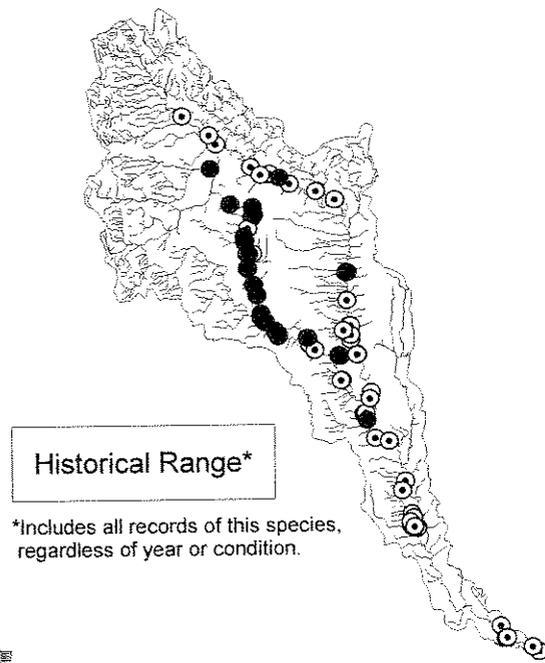
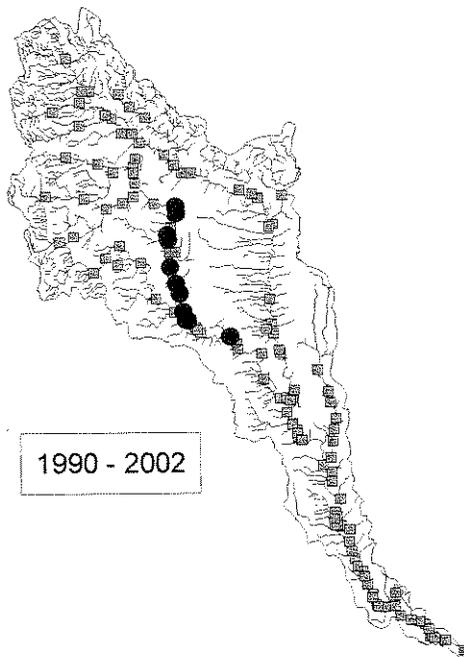
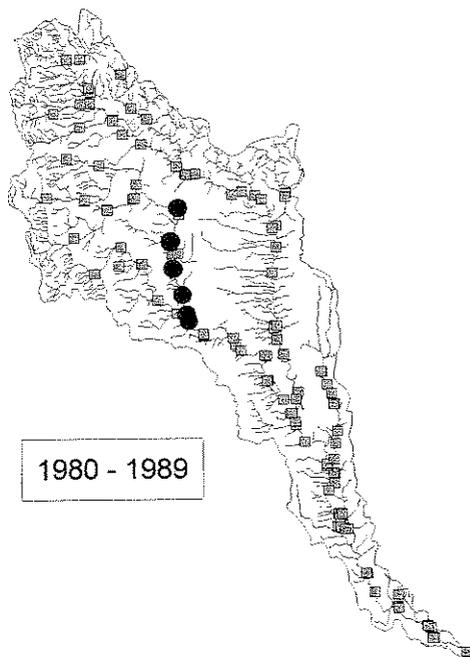
