2014 San Juan River Colorado Pikeminnow and Razorback Sucker larval fish monitoring

Prepared for the Coordination Committee of the
San Juan River Basin Recovery Implementation Program

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13 May 2015

Project Goals and Objectives

As related to the San Juan River Long Range Plan (LRP)

LRP Task #	*Specific goals, actions, and tasks*
● **Task 4.1.1.1**	**Monitor and evaluate fish community**
● **Task 4.1.2.1**	**Conduct larval fish studies to determine:** ➔ is reproduction occurring ➔ locate spawning and nursery areas ➔ gauge the extent of annual reproduction
● **Task 4.1.2.5**	**Acquire catch rate data to:** ➔ Estimate relative abundance of endangered (larval) fish populations
● **Task 4.2.3.2**	**Identify principal river reaches and habitats used by early life stages of endangered fishes**

Methods

- **Study Area:**
  - ➔ **Shiprock to Clay Hills (RM 147.9 - 2.9)**
  - ➔ **Reach 5 through Reach 1**

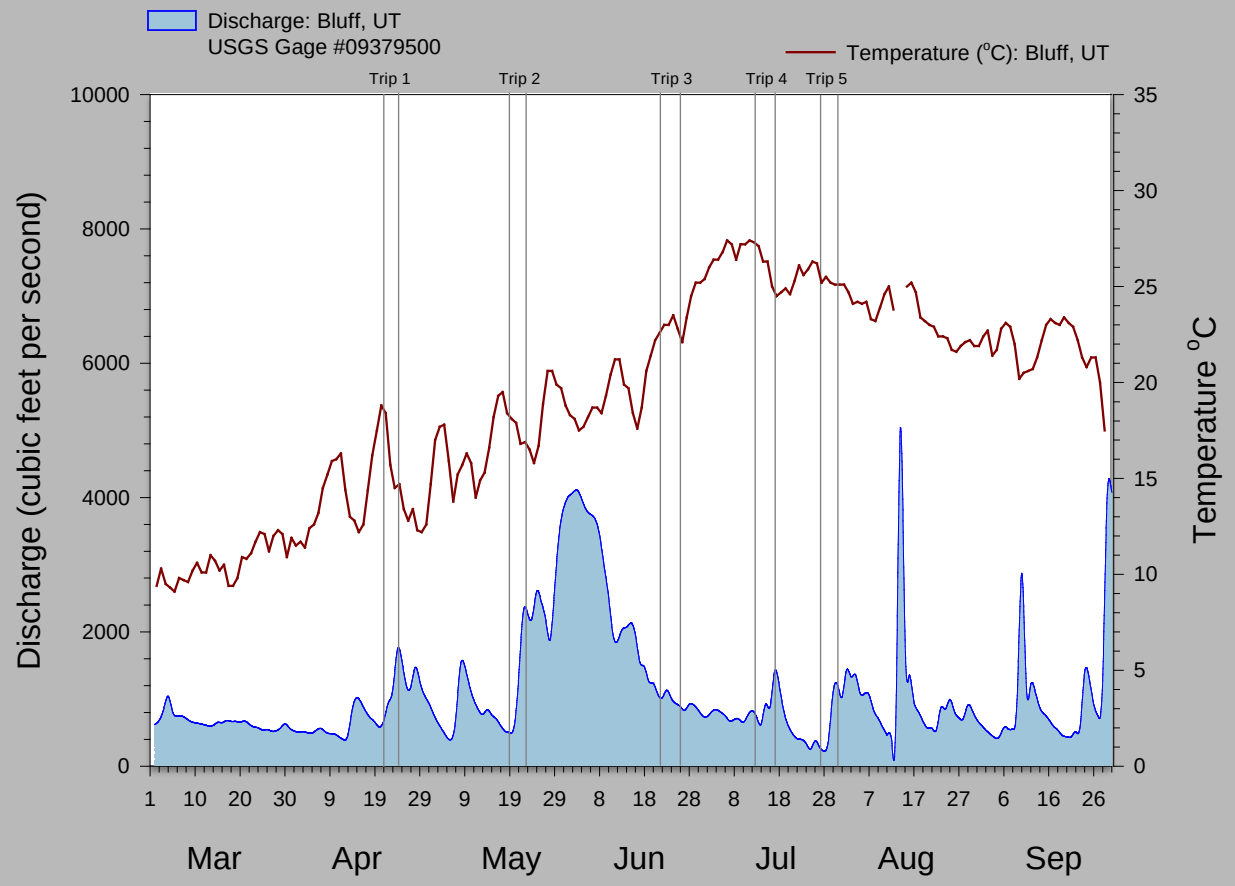
- **Five Sampling Efforts per year:**
  - ➔ **April through August**
  - ➔ **Two crews simultaneously sample upper & lower reach (upper: RM 147.9 – 76.6; lower: RM 76.6 – 2.9)**

- **Only larval fish habitats are sampled**
  - ➔ **Low-velocity (=nursery habitats)**
  - ➔ **Fish sampled with fine-mesh seine (0.8 mm mesh)**

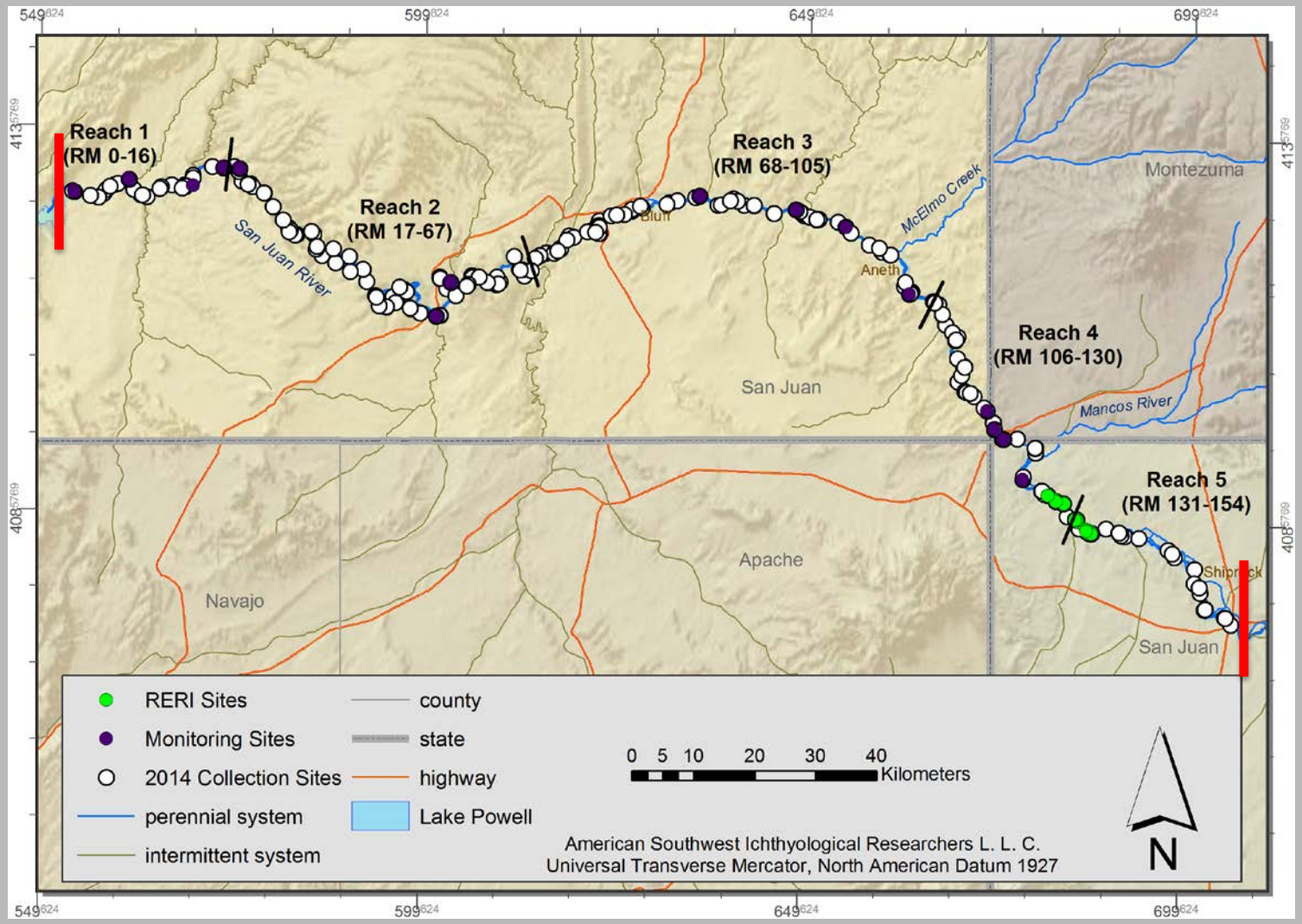
- **Larval specimens preserved in field (identified in lab)**
  - ➔ **Age class (age 0, age 1+) determined for all species**
  - ➔ **Larval stage & length determined for endangered fish** *(protolarvae, mesolarvae, metalarvae, juvenile*)

2014 San Juan River Hydrograph

Larval ichthyofaunal collection dates



2014 Distribution of collection sites



2014 Larval Fish Survey
River-wide Catch

Species	Age 0	Age 1+
Colorado Pikeminnow	**312 (58 in previous 21 yrs)**	**98**
Roundtail Chub	1	-
Speckled Dace	4,897	17
Fathead Minnow	1,155	86
Red Shiner	6,287	889
Common Carp	17	-
Razorback Sucker	**612**	**-**
Flannelmouth Sucker	1,945	3
Bluehead Sucker	3,024	2
Black Bullhead	15	-
Yellow Bullhead	-	-
Channel Catfish	881	3
Plains Killifish	25	2
Western Mosquitofish	79	27
Green Sunfish	-	-
Largemouth Bass	38	1
TOTAL	**19,288**	**1,220**

8,623 m^2 sampled *292 collections* *260 unique sites*

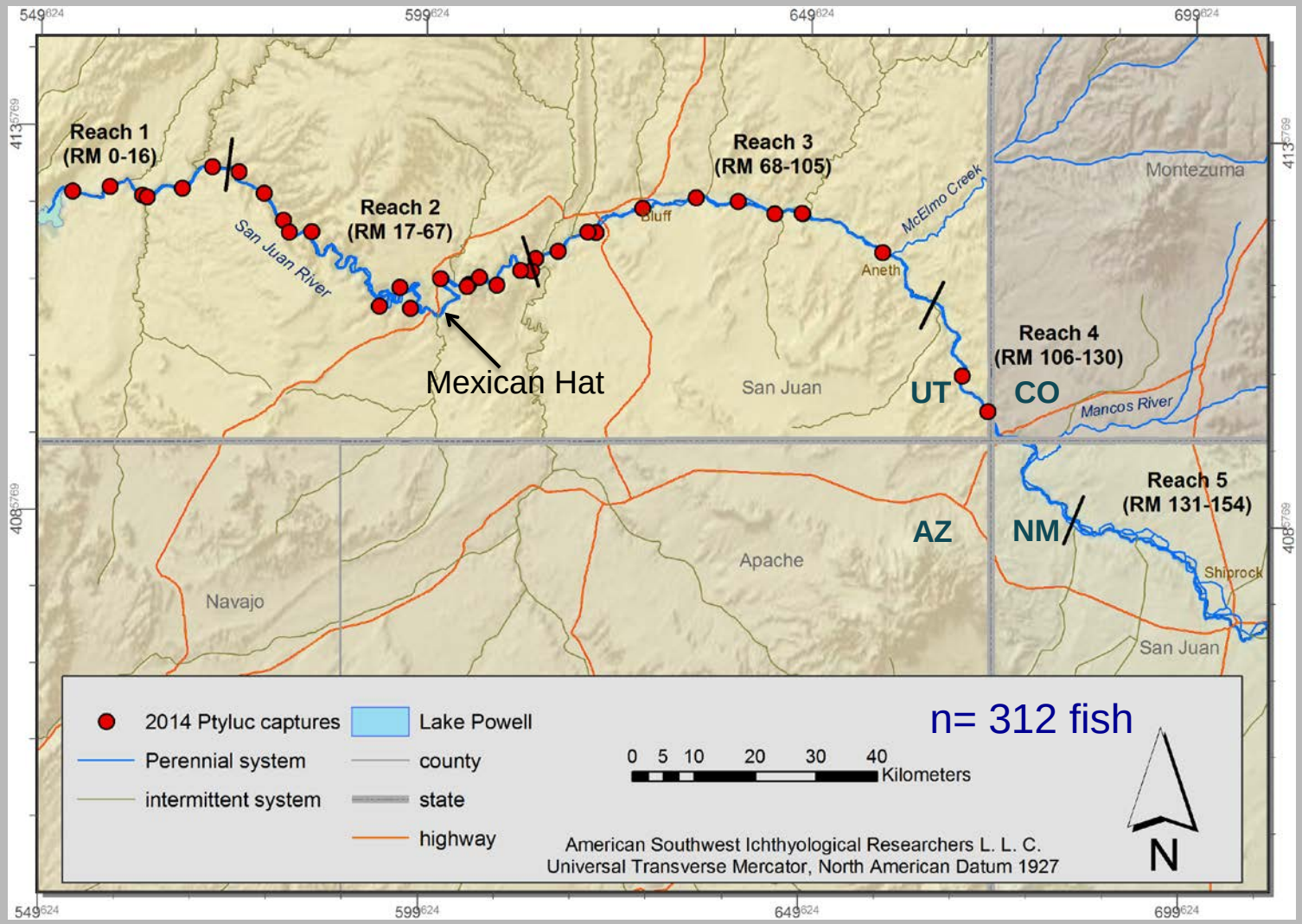
Variables in the mixture-models

Delta(δ)	Probability of occurrence. Present or absent?
Mu(μ)	Mean density. Number of fish/area sampled.
E(x)	Combine Delta and Mu to get an overall estimated density.