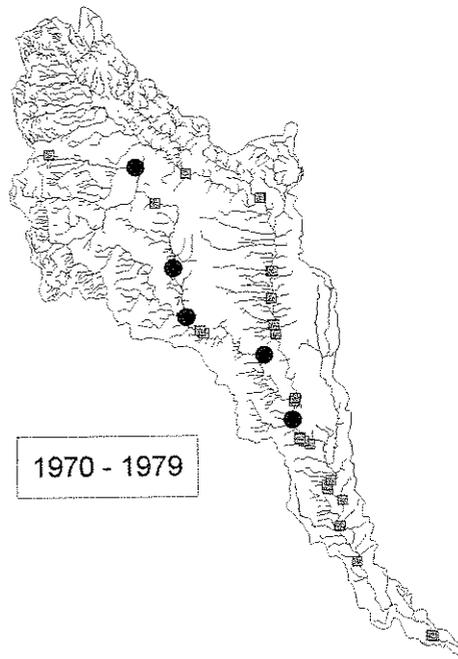
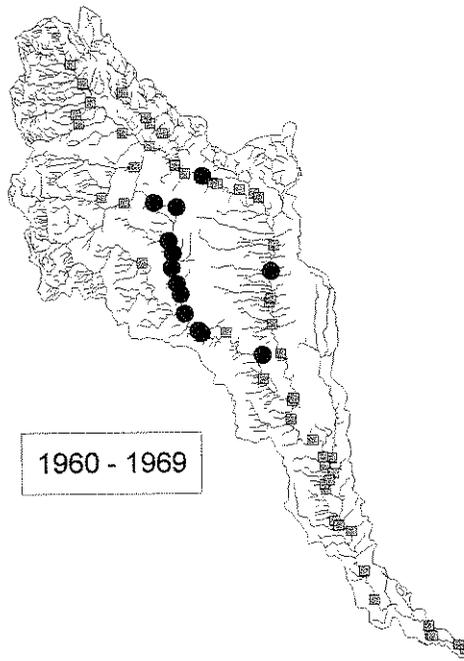
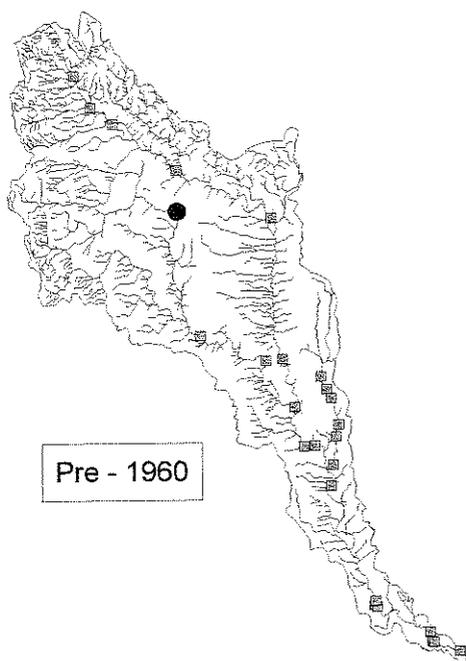
1990 - 2002