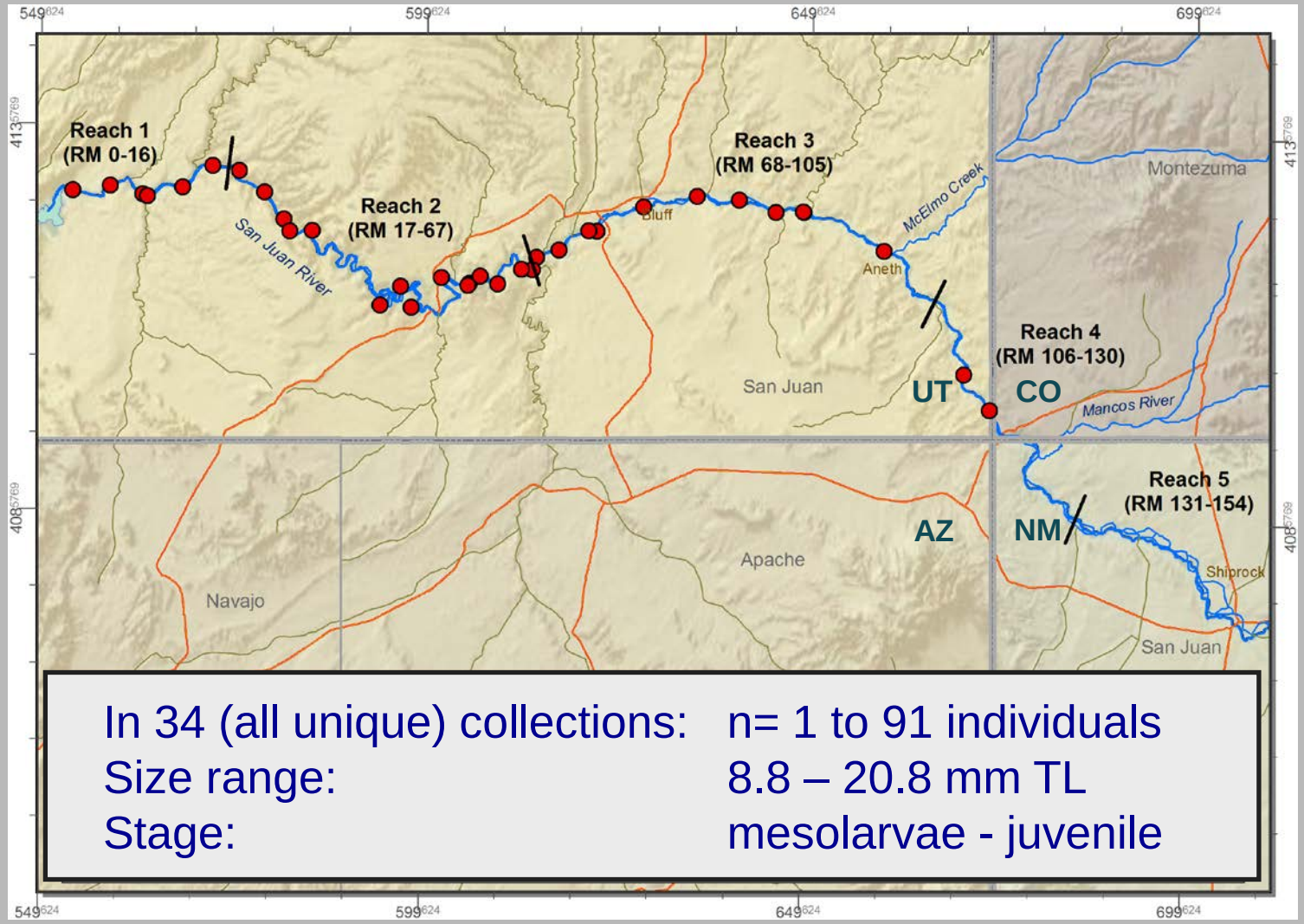
Covariates used in models in addition to year and reach

Razorback Sucker 1999-2014	Mean April flow and temperature	Mean May flow and temperature	Annual # stocked	Cumulative # stocked	Fall Monitoring Captures
Colorado Pikeminnow 2003-2014	Mean June flow and temperature	Mean July flow and temperature	Fall Monitoring Captures: • 450+ mm TL • 300-449 mm TL		

2014 Distribution of age-0 Colorado Pikeminnow

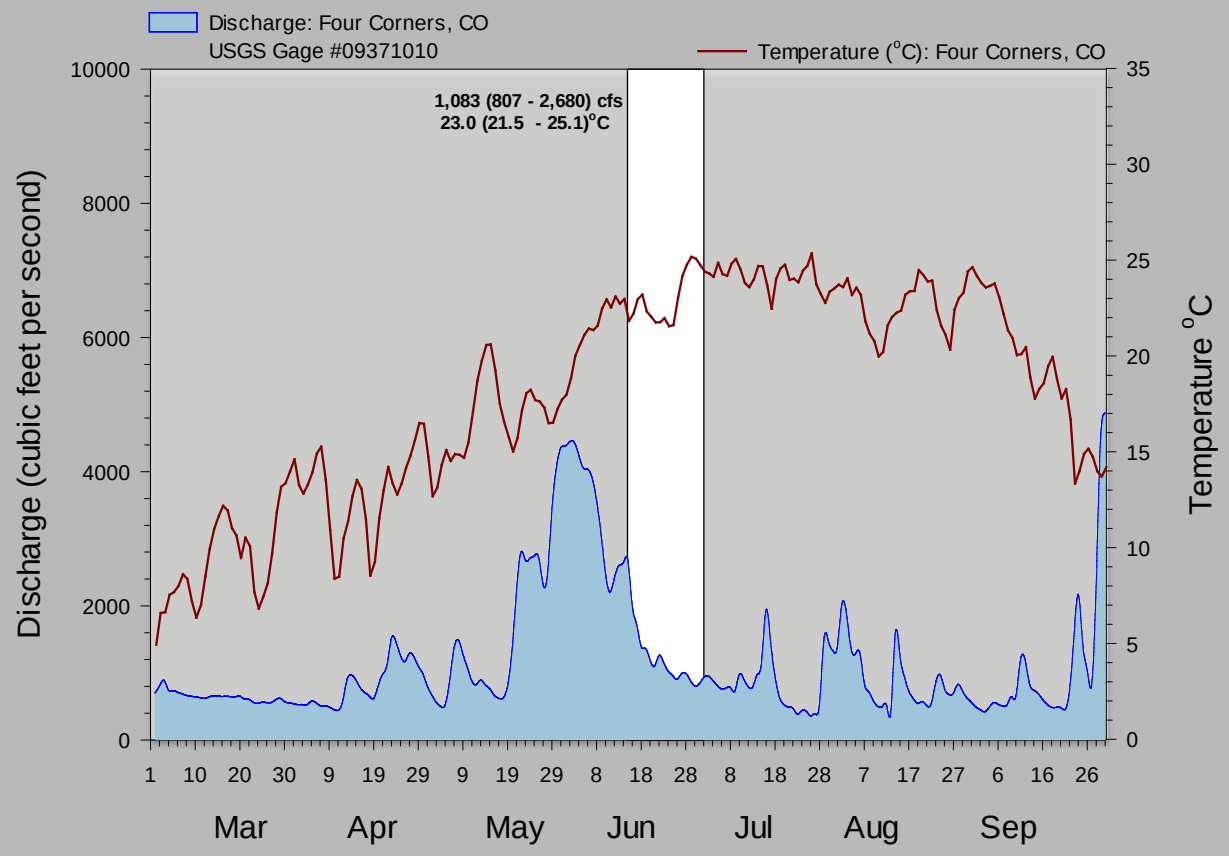


2014 Distribution of age-0
Colorado Pikeminnow

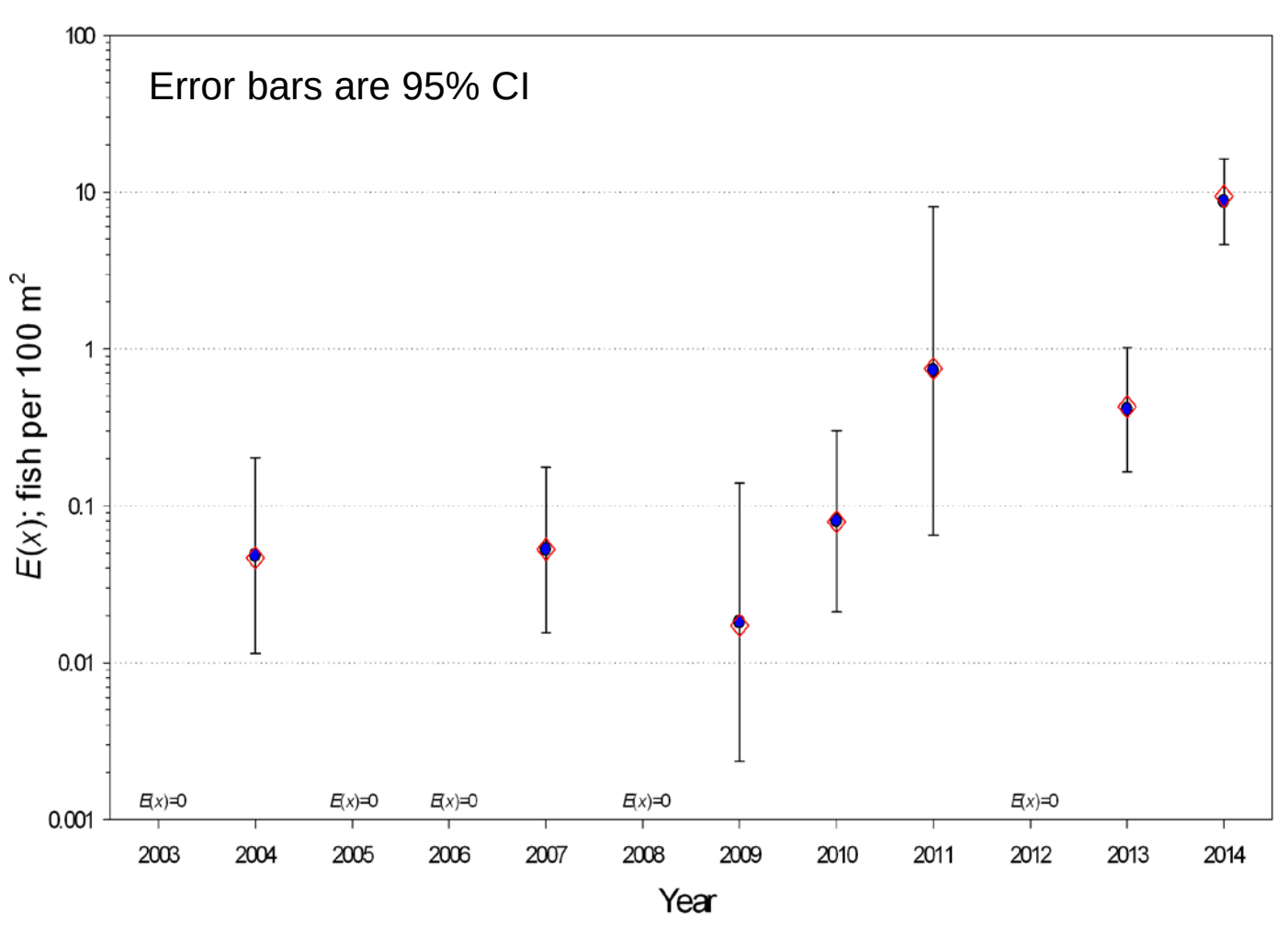


In 34 (all unique) collections:	n= 1 to 91 individuals
Size range:	8.8 – 20.8 mm TL
Stage:	mesolarvae - juvenile

Back-calculated spawning dates
of larval Colorado Pikeminnow. 15 June - 2 July (18d)



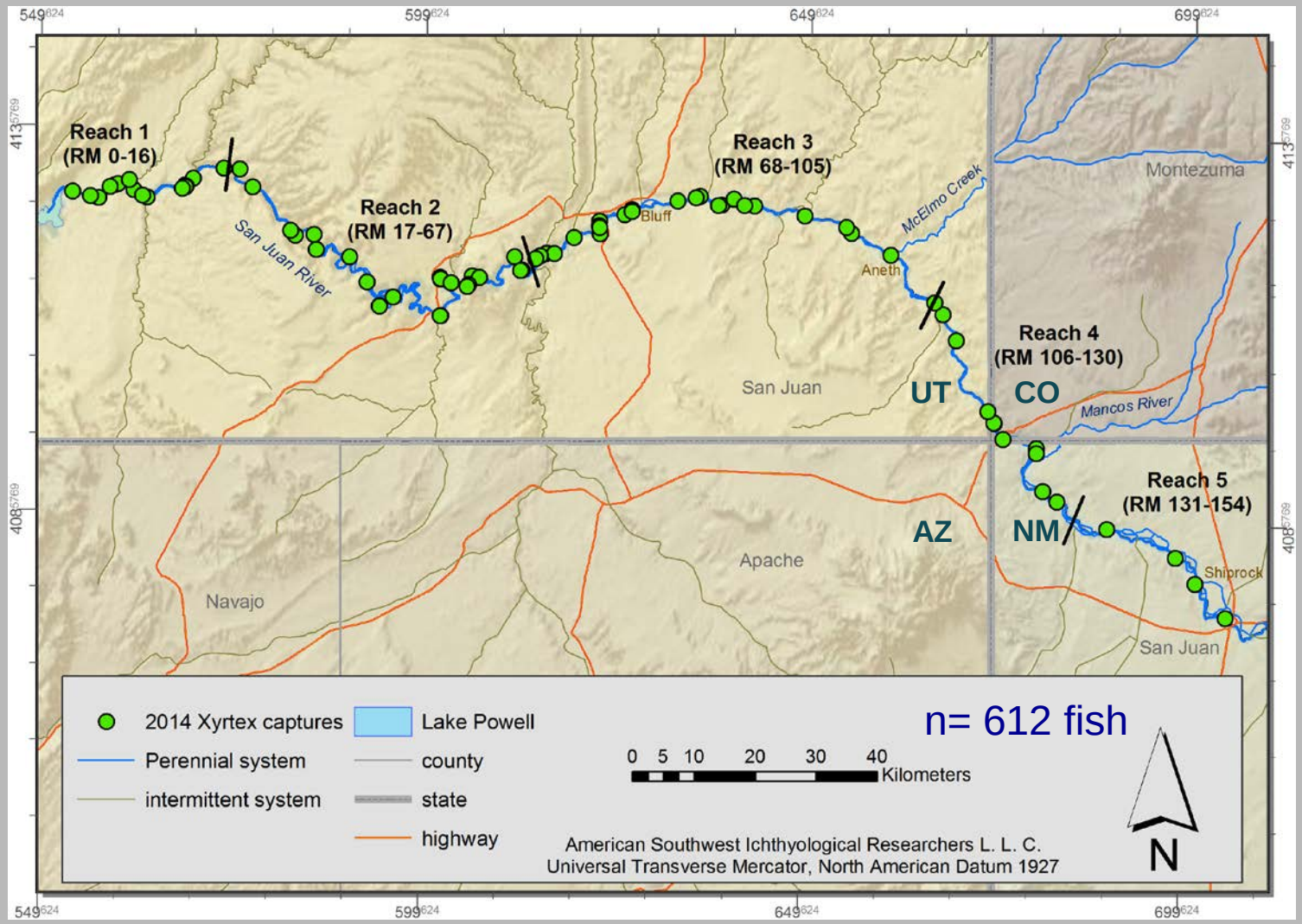
Colorado Pikeminnow mixture-model estimates (*E(x)*) 2003 - 2014



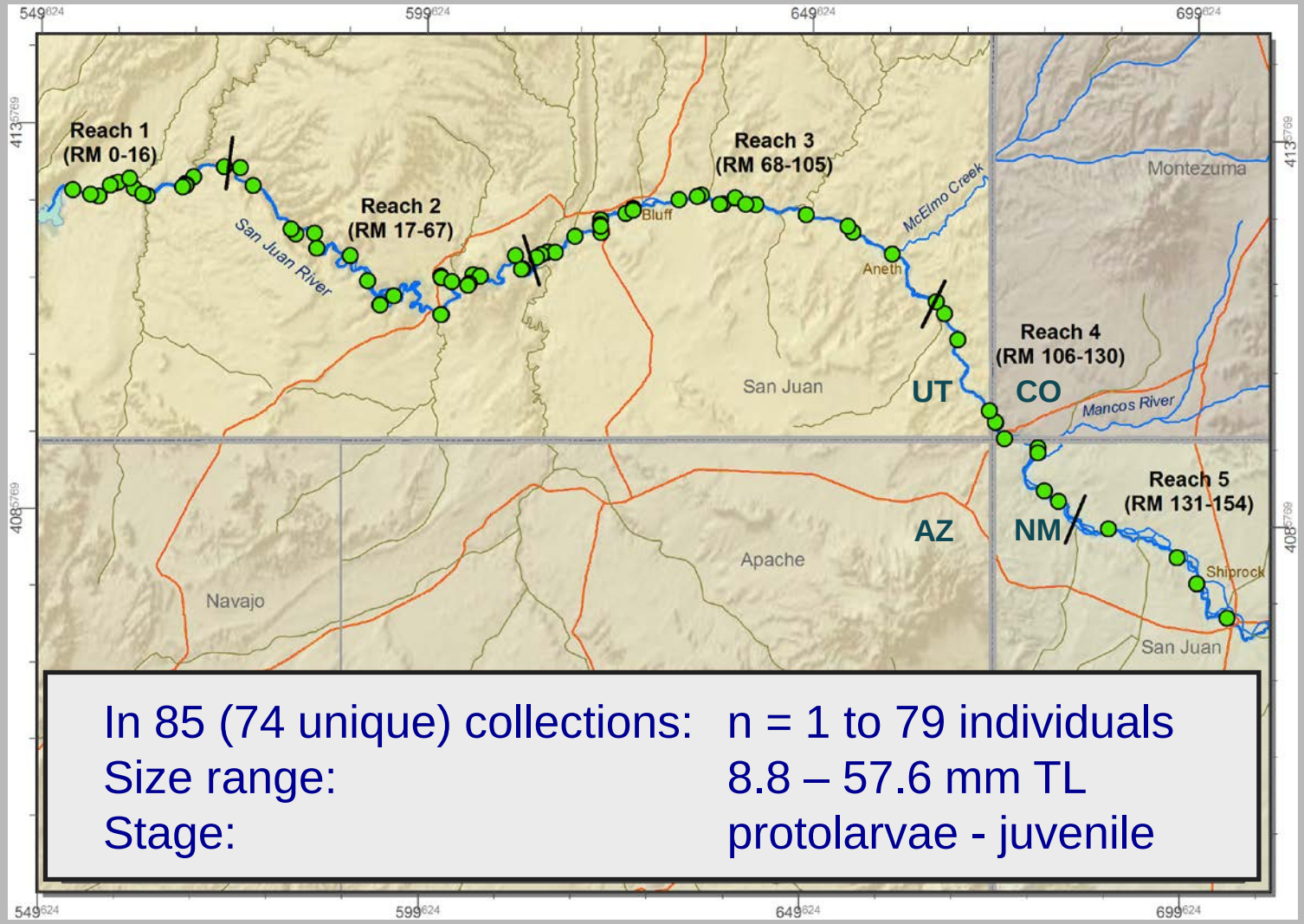
General linear models of Colorado Pikeminnow mixture-model estimates Delta(δ) and Mu(μ)

Model	K	AIC_C	Weight AIC_C
δ(Year) μ(Monitor 450+mm TL)	16	414.61	0.491
δ(Year) μ(Monitor 300-449 mm TL)	16	416.82	0.163
δ(Year) μ(.)	14	417.46	0.118
δ(Year) μ(June flow)	16	419.06	0.053
δ(Year) μ(July temp.+random)	17	419.57	0.041
δ(Year) μ(June flow+random)	17	419.71	0.038
δ(Year) μ(Monitor 450+mm TL+random)	17	419.87	0.035
δ(Year) μ(Monitor 300-449 mm TL+random)	17	419.92	0.034
δ(Year) μ(July temp.)	16	420.60	0.025
δ(Monitor 450+mm TL+random) μ(Monitor 450+mm TL+random)	9	427.76	0.001

2014 Distribution of age-0
Razorback Sucker

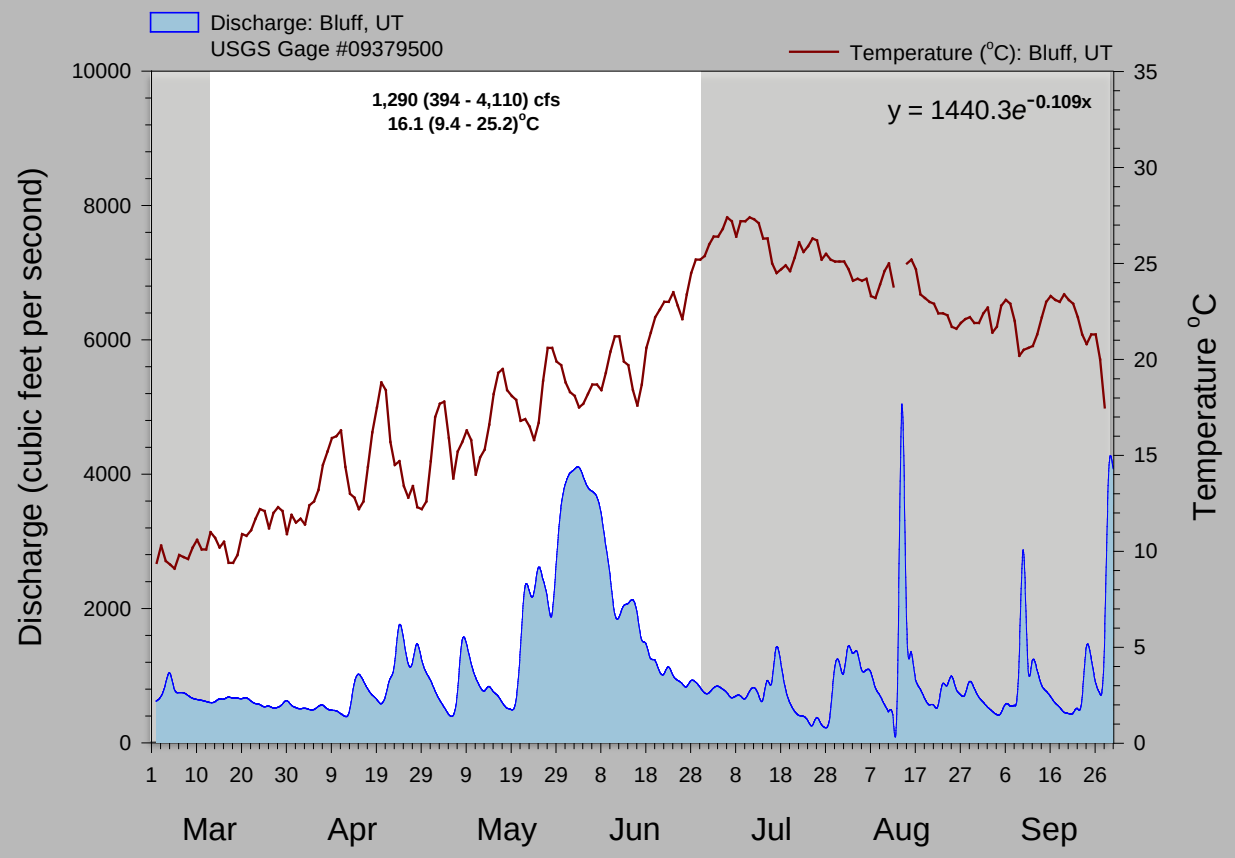


2014 Distribution of age-0
Razorback Sucker

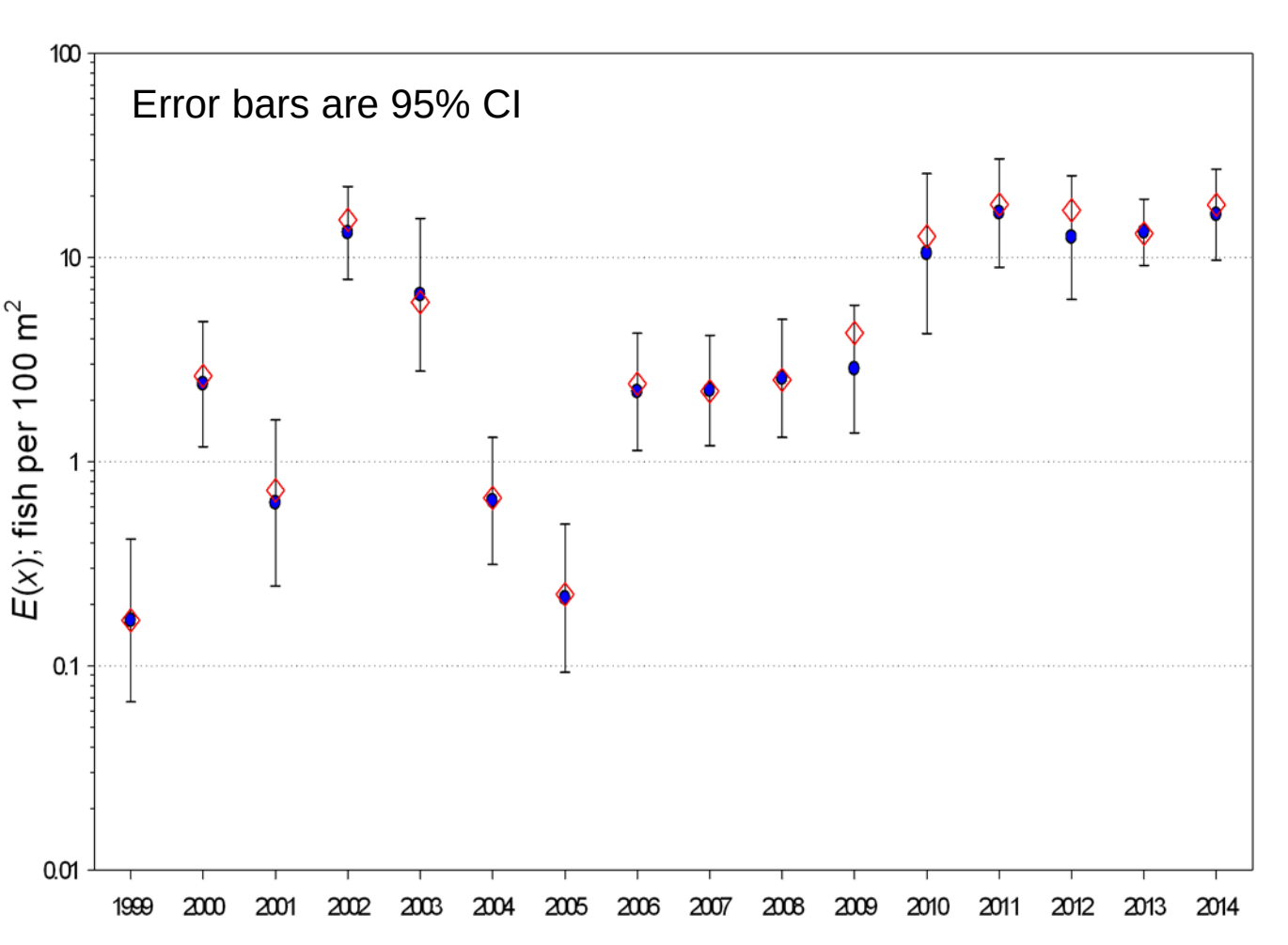


In 85 (74 unique) collections:	n = 1 to 79 individuals
Size range:	8.8 – 57.6 mm TL
Stage:	protolarvae - juvenile