Clubshell

Big Darby Creek System

Pleurobema clava (Lamarck, 1819).



0 4 8 12 16 20 Miles

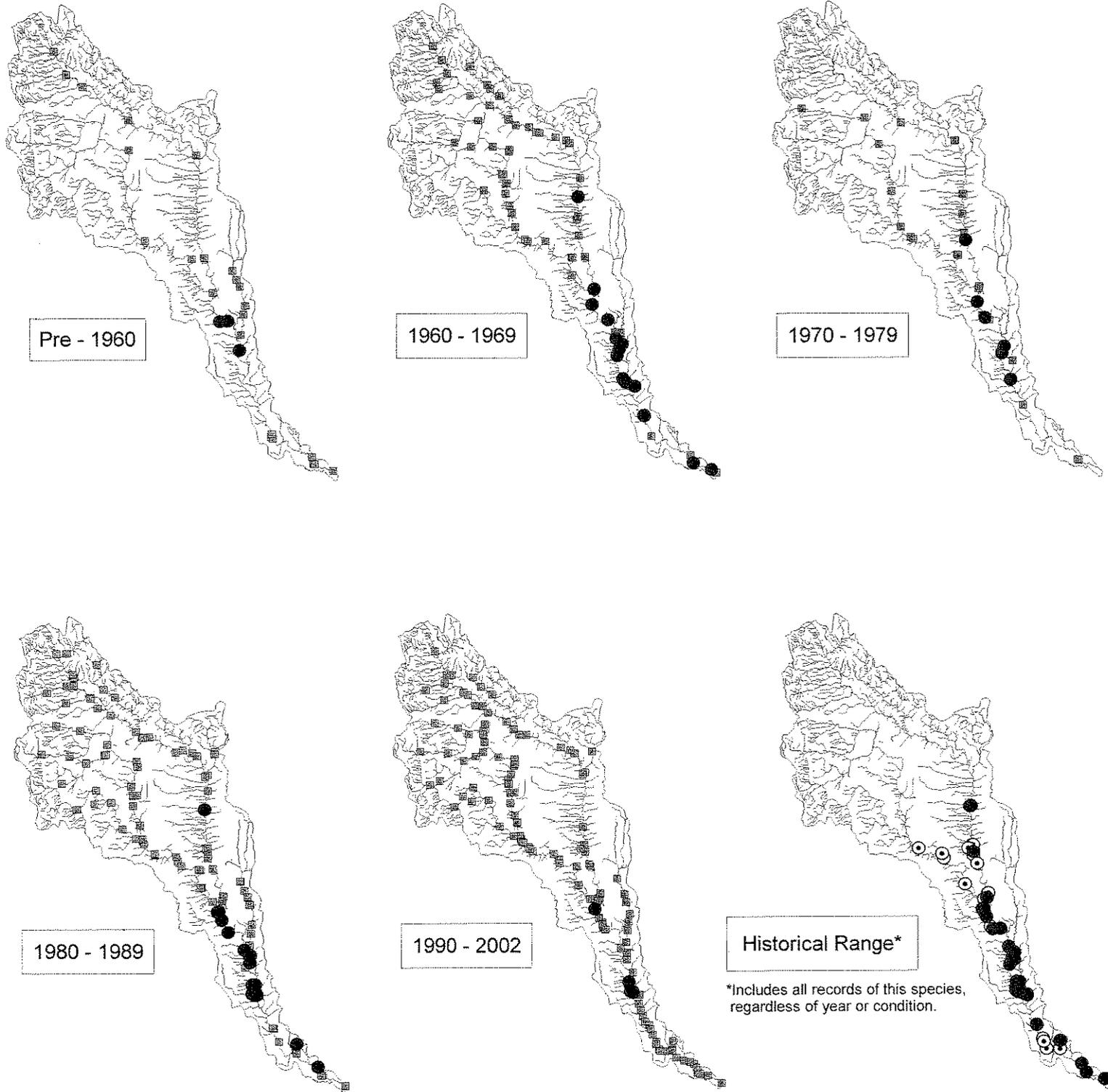
0 5 10 15 20 25 Kilometers

- Alive or fresh dead
- ⊙ Weathered or subfossil only (noted only for Historical Range)
- Location surveyed, but this species not found

Northern riffleshell

Big Darby Creek System

Epioblasma rangiana (Lea, 1838).



0 4 8 12 16 20 Miles

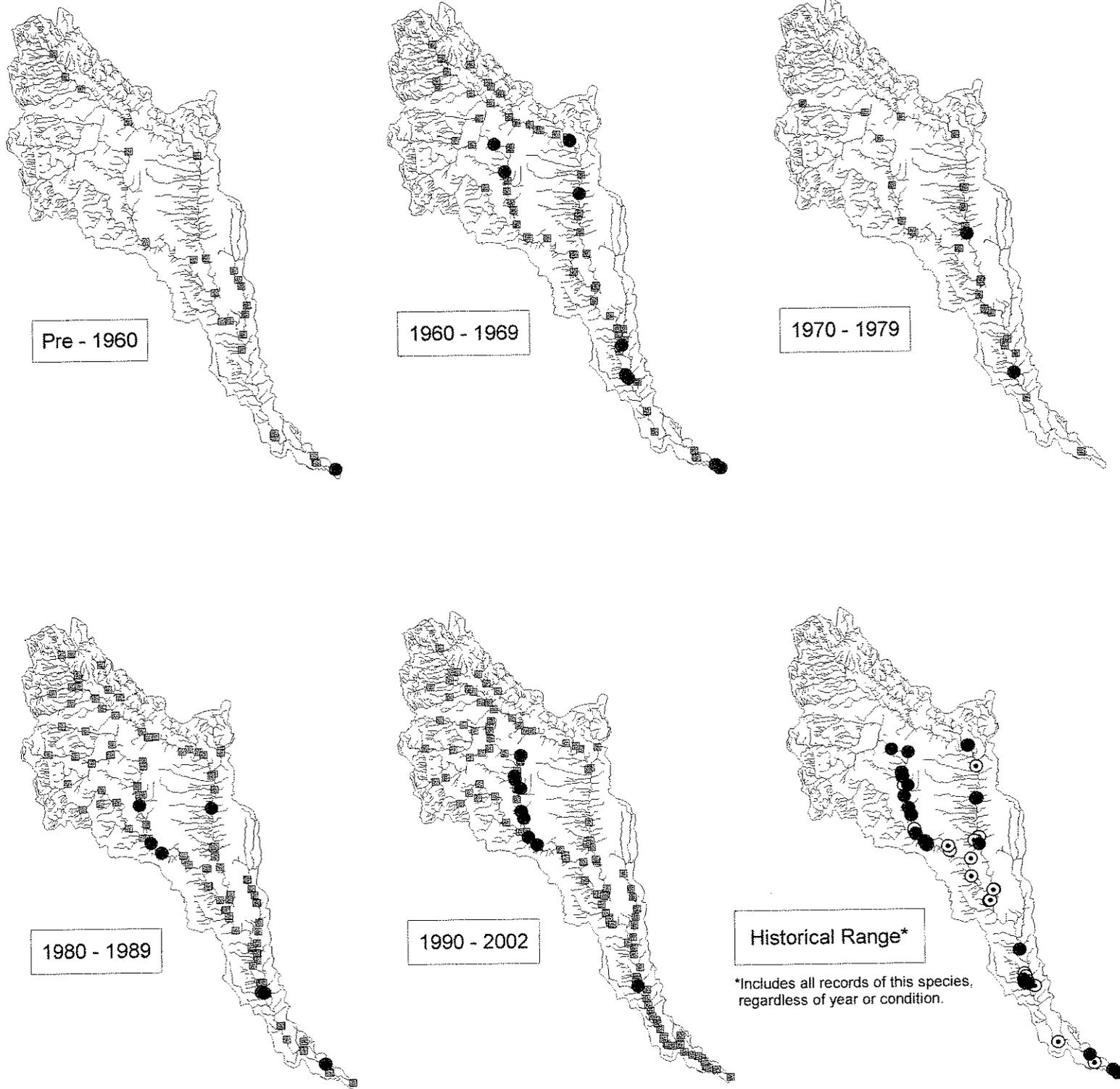
0 5 10 15 20 25 Kilometers

- Alive or fresh dead
- ⊙ Weathered or subfossil only (noted only for Historical Range)
- Location surveyed, but this species not found

Rabbitfoot

Big Darby Creek System

Quadrula cylindrica (Say, 1817).



Pre - 1960

1960 - 1969

1970 - 1979

1980 - 1989

1990 - 2002

Historical Range*

*Includes all records of this species, regardless of year or condition.