Back-calculated spawning dates
of larval Razorback Sucker. 13 March – 30 June (110d)



Razorback sucker mixture model estimates (*E(x)*) 1999 - 2014



General linear models of Razorback Sucker mixture-model estimates Delta(δ) and Mu(μ)

Model	K	AIC_C	Weight AIC_C
δ(Cum.Stock+random) μ(Cum.Stock+random)	9	3,267.38	0.720
δ(May flow+random) μ(May flow+random)	9	3,270.63	0.139
δ(Monitor+random) μ(Monitor+random)	9	3,292.62	0.091
δ(CumStock+random) μ(Year)	35	3,273.34	0.036
δ(Monitor+random) μ(Year)	35	3,276.81	0.006
δ(May flow+random) μ(Year)	35	3,278.24	0.003
δ(Year) μ(May flow+random)	21	3,279.10	0.002
δ(Year) μ(May flow)	20	3,279.18	0.002
δ(Year) μ(Year)	48	3,280.56	<0.001
δ(April flow+random) μ(April flow+random)	9	3,282.64	<0.001

2014 Conclusions
Age-0 Colorado Pikeminnow

- Spawning by Colorado Pikeminnow has been documented in 7 of the last 12 years (and 5 of the last 6).
- Mixture-model estimates suggest Fall Monitoring capture data is most likely to explain variation in annual larval Colorado Pikeminnow captures.
- The 2014 larval Colorado Pikeminnow collections were “record setting” in terms of numbers and frequency of occurrence.

2014 Conclusions
Age-0 Razorback Sucker

- Razorback Sucker has spawned 17 consecutive years (1998 – 2014)
- Back-calculated dates (2014) indicate spawning occurred over a nearly 16 week period.

2014 Conclusions
Age-0 Razorback Sucker

- Mixture-model estimates suggest that cumulative stocking (1998 – 2013) is most likely to explain variation in annual larval Razorback Sucker captures.

- Between 1998 – 2014 increased densities, range expansion, increased frequency of occurrence, prolonged spawning periods, and increases in the number of larger juvenile fish all imply management actions are having a positive impact on Razorback Sucker.

Acknowledgements

USFWS, San Juan River Recovery Implementation Program Office:
David Campbell, Scott L. Durst, Sharon B. Whitmore

U. S. Bureau of Reclamation, Salt Lake City Project Office:
Mark C. McKinstry, Melynda Roberts

U. S. Bureau of Land Management:
Brandt G. Hart, Linda M. Richmond, Silas Sparks

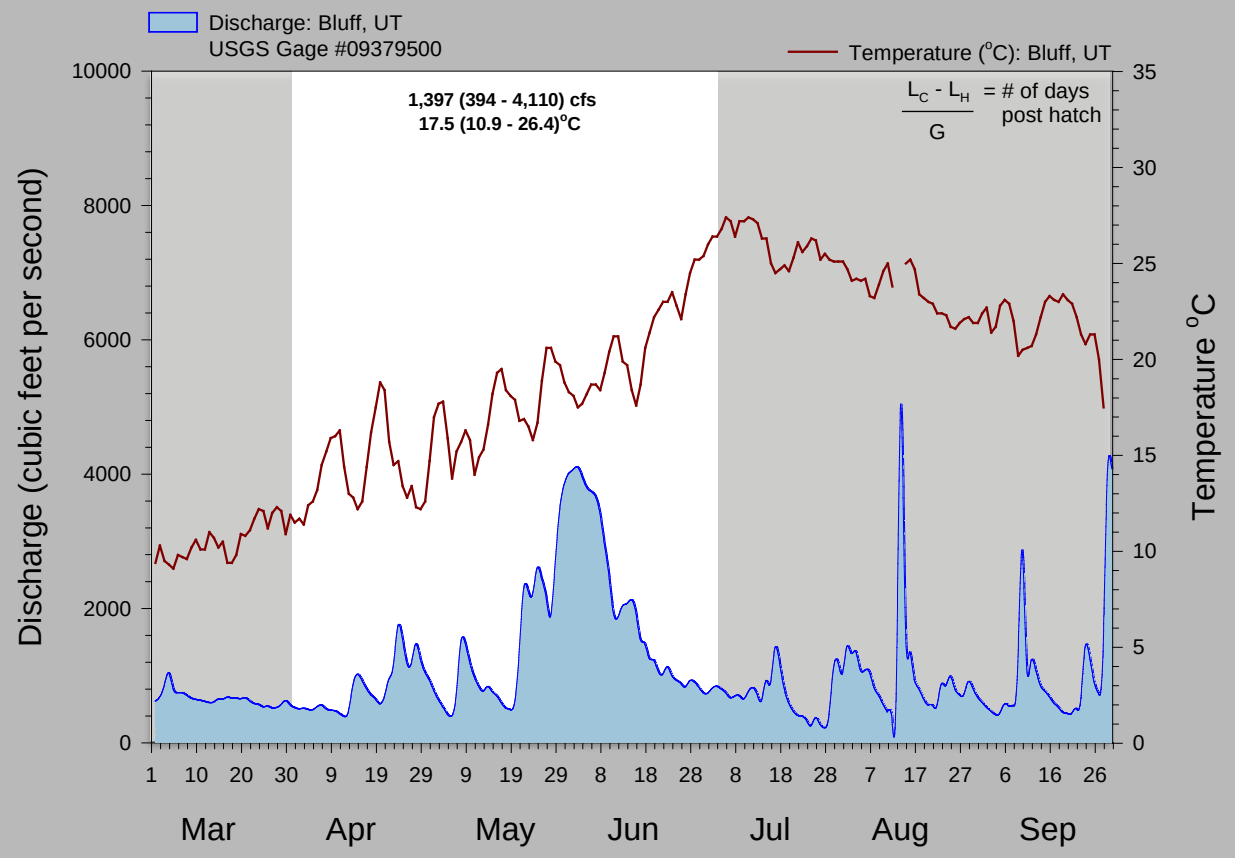
Field Assistance:
W. Howard Brandenburg, Chris A. Cheek, Scott L. Durst, Austin L Fitzgerald, Lee A. Fitzgerald

Data acquisition:
Scott L. Durst, D. Weston Furr, Benjamin Schleicher

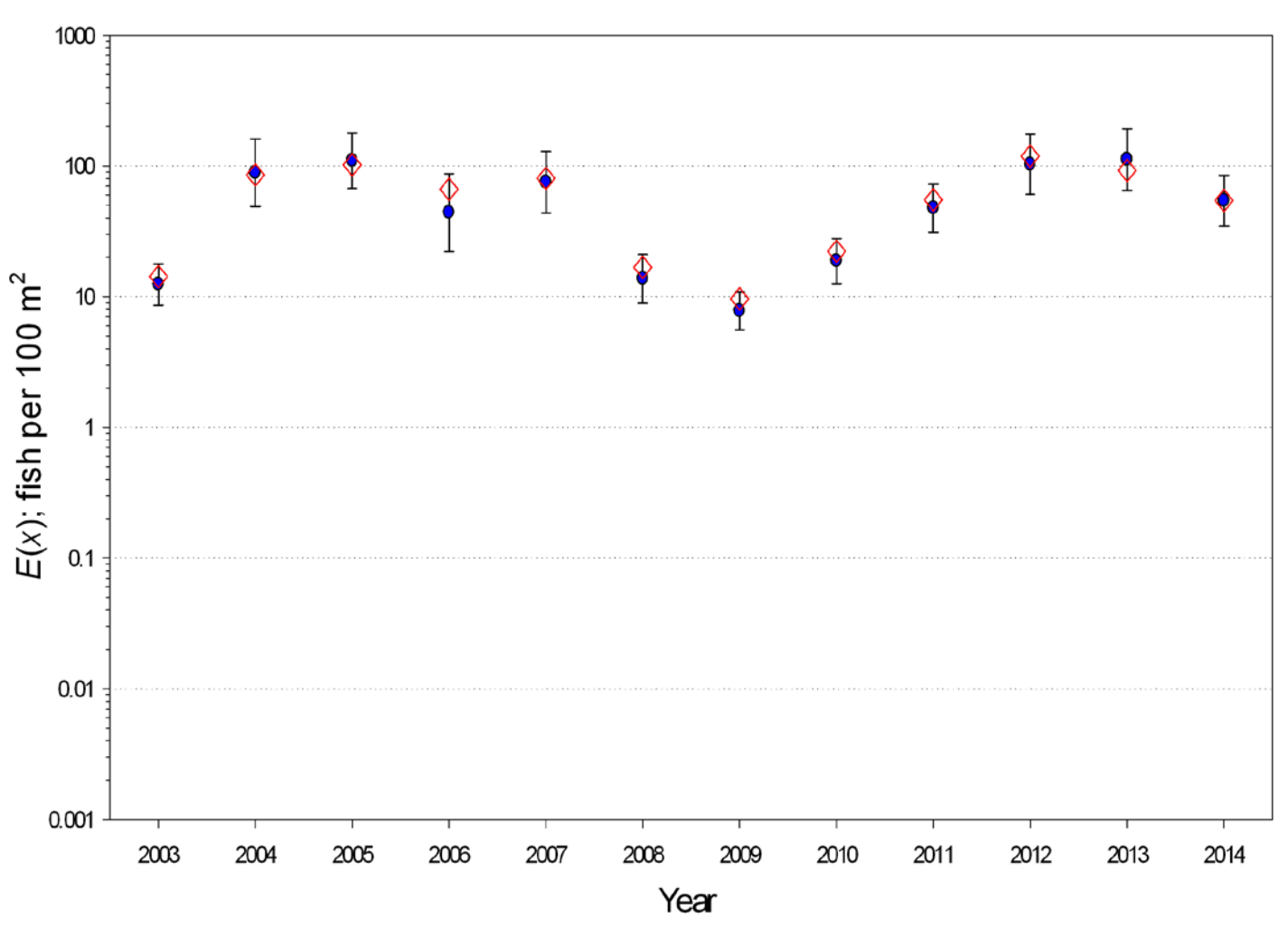
Museum of Southwestern Biology, University of New Mexico:
Alexandra M. Snyder, Thomas F. Turner (Curator), Kendra Brunet-Lecomte, Larissa E. Garcia, Maribel Solis

Review of Data and Reports:
Scott L. Durst, Stephen T. Ross, Melvin L. Warren, Tom Wesche

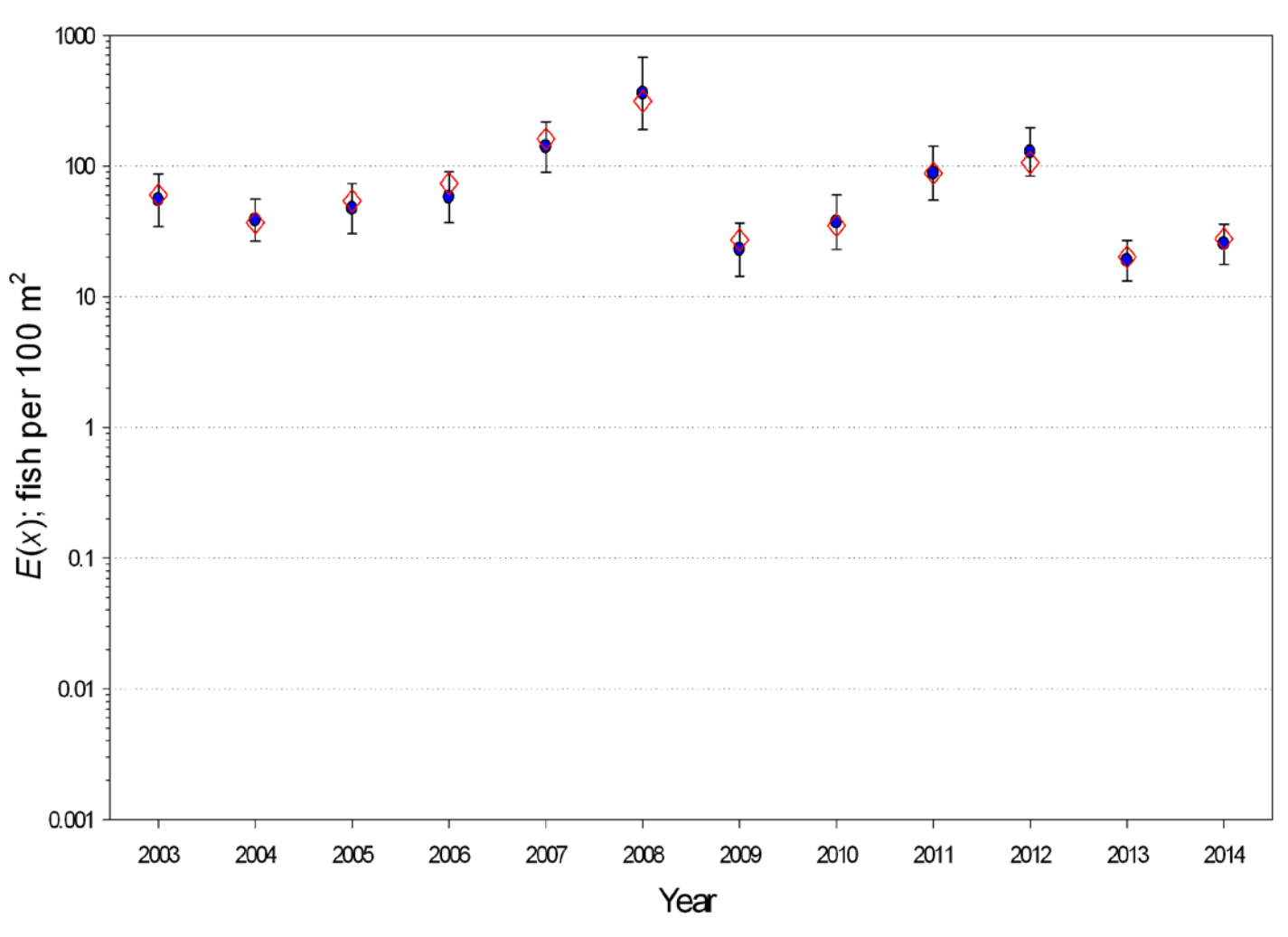
Back-calculated hatching dates
of larval Razorback Sucker. 31 March – 4 July (96d)



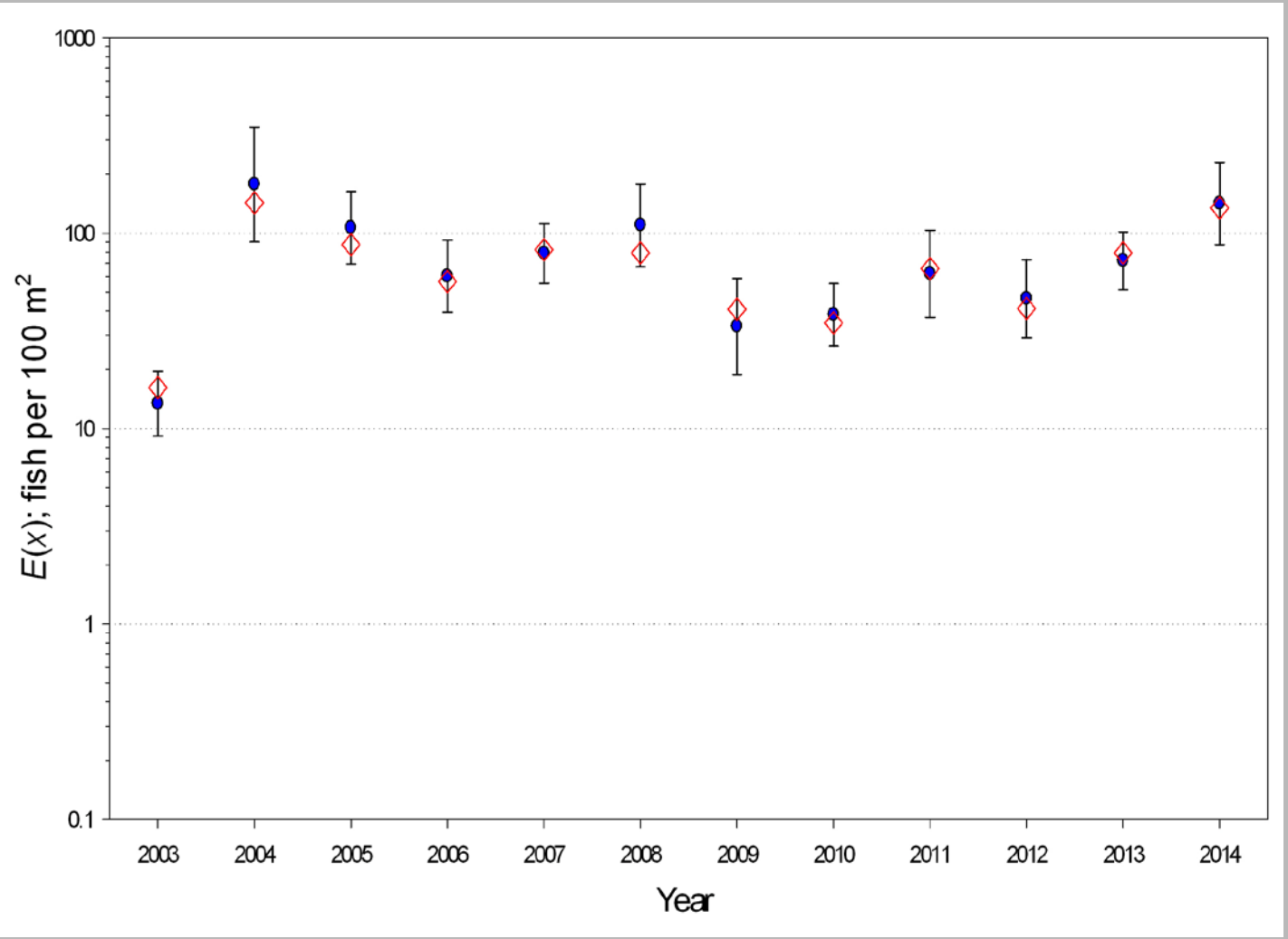
Bluehead Sucker mixture-model estimates (*E(x)*) 2003 - 2014



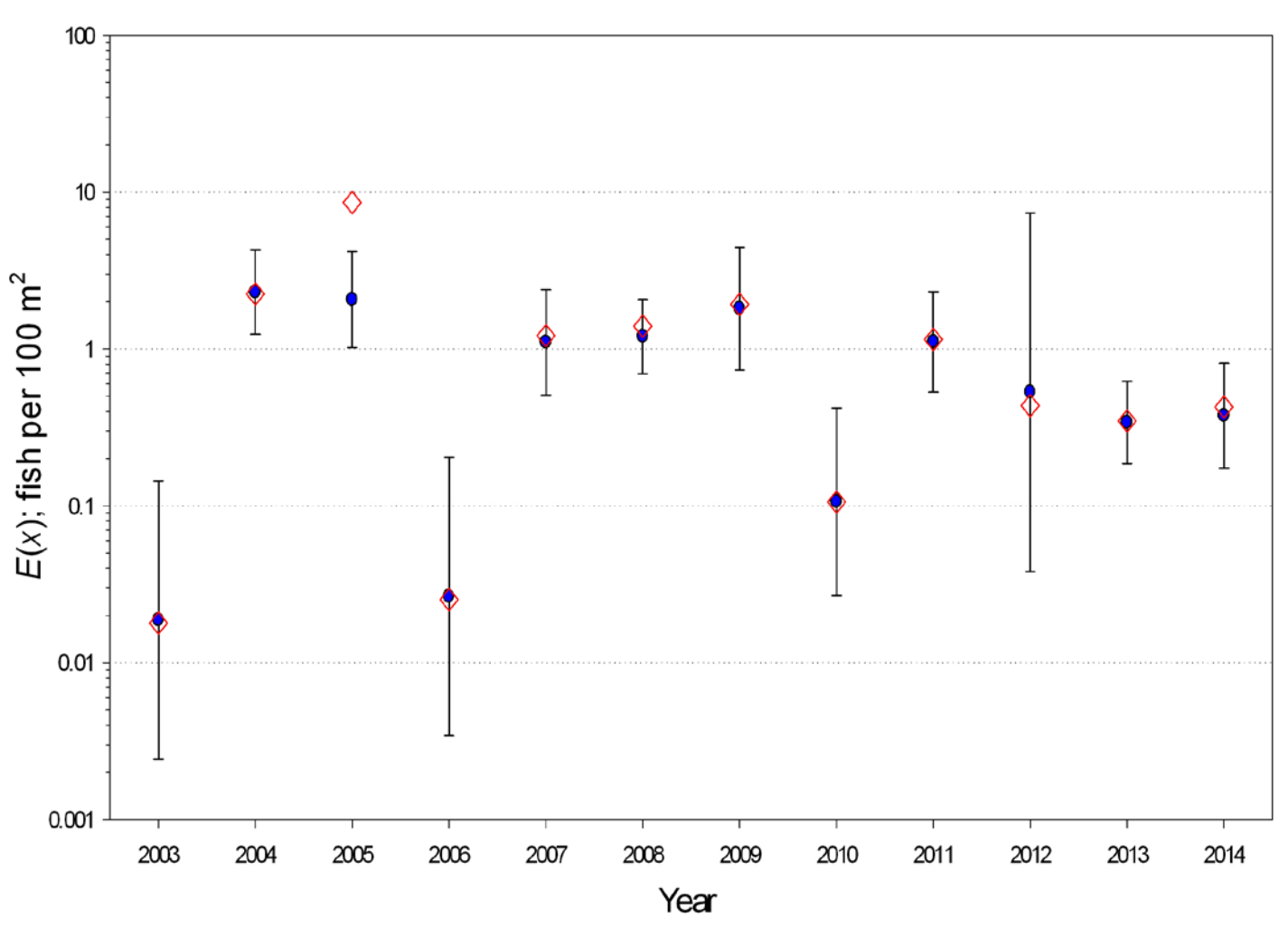
Flannelmouth Sucker mixture-model estimates (*E(x)*) 2003 - 2014



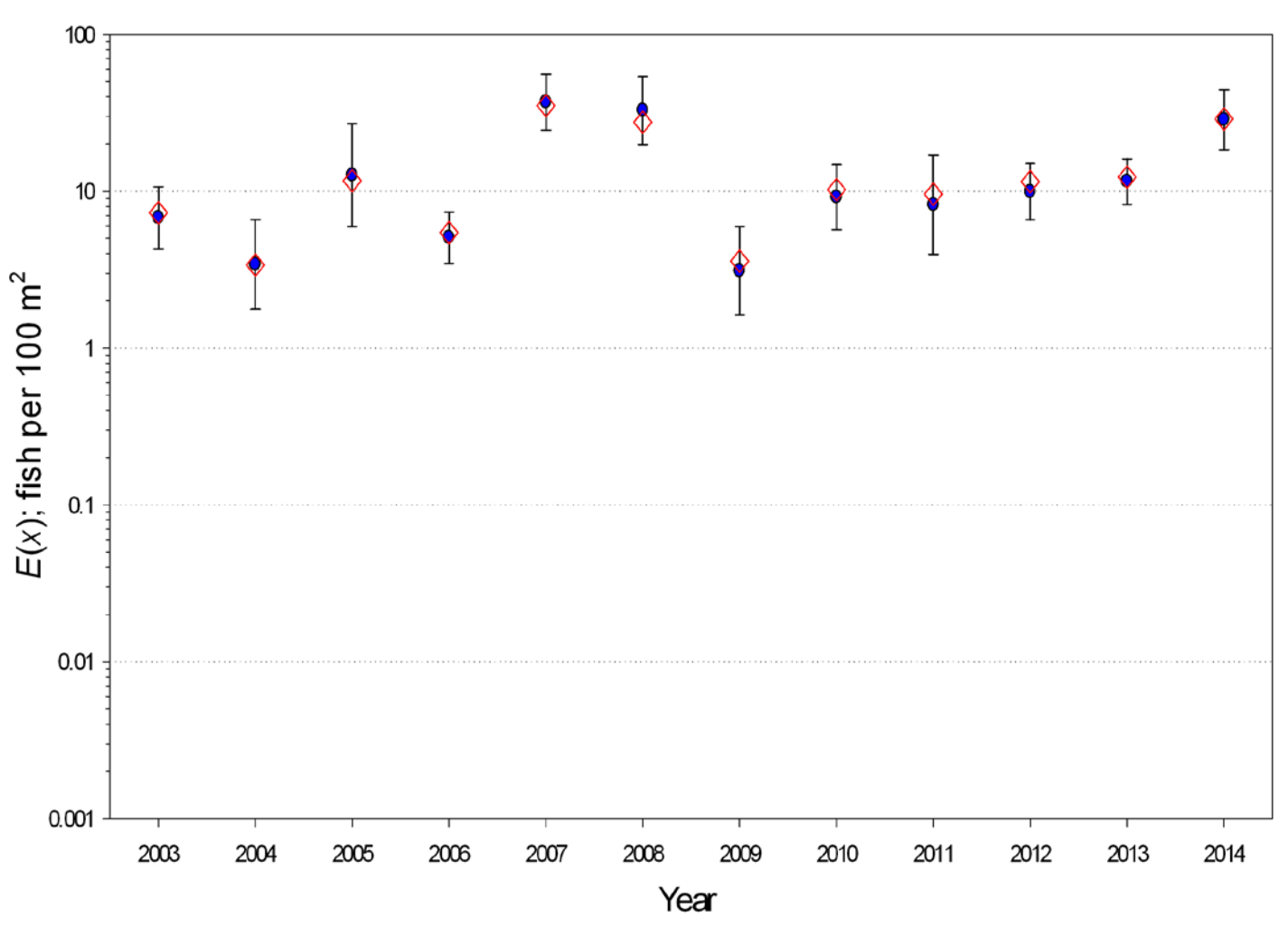
Speckled Dace mixture-model estimates (*E(x)*) 2003 - 2014