0 4 8 12 16 20 Miles

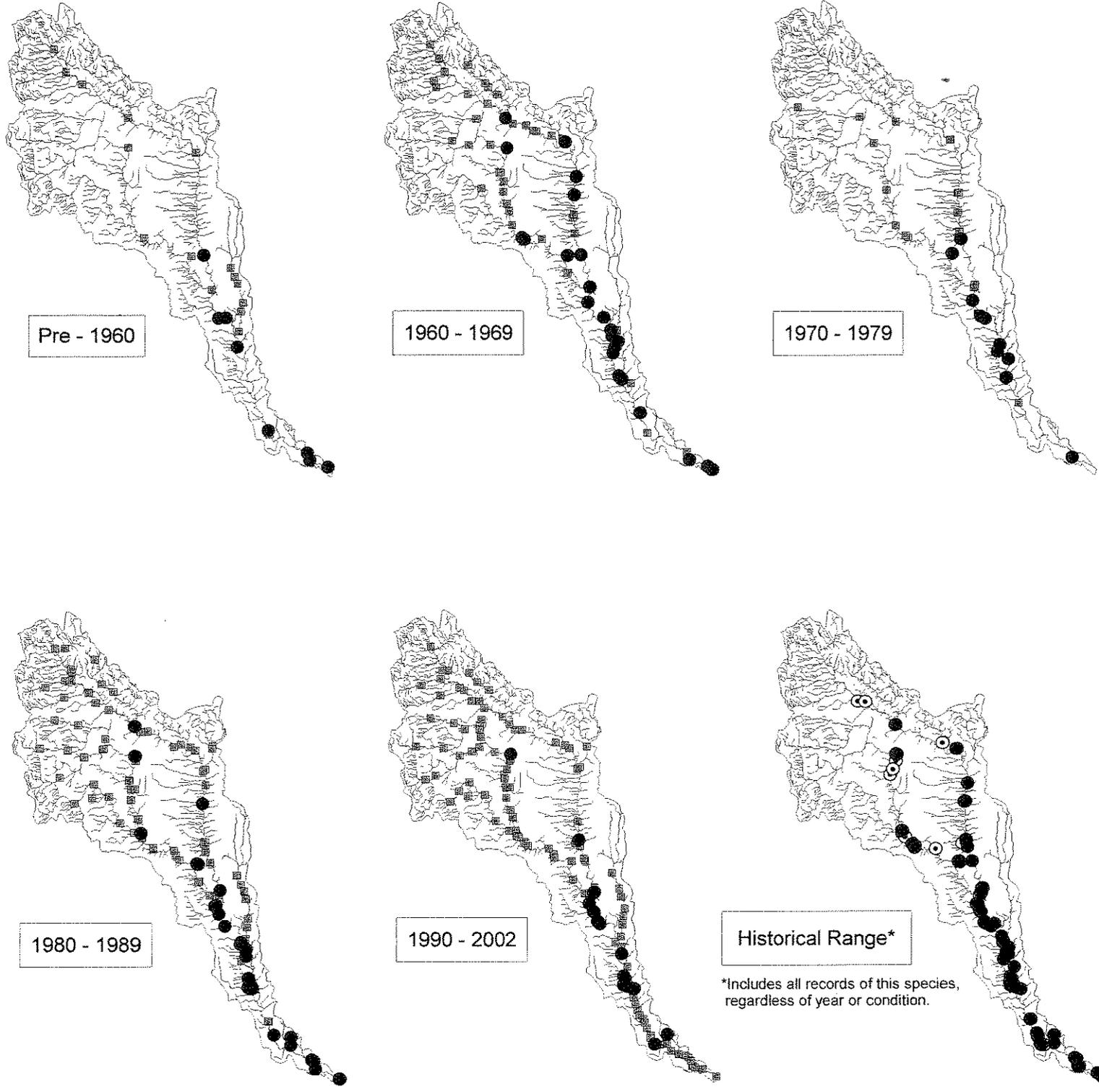
0 5 10 15 20 25 Kilometers

- Alive or fresh dead
- ⊙ Weathered or subfossil only (noted only for Historical Range)
- Location surveyed, but this species not found

Snuffbox

Big Darby Creek System

Epioblasma triquetra (Rafinesque, 1820).



Historical Range*

*Includes all records of this species, regardless of year or condition.