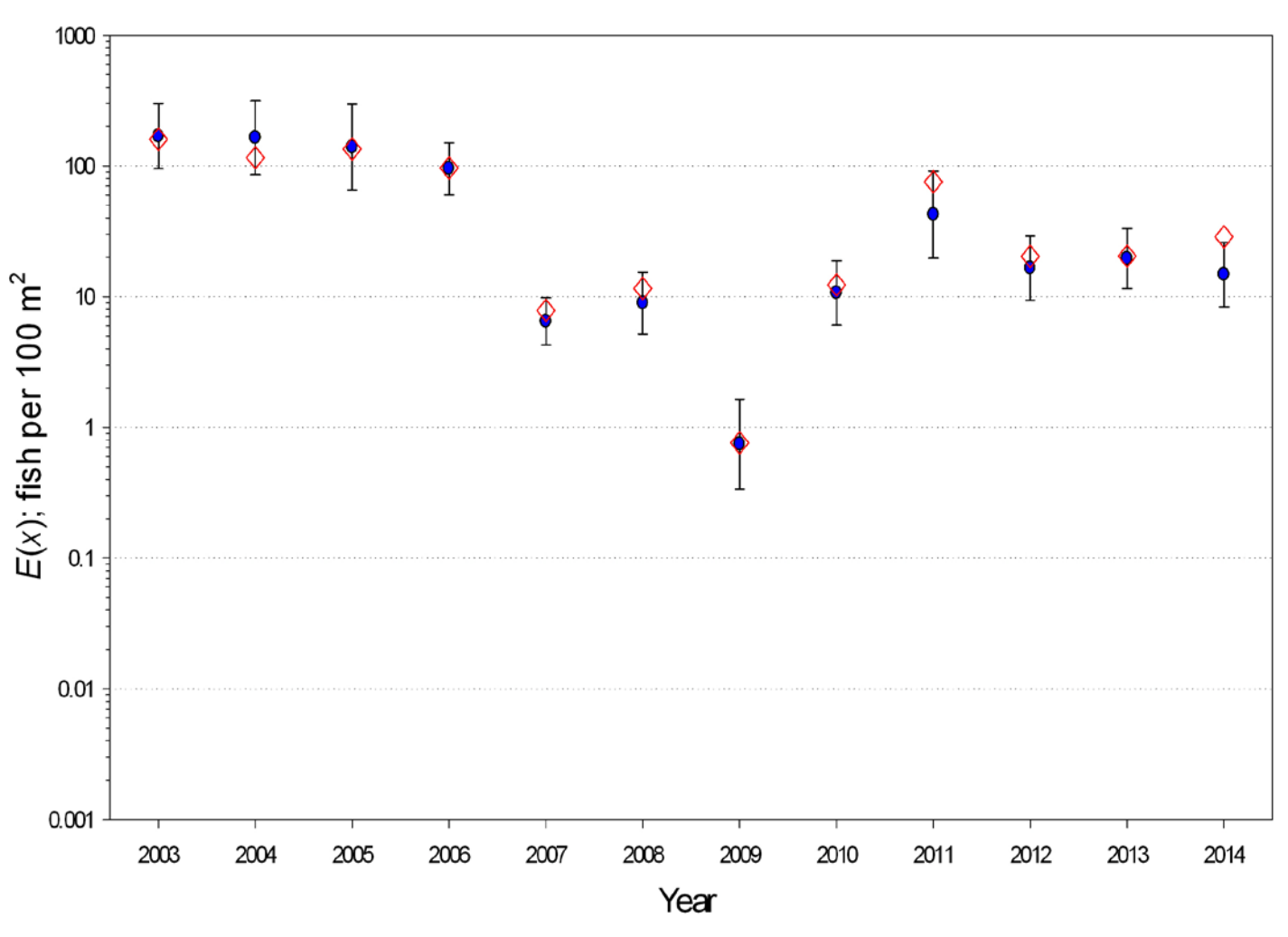
Common Carp mixture-model estimates (*E(x)*) 2003 - 2014



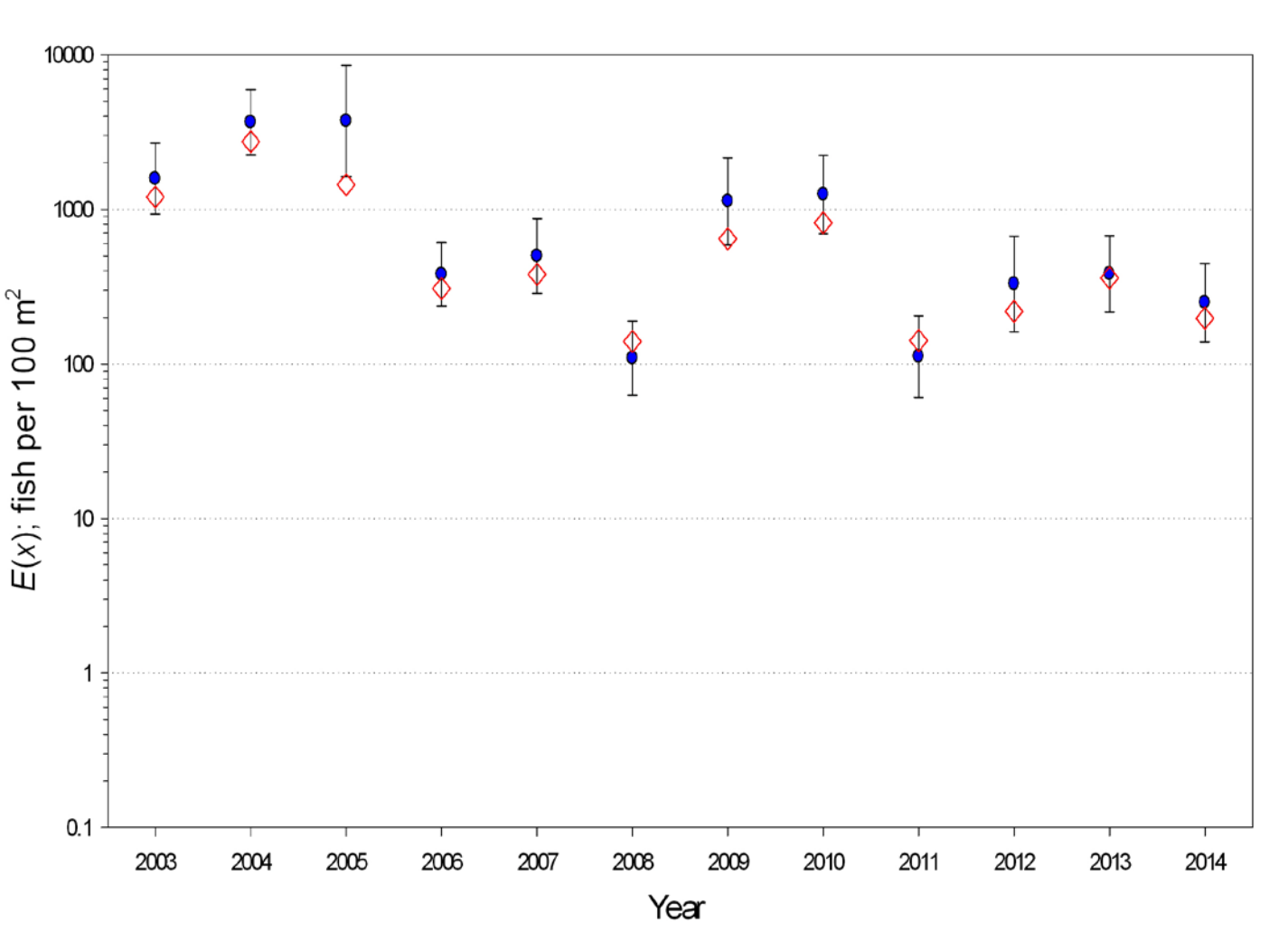
Channel Catfish mixture-model estimates (*E(x)*) 2003 - 2014



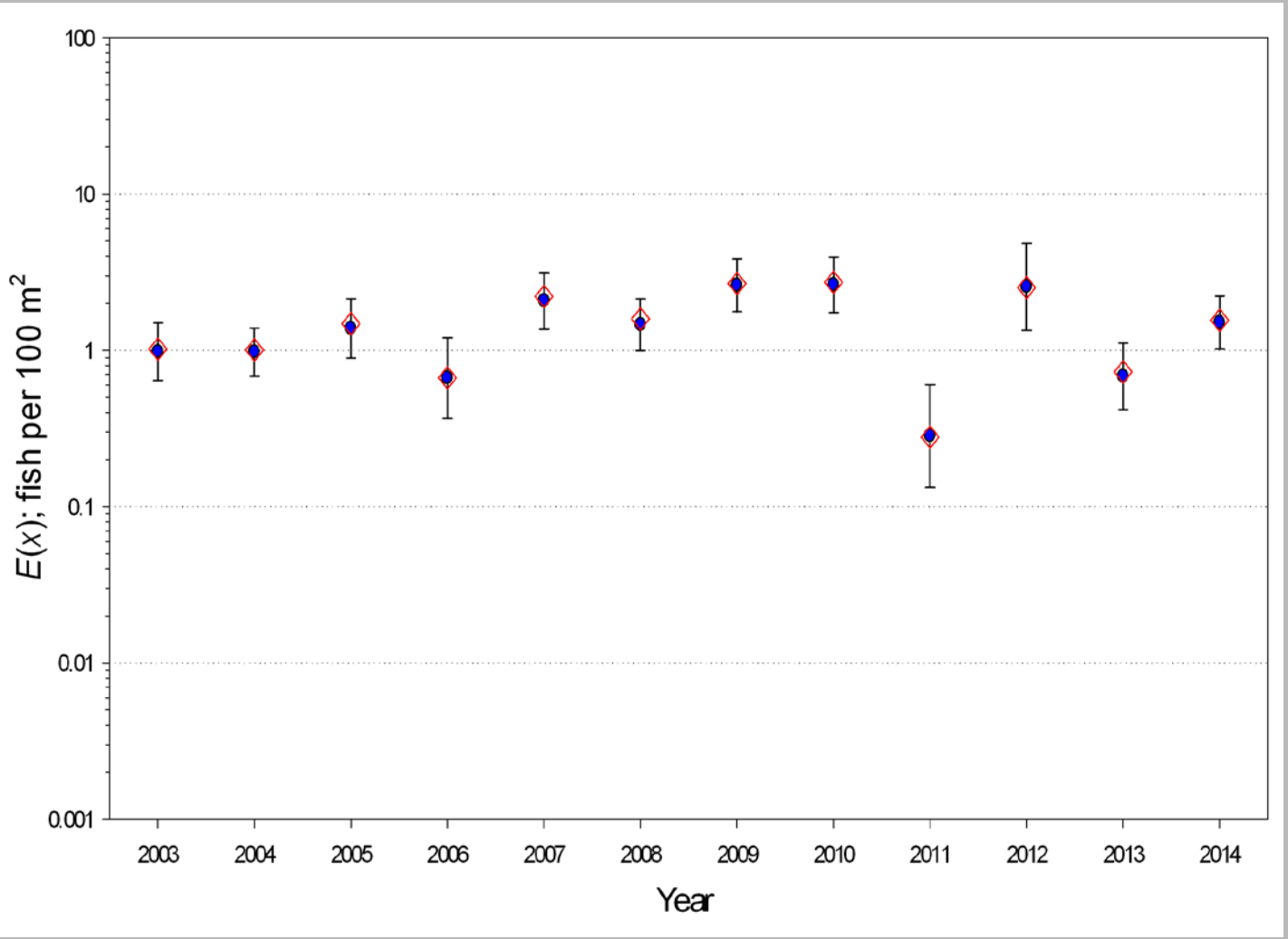
Fathead Minnow mixture-model estimates (*E(x)*) 2003 - 2014



Red Shiner mixture-model estimates (*E(x)*) 2003 - 2014

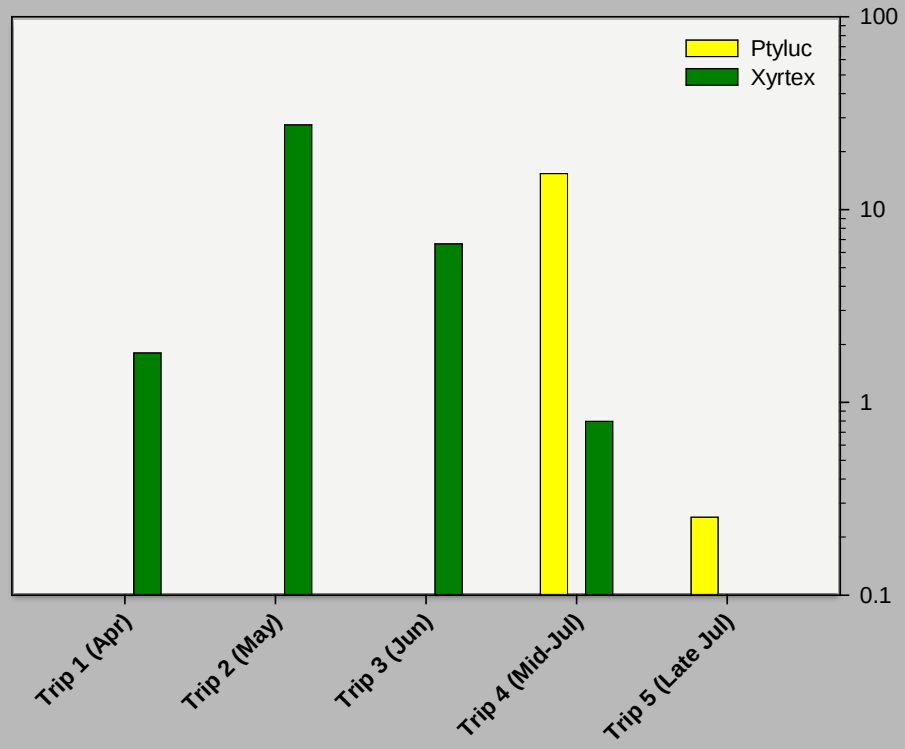


Colorado Pikeminnow mixture-model estimates (*E(x)*) 2003 – 2014 (Age-1+)

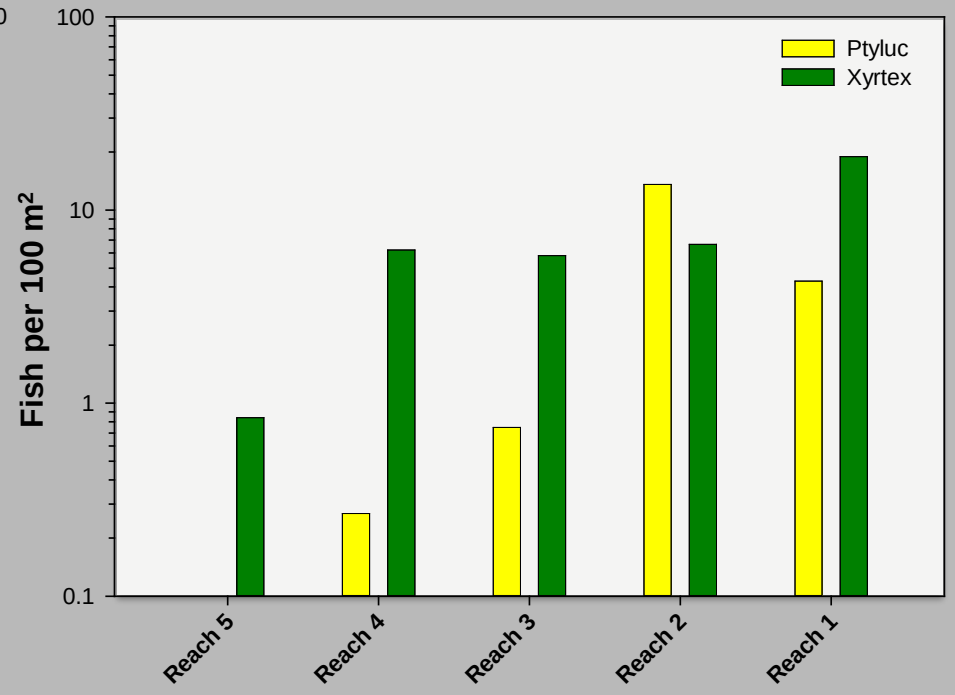


2014 larval *Colorado Pikeminnow* and *Razorback Sucker* densities by trip and reach

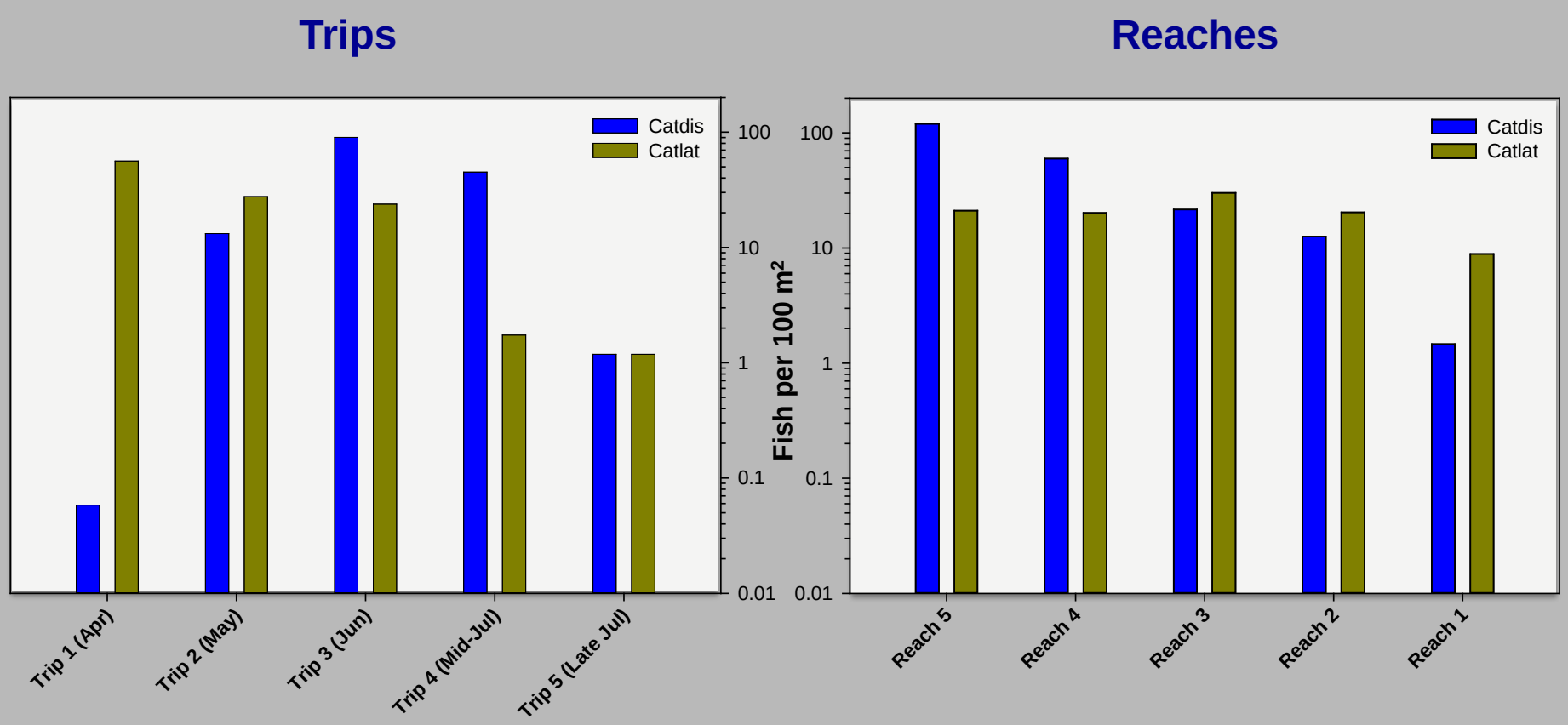
Trips



Reaches

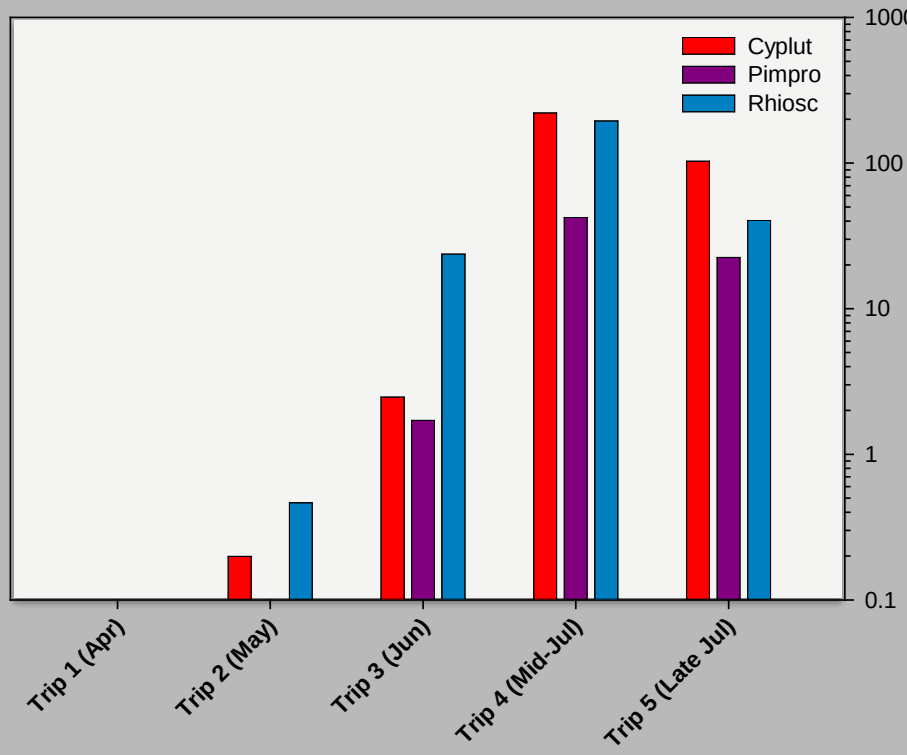


2014 larval *Bluehead sucker* and *Flannelmouth Sucker* densities by trip and reach

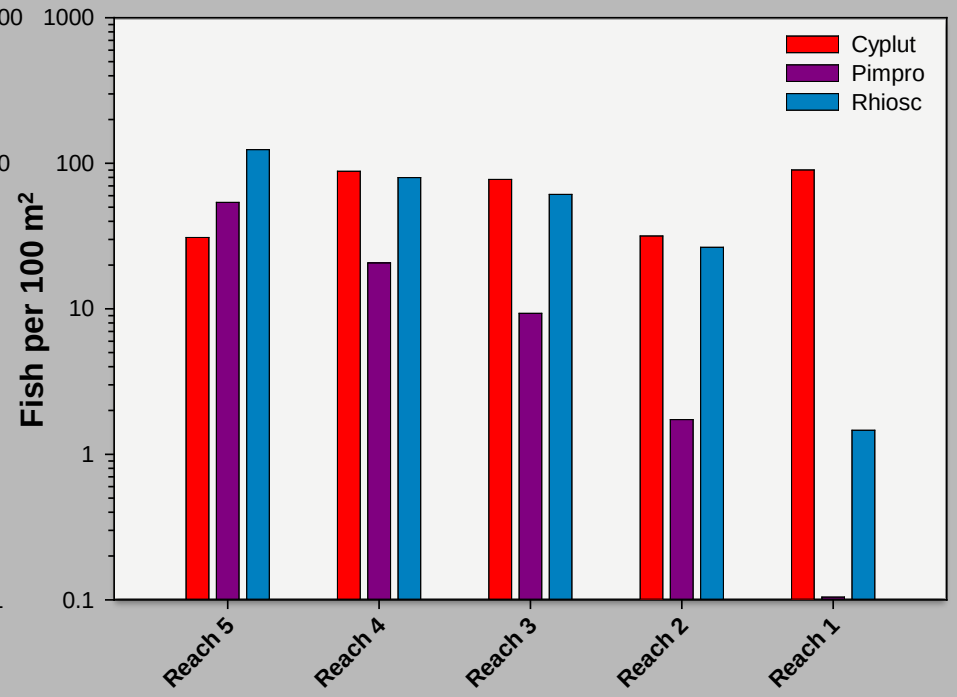


2014 larval *Red Shiner*, *Fathead Minnow* and *Speckled Dace* densities by trip and reach