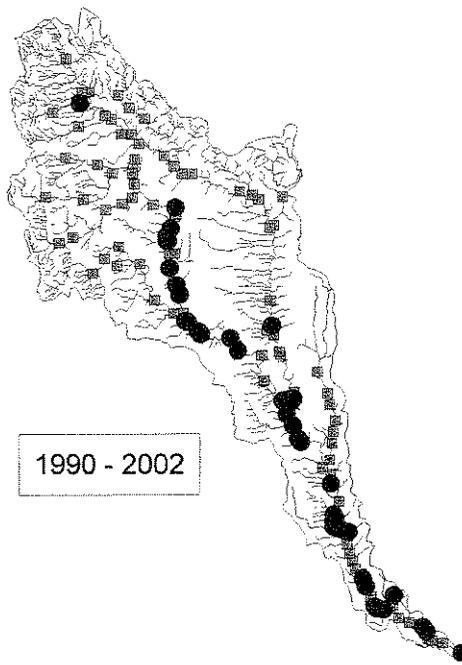
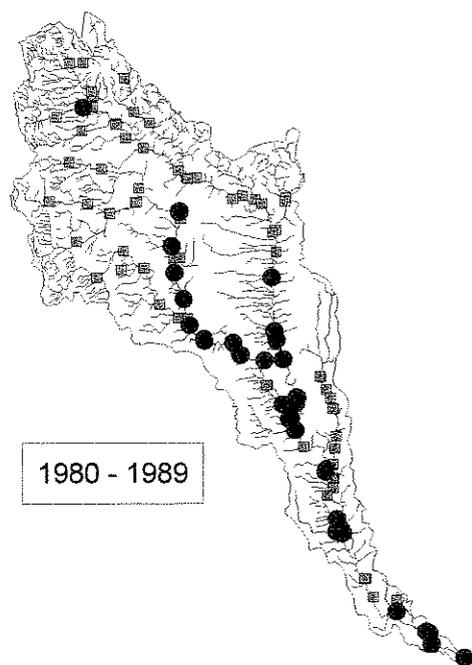
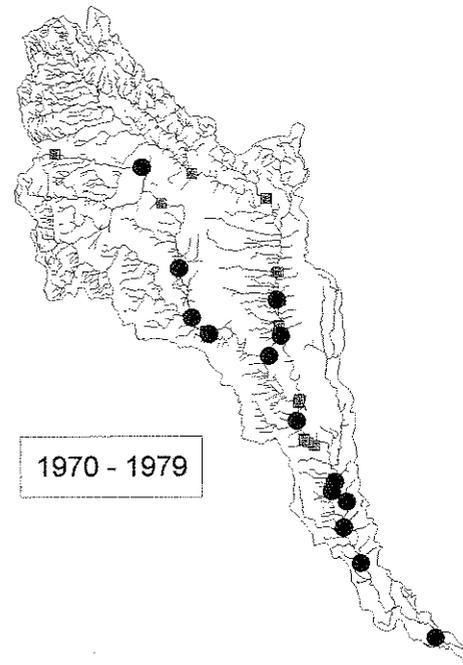
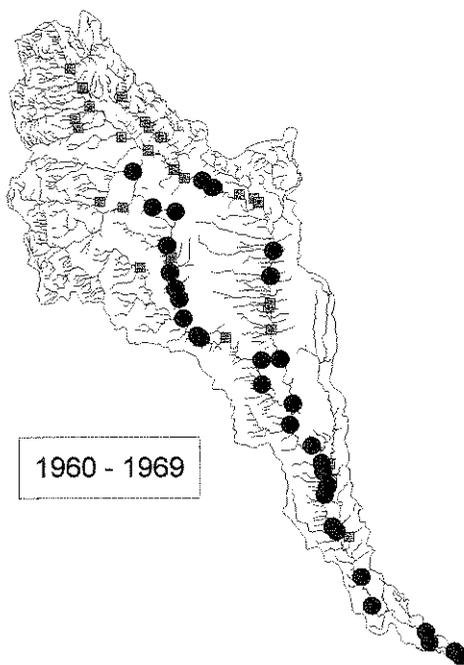
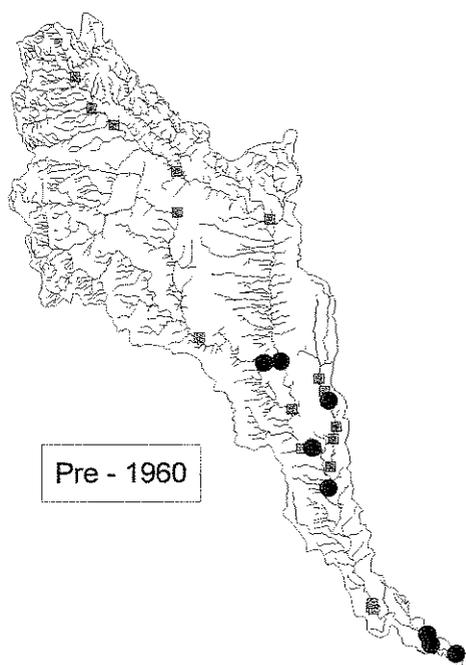


- Alive or fresh dead
- ⊙ Weathered or subfossil only (noted only for Historical Range)
- Location surveyed, but this species not found

Wavy-rayed lampmussel

Big Darby Creek System

Lampsilis fasciola Rafinesque, 1820.



0 4 8 12 16 20 Miles

0 5 10 15 20 25 Kilometers

- Alive or fresh dead
- ⊙ Weathered or subfossil only (noted only for Historical Range)
- Location surveyed, but this species not found