Trips

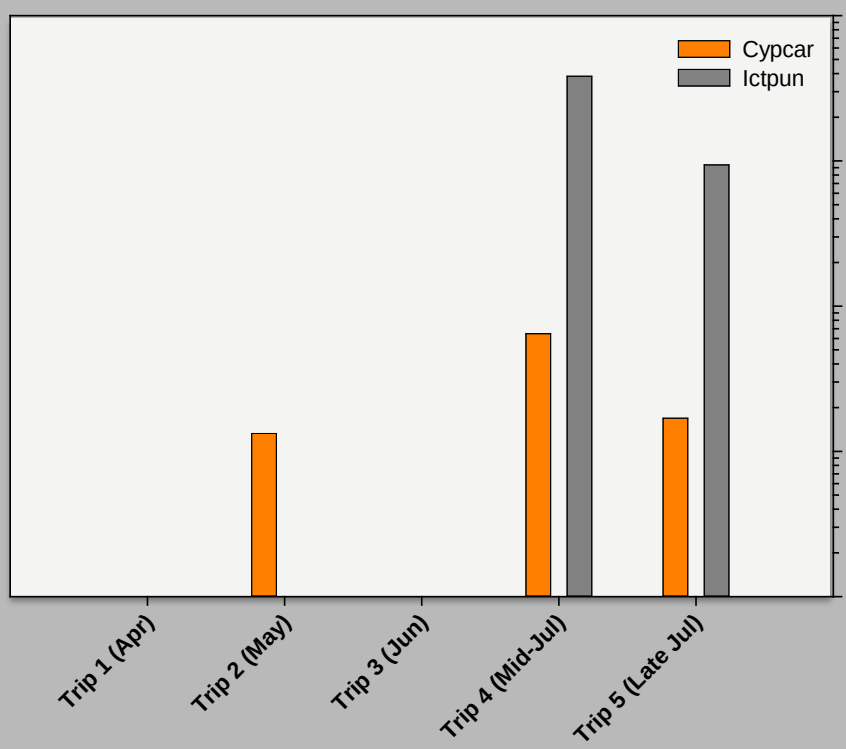


Reaches

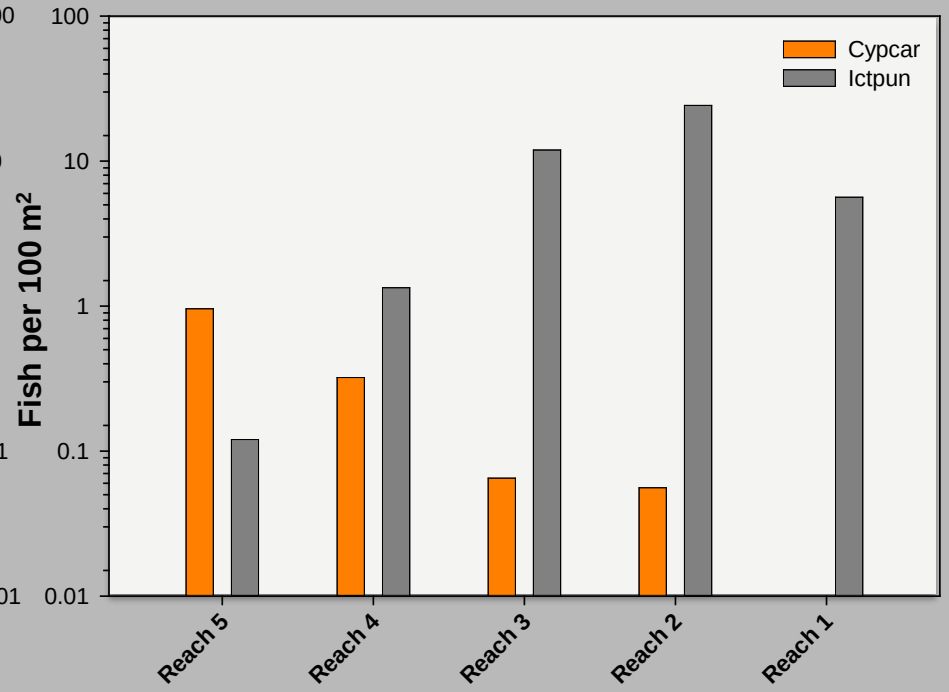


2014 larval *Common Carp* and *Channel Catfish* densities by trip and reach

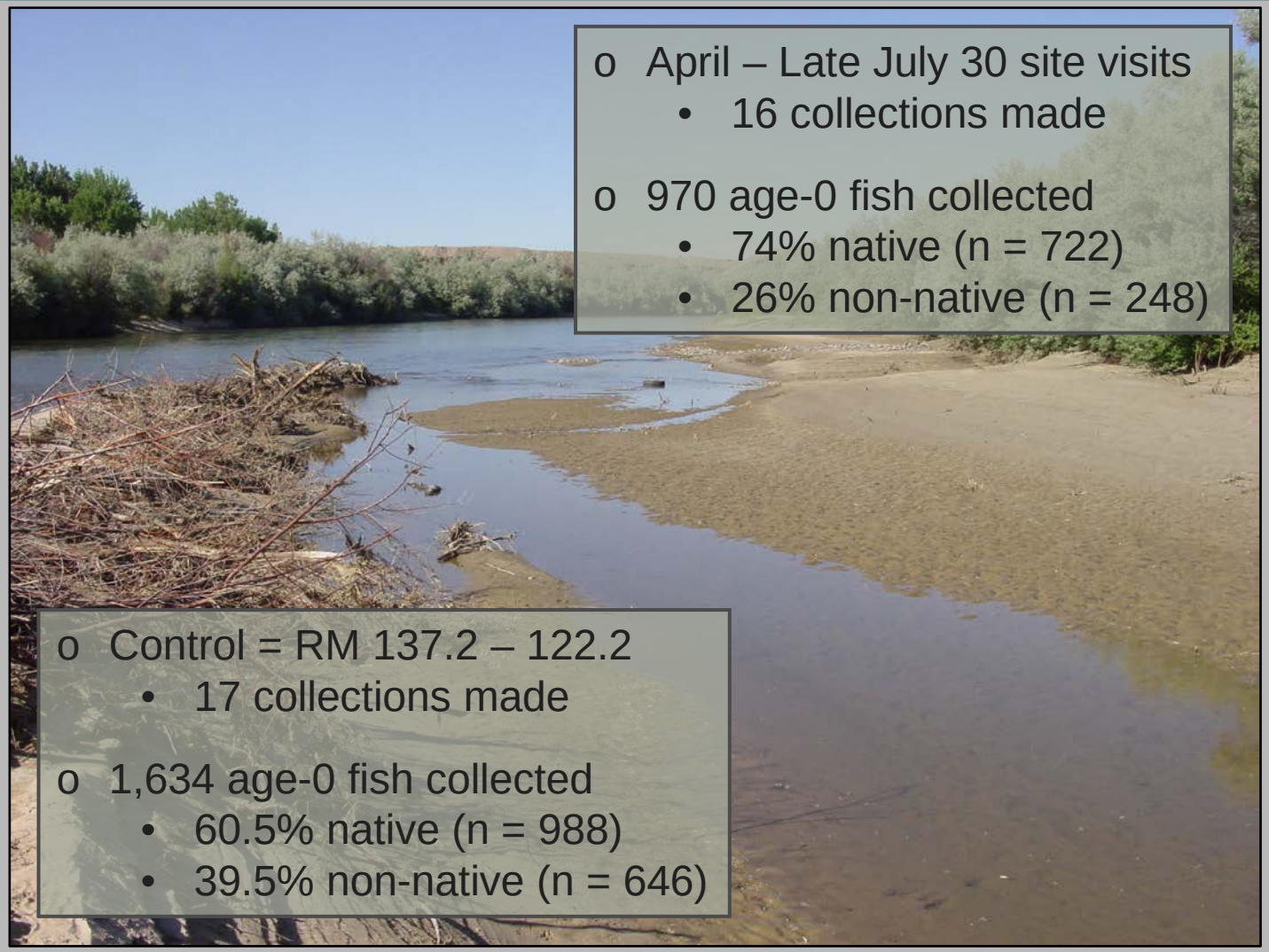
Trips



Reaches



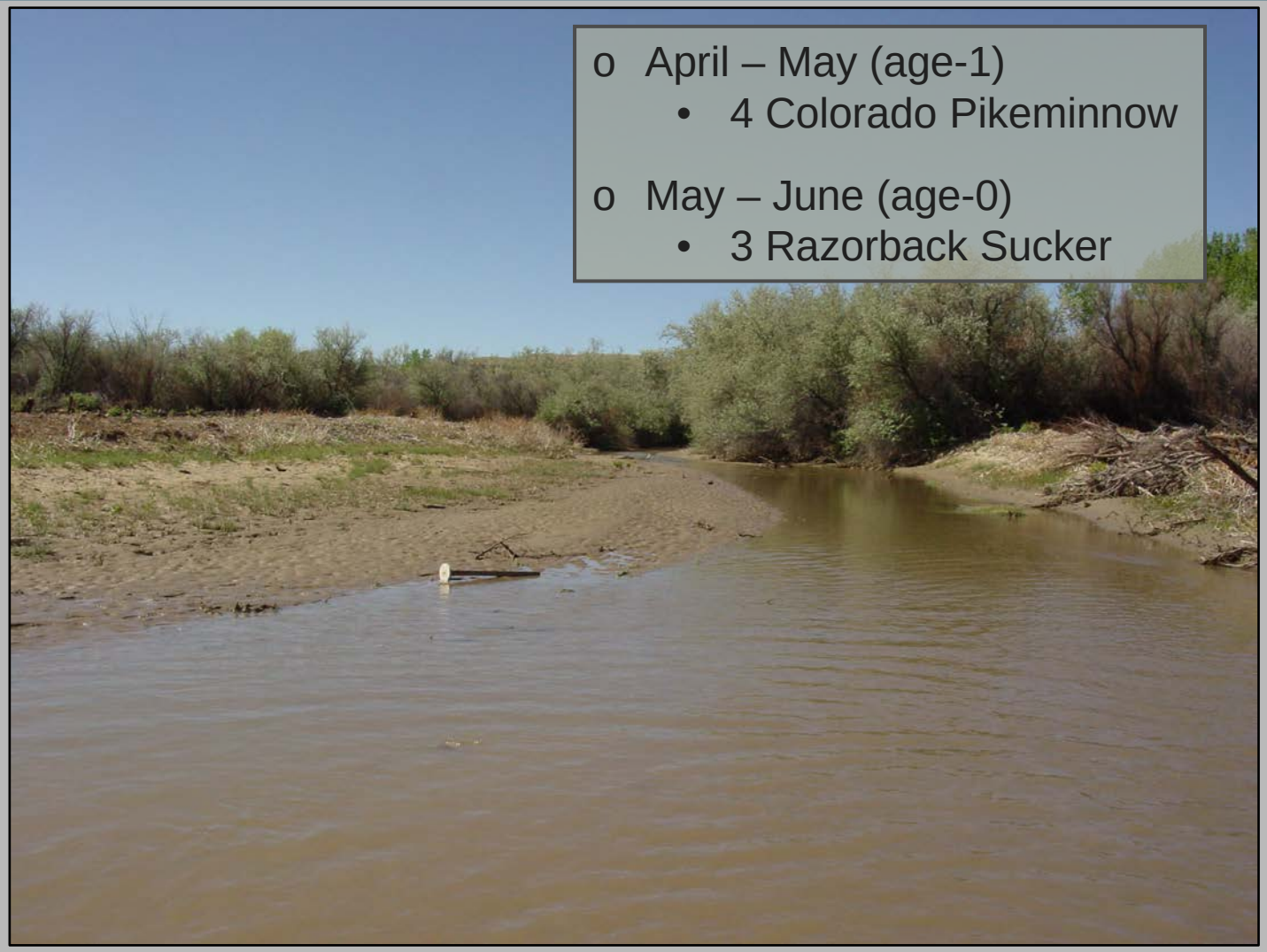
2014 RERI Monitoring
Six sites between 132.2 – 127.2



- April – Late July 30 site visits
  - 16 collections made
- 970 age-0 fish collected
  - 74% native (n = 722)
  - 26% non-native (n = 248)

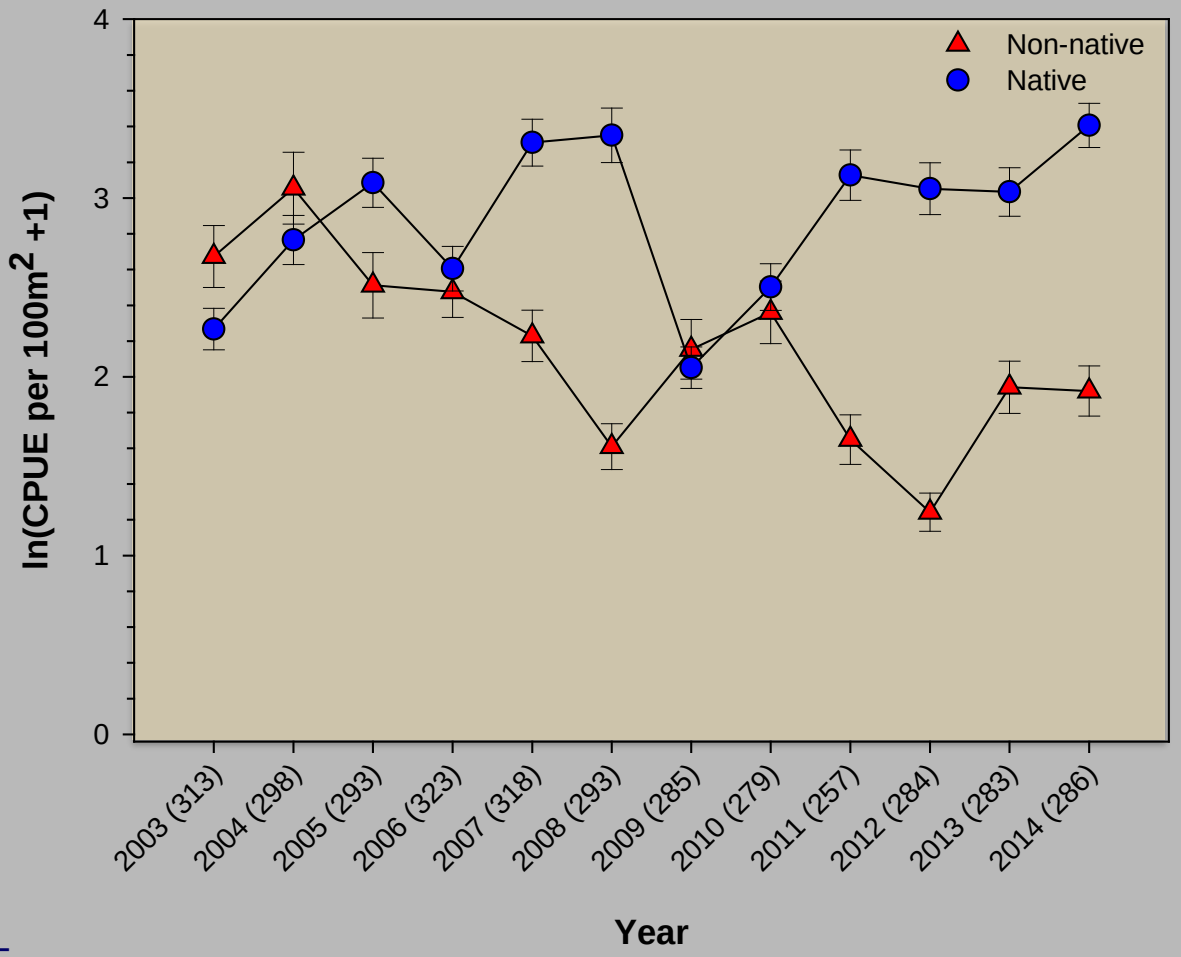
- Control = RM 137.2 – 122.2
  - 17 collections made
- 1,634 age-0 fish collected
  - 60.5% native (n = 988)
  - 39.5% non-native (n = 646)

2014 RERI Monitoring
Six sites between 132.2 – 127.2



- April – May (age-1)
  - 4 Colorado Pikeminnow
- May – June (age-0)
  - 3 Razorback Sucker

2003-2013 age-0 *native vs. non-native* mean *ln* CPUE/100 m^2



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